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SPATIAL SOUND PHENOMENA

Echologies of Invisible Sonic Volumes



MASTER THESIS

SPATIAL SOUND PHENOMENA: Echologies of Invisible Sonic Volumes

carried out for the purpose of obtaining the academic degree of
Diplom-Ingenieur (Dipl.-Ing.) under the supervision of

Christine Hohenbüchler, Univ.Prof.in Mag.a art.
E 264 Institut für Kunst und Gestaltung
E 264/1 Zeichnen und visuelle Sprachen

and

Vera Bühlmann, Univ.Prof.in Dr.in phil.
E 259 Institut für Architekturwissenschaften
E 259/4 Architekturtheorie und Technikphilosophie

submitted at the Vienna University of Technology,
the Faculty of Architecture and Planning by

Iva Grlić Radman, BSc.
01328482

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Abstract

A mirror has the same effect upon increasing one's vision through reflection as looking out of the window does by establishing a visual relation between the observer and the expanded visual space. The same reflection manifestation also occurs at the acoustic level in the form of an echo being aurally perceived. Visual design and its appropriate vocabulary almost always dominate in the field of architecture. Even though all five senses are essential to a whole experience of the space, aural architecture emerges due to those criteria.

This Thesis aims to provide multiple facets of the sound medium in architecture and is divided into two parts: the first one is a theoretical approach investigating and elaborating on the overlooked medium of the sound, and the second one is their implementation in the architectural space as a Sound installation. Staircases and corridors as public connecting architectural spaces are examined, for here they are due to their (echoey) resonance characteristics in the first place, apart from being considered accessible and servant spaces. Thinking along and throughout the scale of architecture as an amplifying tool in this position, the concept of Echology will also be introduced. Hence encouraging echoes as an anomaly and spatio-temporal sonic contingency lead to four main aspects of the echo phenomenon: Mirroring, Interruption, Cyclical Repetition, and Sonic Volumes. The second part, the Sound installation, is the outcome of an extensive research study, mainly referring to the works of Bernhard Leitner, Susan Philipsz, and Alvin Lucier, among others.

The sound as an intangible and ephemeral sensibility requires mental engagement in the present moment to reorient oneself and form creative and critical anticipation. How could the existing sonic vocabulary expand and open up within the framework of the predominant visual one? What can one get from the multiplicity of a disembodied echo, and who does this entity belong to if not to its originator?

Keywords

spatial sound phenomena, echo, echologies, sonic environments, aural architecture, sonic glossary, reflection, resonance, multiplicity

Kurzfassung

Ein Spiegel hat die gleiche Wirkung auf die Erweiterung unseres Sehvermögens durch Reflexion wie ein Blick aus dem Fenster, indem er eine visuelle Verbindung zwischen dem Betrachter und dem erweiterten visuellen Raum herstellt. Diese Erscheinungsform der Reflexion findet auch auf der akustischen Ebene in Form eines Echos statt und wird akustisch wahrgenommen. Der Bereich der Architektur wird sehr oft von visuellem Design und Glossar dominiert, während die akustische Architektur nur eine Folge visueller Kriterien ist, obwohl alle fünf Sinne wichtig sind, um den Raum zu erfahren.

Diese Arbeit zielt darauf ab, die verschiedenen Facetten des Mediums Klang in der Architektur zu beleuchten und ist in zwei Teile gegliedert: Der erste Teil ist ein theoretischer Ansatz, der das übersehene Medium Klang untersucht und näher beobachtet. Der zweite - ist eine Umsetzung dieser in den architektonischen Raum als eine Klanginstallation. Untersucht werden dienende öffentliche architektonische Räume, wie Treppenhäuser und Korridore, die aufgrund ihrer Echoeigenschaften eine wichtige Rolle spielen, aber auch soziale und zugängliche Räume sind.

Das Konzept der Echologie wird vorgestellt, indem es ist den Maßstab der Architektur als ein verstärkendes Instrument in dieser Position betrachtet. Die Förderung des Echos als Anomalie und räumlich-temporalische klangliche Kontingenz führt zu vier Hauptaspekten des Echos: Spiegelung, Unterbrechung, Zyklische Wiederholung und Klangliche Volumina. Der zweite Teil, die Klanginstallation, ist das Ergebnis einer umfangreichen Forschungsarbeit, die sich vor allem auf die Arbeiten von Bernhard Leitner, Susan Philipsz und Alvin Lucier bezieht um nur einige zu nennen.

Als ungreifbare und flüchtige Sensibilität verlangt der Klang eine geistige Auseinandersetzung mit dem gegenwärtigen Moment und ermutigt uns, zu beobachten und uns neu zu orientieren, wodurch eine kreative und kritische Vorwegnahme entsteht. Wie können wir unser klangliches Vokabular im Rahmen des vorherrschenden visuellen Vokabulars erweitern? Was haben wir von der Vielfältigkeit eines körperlosen Echos und wem diese Entität gehört, wenn nicht ihrem Urheber?

Stichwörter

Raumklangphänomene, Echo, Echologien, Klangumgebungen, akustische Architektur, Klangglossar, Reflexion, Resonanz, Vielfältigkeit

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WHY NON-VISUAL ARCHITECTURE?

“Sight isolates, whereas sound incorporates; vision is directional, whereas sound is omni-directional. The sense of sight implies exteriority, but sound creates an experience of interiority. I regard an object, but sound approaches me; the eye reaches, but the ear receives. Buildings do not react to our gaze, but they do return our sounds back to our ears.”¹

In the Pythagorean school (in 6 BC), the dominant study cause was a sensation of hearing not visualization. The noticed obstacle was the nature of sound and the circumstances it brings within. Out of those observations, the theoretical framework was developed to deal with these difficulties, namely Harmonics. From the studies related to Harmonics, to notion of numbers and geometry evolved. It is reasonably given that the order and proportion in music are based on the length of the octave (the interval between one musical pitch and another with double its frequency), as much as the repetition and length of the pauses, rhythm and tempo. Those harmonic principles were of particular importance since they were later applied in architecture. The Roman architect and engineer Vitruvius (80-15 BC) in his book *De Architectura* (Ten Books on Architecture) suggests how architecture fundamentally depends on order, arrangement, eurythmy, symmetry, propriety and economy. What does „to be in order“ mean? In „harmony“ with another one? The word order (Greek τάξις, Lat. *ordinem*) initially means “arrangement”, thus implying a representa-

tion of things being carefully arranged and organized. Later on, because of its suggestive visual meaning, the word began to be used as “in proper sequence” or shortly, “in order.” Its opposition “out of order” etymologically represents a chaotic, unorganized outlook. According to Vitruvius, the order measures the arrangement of individual parts, whereas symmetry considers the proportions and adjustments of the whole (according to its quantity).² One could imagine them as qualitative parts of a bigger system at work. Arrangement implies putting things where they belong and thus creating an elegant impact through adjustments that are convenient. Eurythmy considers harmonious proportions of the whole - taken for example - proportions of the human body (Da Vinci’s *Vitruvian Man*), which were subsequently implemented in architecture. In ancient Greece, the word harmony (Greek ἁρμονία / *harmonia*) was used to describe the agreement, or the concord of sounds, indicating the state of being in balance or, acoustically speaking, being melodic, symphonious tones. Lastly, the symmetry is a relation between different parts and the whole general scheme, which could be found in natural proportions of the human body, as well as in temples, or seen as an implementation of the golden ratio on the facades. This synthesis of harmonic principles was of considerable importance for architecture in the Renaissance period as it aimed to be recognized as a branch of knowledge, closely related to arithmetic, geometry, astronomy, music, rather than just a craft. “The eye and the ear were understood to acknowledge the same principles of harmony mediating between man and cosmos...Man has not always been dominated by vision; in fact, a primordial dominance

of hearing has only gradually been replaced by that of vision.”³ Indeed, in the modern age architecture has forsaken its metaphysically bridging task and has devolved into merely visual aesthetics - an art of the eye with no metaphysical or spiritual intentions, and the senses have become rigidly hierarchized and isolated from one another.⁴ The sense of hearing, and sound as a medium, is of particular importance since it makes one audible and “seen”. It does not necessarily define but adds a plural side to things and meanings. One could characterize it also as a feminist medium of modern times. Through sounding and listening one provides a democratic aspect by giving a voice to the ones that were silenced before.

The participative and plural side of the sound widens the field of vision and thus opens new perspectives. The sound as a physical, intangible and ephemeral sensibility demands mental engagement in the present moment and encourages us to observe, to re-orientate and thereby creating creative and critical anticipation. The fluidity of the sound is interesting rightly because of its subversive but at the same time collaborative, responsive nature. The sound resonates with every environment in which it has been produced. Any space can be perceived through sound, i.e. we can all sense spatial geometry and picture the depth and height of space even with our eyes closed. The sound reflected off walls creates an aural⁵ stimulus through which one becomes aware of the surrounding space, its properties and its shape. Space thus becomes audible (Lat. *audibilis* - that may be heard). It is expressed with an aural manifestation which parallels the visual and the tactile ones. Through perceiving, one grasps the unique structure of things and their exceptional way of being

which simultaneously speaks to all our senses. In order to create a seamless, continuous and consistent mental representation of the event encountered, sight, hearing and touch must work together as one during the process of spatial perception.⁶ So is it in the example of human experience of a sonic⁷ process, where one could say that aural and visual parallel each other. However, even though all five senses are necessary to fully experience space, visual design and vocabulary frequently dominate the architectural world, leaving aural architecture as a mere byproduct of visual choices. Speech is one of the most defining aspects of human evolution and culture, while hearing is one of the most crucial survival skills in the natural world. Nonetheless, different cultures cultivate sound and aural experience differently, just as the individual’s subculture influences the experience of spatial acoustics. Aural architecture happens mostly spontaneously due to culture, religion, habits and ceremonies, meaning that the society and the culture have created it, not necessarily an individual. There are four aspects of aural architecture: social, navigational, aesthetic, and musical spatiality.⁸ Ideally, all of the four aspects are considered, but sometimes only one or two facets dominate the design criteria. So for example, a space designed for navigation can be evaluated for its musical and social qualities and vice versa. As a common aural architecture or sonic environment, one could reckon church bells ringing within a town. According to a town’s natural geography, topography and infrastructure, those sounds resonate and create a specific environmental soundscape within an object, city or region. “Likewise, the sound of monastery bells ringing at certain hours in the city of Kyoto yields a spatial map of

¹ J. Pallasmaa, *The Eyes of the skin: Architecture and the Senses*, London, Wiley-Academy, 2005, p.48

² M. Vitruvius, *The Ten Books of Architecture*, tr. Morris Hicky Morgan, Toronto, Harvard University Press, 1980, p.13-14

³ J. Pallasmaa, *Touching the World: Vision, Hearing, Hapticity and Atmospheric Perception*, for *Invisible Places: Sound, Urbanism and Sense of Place*, São Miguel Island, Azores, Portugal, Proceedings, 2017, p.15

⁴ Ibid., p.16

⁵ aural - relating to the ear or to the sense of hearing; Merriam-Webster. (n.d.). Merriam-Webster.com dictionary. [Accessed: January 30, 2023, from <https://www.merriam-webster.com/dictionary/stereotypy/> “Merriam-Webster.com dictionary”]

⁶ B.Blesser, L.R.Salter, *Spaces Speak, Are You Listening?: Experiencing Aural Architecture*, London, The MIT Press, 2009, p.13

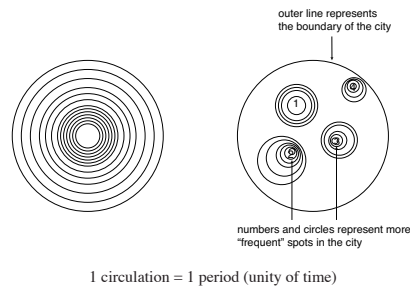
⁷ sonic - utilizing, produced by, or relating to sound waves; involving sound; from Merriam-Webster.com dictionary. [Accessed: January 30, 2023]

⁸ B.Blesser, L.R.Salter, *Spaces Speak, Are You Listening?: Experiencing Aural Architecture*, p.15

the city's geometry in relation to locations in the fading distance. In some European cities, the regular sound of the church bell's community call creates a psychological space. Its perceptual associations are tied to the materiality of the bell, its resonant tower, and the adjacent square.⁹ This familiar mental association of the church bell's ringing is common to most of us, depending on where we grew up. The sound of church bells echoing through the streets makes us aware of our citizenship.¹⁰ The sound of approaching footsteps reverberating off the stone floors as they echo through the long corridor. A hasty walk through the grand main staircase of a building, the sound of children chasing a ball in a narrow street, and the murmur of voices mingling in the squares. Those urban soundscapes or sonic commons generate a sense of place, orientation, navigation and psychological and social identification, which we use consciously or subconsciously to identify ourselves and our surroundings. One could say that buildings and cities are harmonic instruments and monuments of time. They provide us with a precious ability not only to see and comprehend the passage of time but to take part in time cycles that go beyond our own personal lives as well.¹¹

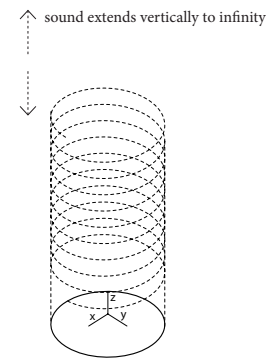
One could consider the idea of a town as a metaphor for an imaginary harmonic instrument. This imaginary town or a harmonic instrument is composed of "chords" of various lengths, depending on where they are, fixed and bounded to vibrate accordingly. What one could correspondingly observe as a role of a common synchronizing centre of that imaginary town (harmonic instrument), would be some frequent public spaces such as main squares, parks and then also bureaucratic types of buildings such as banks

(political) or even hospitals, schools, and churches (ethical, ideological), as well as libraries, theatres, shopping malls (social). There may also be morphology or topography of this imaginary city important, such as: whether this imaginary city is settled on a hill or on more hills - like Rome, Athens, Lisbon, for example. And whether there is a river and whether it plays a significant role in the shaping of the city and its infrastructure. Talking of those either institutional topologies or public spaces, there should also be some hierarchical gradation, and then with this in mind, also some more and less synchronizing "points" - in the sense of purpose, usage and availability, which then again build kind of bows in the city society and its structure. For example, sanctuaries could be some bounds or a type of abstract monochord that could produce harmonics in the city. Imagining the city as a string, all those events and structures make bows, and, with their sound and harmony, they influence each other and create a "symphony" in this way. By its definition, consonance is a combination of notes in harmony with each other due to the relationship between



One could imagine these circles as more or less frequent spots within a city; it could be an example of a Masterplan of the city.

fig. 01: Movement of sound as cyclical repetition, observed as a metaphor for the frequent spots in a "imaginary harmonic town"



Frequency captures the repetition in relation to time. *Natural Communication* is a circulation, because the process is a round trip between two, or more levels in depth (fig.03)

$$E \sim V \times (\text{constant})$$

(energy) (frequency) >> periodicity

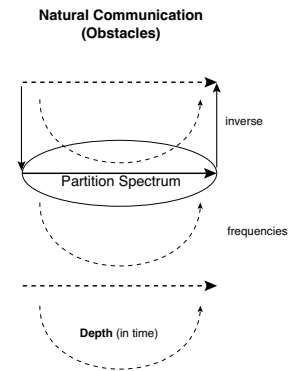


fig. 02: Periodic circulation of sound moving vertically

fig. 03: Obstacle of sound with temporal depth

their frequencies, meaning everything is in harmonious balance. Due to current social, economic or political changes, they either rise or drop, leading to some dissonance. Dissonance is inharmoniousness or lack of harmony among musical notes or, one could say - an imbalance. The consonance and the dissonance are constantly related, because, taken from this particular concept, some "infrastructures" of "a harmonic town" came out of social constructs. Moreover, like in any society, there are constant movements and changes (trends, economic crises, diseases), which also affect an equilibrium, (dis)harmony of the present time in which this "imaginary city"/"harmonic instrument" fluctuates and evolves.

Architecture as a mediator, an instrument and a tool reverberates the resonance of its surroundings, influencing directly or indirectly the dis/harmony of the space i.e. of its sonic milieu. As it stands, most of how architecture is portrayed to the observer is visual. In today's digitalized world, one is constantly exposed to visual material, most of which prioritizes aesthetics over substantive quality. Aural architecture and sonic

vocabulary contribute to the quality of architectural spaces, allowing people to experience the space through sound and vibrations. However, the sound does not resonate in the open and closed spaces in the same way and neither in the horizontal and vertical interiors. Previously mentioned aural architectures are also spaces that primarily had not been designed for musical purposes but afterwards became such due to their outstanding acoustic qualities.

For the purpose of this Thesis, the author is mainly interested in navigational and "servant" spaces ("dienende Räume"), which possess acoustic or echoey characteristics and hereby offer aural experience and, at the same time, present democratic, available public spaces. Those spaces would namely be staircases and corridors. The sonic space is created by architecture and determined by the users' behaviours and manners. One of the sound phenomena in space is the echo - by definition - the repetition of a sound caused by the reflection of sound waves. It could also mean copy, reproduction, replica and mimic. The echo as a phenomenon is intriguing mainly because of its repetiti-

⁹ S. Holl, J. Pallasmaa, A. Perez-Gomez, *Questions of Perception: Phenomenology of Architecture*, CA: William Stout Publishers, San Francisco, 2006, p. 87

¹⁰ J. Pallasmaa, *Touching the World: Vision, Hearing, Hapticity and Atmospheric Perception*, p.19

¹¹ *Ibid.*, p.20

ve characteristic moment, resulting in being detached and disembodied from its originator. Eventually, it belongs to no one, and it extends to infinity.

By interpreting architecture as an amplifying tool in the manifestation of echoes, the concept of the Echology¹² is here proposed, encouraging the echoes as an anomaly and (sonic) contingency of the passive, steady ground. What one defines by the term Ecology (*oikologia*) is the caring of the shared habitat, relationships between living organisms, human and non-human. In other words, it would etymologically represent a natural environment, a territory created for ourselves and others around us.

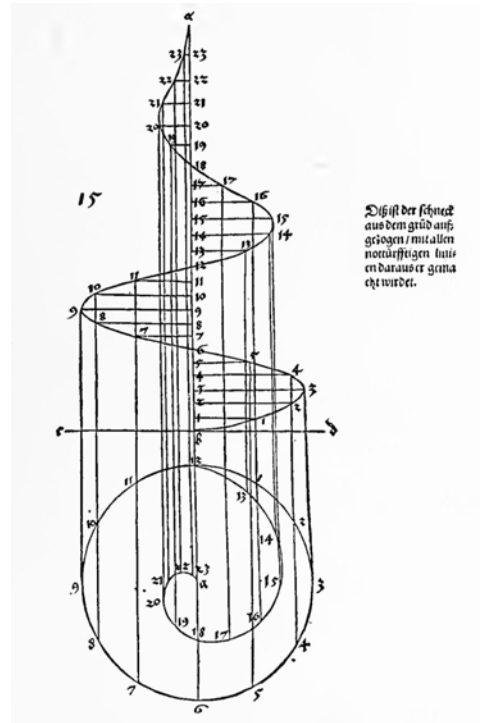


fig. 04: Dürrer's calculation for making a conical helix from a flat spiral - example of a golden ratio in the nature

What is defined and what is shared when the voice has been given to Space?

This Thesis will use the notion of Echologies to expand onto its traditional architectural role in the visual domain, thus leading to four main aspects of the echo: mirroring, interruption, cyclical repetition and sonic volumes. It will try to provide other vectors of architecture that do not strictly mean how to build and how to impose, but to set aside the notion of the human as an ultimate model or norm of the planet and to reflect upon the Anthropocene epoch critically. Which are the acoustic qualities of the sounds of monumentality? Which of hospitality or hostility? In the words of Salomé Voegelin: "I aim for a sonic practice whose voice does not rise against harmonic tonality, the dominant self but sounds itself, and whose clamour, therefore, cannot be silenced in its opposition but whose possibilities are inexhaustible."¹³

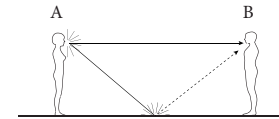


fig. 5

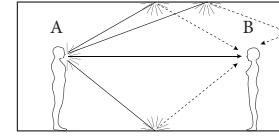


fig. 6

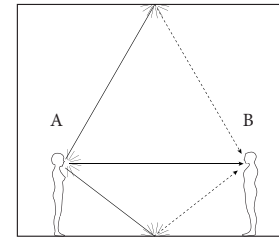


fig. 7

A-talker; B-listener

*"What the human ear recognizes as 'harmonic' is often associated with mathematics. What sounds right in harmony is also right mathematically. Mathematics is probably the biggest reason most people can agree on whether something sounds good or whether they hear meaning in the sound constructions we perceive as music today. We took mathematical patterns (especially from classical music) and transferred them to how we make music today. Our ears have been trained for thousands of years to hear."*¹⁴

*"Sound is, from a physical side, a vibration that spreads in a certain way, reaching us or better to say, resonating through the ear or the body, meaning either in a way that we hear or feel it."*¹⁵

¹² A combination of words echo + ecology, as in acknowledging and encouraging the notion of echo (in its spatial and metaphorical sense)

¹³ S. Voegelin, *The Political Possibility of Sound: Fragments of Listening*, London, Bloomsbury Academic, 2018., p. 30

¹⁴ Quoted from the interview with Dora, p.80

¹⁵ Quoted from the interview with Ivan, p.95-95

PART I

Architecture and Sound

“One can also recall the acoustic harshness of an uninhabited and unfurnished house as compared to the affability of a lived home, in which sound is refracted and softened by the numerous surfaces of objects of personal life. Every building or space has its characteristic sound of intimacy or monumentality, invitation or rejection, hospitality or hostility. A space is understood and appreciated through its echo as much as through its visual shape, but the acoustic percept usually remains as an unconscious background experience.”

- JUHANI PALLASMAA, *The Eyes Of The Skin*, 1996.

a perspective

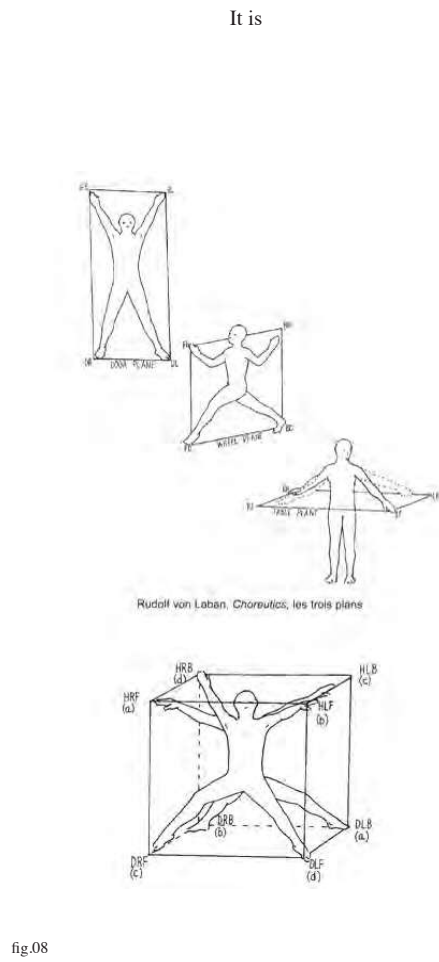


fig.08

a matter

“In listening to sound we are always already in matter: an embodied ear that sounds and hears through its own simultaneity with ‘what sounds’ as an unseen and inter-existing ‘what is’. From there we can come to understand matter and meaning in a different way, diffracted and simultaneous, invisible and indivisible, not as excess and not as becoming, but as a practical interbeing in the world not of signs and symbols, texts and culture, but of inarticulate intensities, indeterminate and indivisible, contingent and transforming.”

— SALOMÈ VOEGELIN, *The Political Possibility of Sound*, 2018.

I

“In the same manner the voice executes its movements in concentric circles; but while in the case of water the circles move horizontally on a plane surface, the voice not only proceeds horizontally, but also ascends vertically by regular stages.”¹⁶

Vitruvius described the sound as a three-dimensional wave, similar to a water wave, which, when blocked by obstacles, would flow back and break up subsequent waves. In order to stop this loss of sound, he clarified that antique theaters had ascending seating. He advised placing the proper size of bronze pots in theaters so they could resonate with the fourth and the fifth, up to the double octave, to reverberate with the more appealing, harmonious tones.¹⁷ This proves how architecture and sound have always been in dialogue, influencing and enhancing each other for centuries. The word acoustics derives from the Greek word *akoustikos* (ἀκουστικός), meaning “connected with hearing,” as well as *akoustos* (ἀκουστός), “heard, audible.” The Latin equivalent *sonic* led to the term “sonics,” which eventually evolved into a subfield of acoustics. Acoustics is a branch of science that has applications in various areas of human society, including music, medicine, architecture,

manufacturing and warfare. As in many other knowledge domains, art, craft, science and technology have stimulated one another to progress the field as a whole. Some of the ancient philosophers, mathematicians and architects investigated the complexities behind the notion of sound and acoustics, namely Aristotle, Pythagoras, Strato of Lampsacus, and Vitruvius. One of the first treatises on this topic is, as previously mentioned “The Ten Books of Architecture” (Vitruvius, 30-15 BC) considered definitions and study of interference¹⁸, echoes¹⁹ and reverberation²⁰. According to Vitruvius, a movement of sound could be likewise compared to the circular movement of water, which, if disrupted by an obstacle, will affect latter formations: “Voice is a flowing breath of air, perceptible to the hearing by contact. It moves in an endless number of circular rounds, like the innumerable increasing circular waves which appear when a stone is thrown into the smooth water and which keep on spreading indefinitely from the centre unless interrupted by narrow limits, or by some obstruction which prevents such waves from reaching their end in due formation. When they are interrupted by obstructions, the first waves, flowing back, break up the formation of those which follow.”²¹ Ear is able to distinguish different sounds, even if they occur simultaneously, it can differentiate larger range than the eye does. Each sound can be characterized and identified by its frequency. The frequency is periodicity or circulation and it captures a number of repetitions in relation to time or how fast or slow this circulation happens. This repetition is then defined as periodicity or circulation. One can imagine the circulation as an unclosed circle which possesses verticality and could extend to infinity.

In harmonics, one tries to find out how different things, which oppose each other, create consonant and dissonant tones. For instance, boundaries and strings oppose each other and as a result, they produce sounds. When the wave interfaces with the bound or the point of stasis (fig. below), it reflects back. Resonance or synchronization is a condition which appears as a result of those vibrations. “Everything begins with the rebound - in the sense in which it was once said of a musical instrument that it bounds or rebounds-that is, springs back and sounds in one way or another.’ A bound through the open is reprised or recovers itself, returns under its own momentum as it responds to itself and thus forms its own reality - its resonance.”²² According to the Quantum Physics, everything vibrates at a certain frequency. Without bounds, there is no vibration and therefore no resonance either. When something resonates, it makes itself heard. The resonance, in other words, “the very existence of sounds - is nothing other than the appropriation or modeling of space-time by a particular vibration.”²³

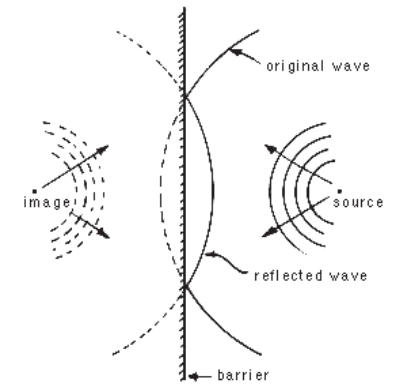


fig.09: Reflection of a sound wave at a barrier, as if from an imaginary source at an equal distance behind the barrier

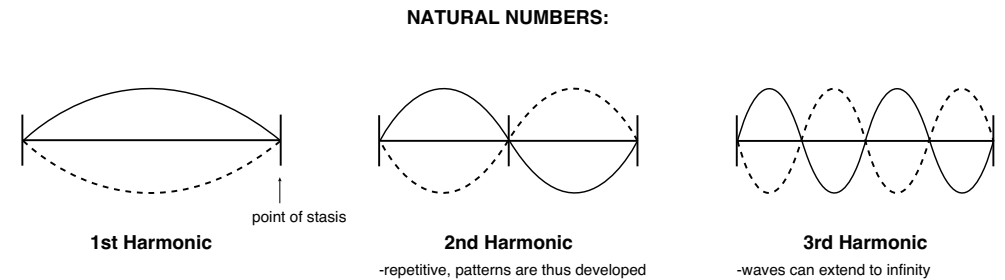


fig.10: the fundamental frequency or the 1st harmonic, followed by the 2nd & 3rd harmonic (higher harmonics); the notion of numbers (Algebra) evolved from the harmonics

¹⁶ M. Vitruvius, *The Ten Books of Architecture* (Book V, Chapter III: Theater), p.138-138

¹⁷ Ibid.

¹⁸ the mutual effect on meeting of two wave trains (as of light or sound) that constitutes alternating areas of increased and decreased amplitude (such as light and dark lines or louder and softer sound), Merriam-Webster. (n.d.). Merriam-Webster.com dictionary, [Accessed January 10, 2023]

¹⁹ the repetition of a sound caused by reflection of sound waves, Merriam-Webster. (n.d.). Merriam-Webster.com dictionary, [Accessed January 10, 2023]

²⁰ the phenomenon in sound propagation whereby a sound wave moves around an object whose dimensions are smaller than or about equal to the wavelength of the sound. B.Truxax, *Handbook for Acoustic Ecology*, Cambridge Street Publishing, 1999

²¹ M. Vitruvius, *The Ten Books of Architecture* (Book V, Chapter III: Theater), p.138-139

²² J.L. Nancy, *Resonance of Sense* included in Spectres II: Resonances, Europe, Shelter Press, 2020, p. 14

²³ Ibid.

HARMONICS IN THE ANCIENT GREECE

Harmonics is defined as the fundamental and the first six overtones of a vibrating string. The earliest records of the study of this phenomenon are attributed to the philosopher Pythagoras. The harmonics, as a branch of physics, is the study of wave patterns and vibrations. In ancient times, the harmonics was used in music and architecture. The Greeks believed that harmonics could create balance and proportion in music and architecture, leading to the development of musical harmony and architectural elements such as columns and pediments.

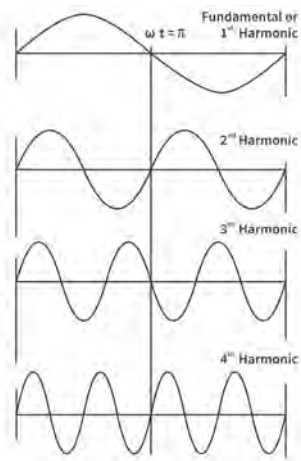


fig.11: complex waveforms expressed as combinations of sinusoids

The fundamental wave itself is called the first harmonic. The second harmonic has the frequency twice that of the fundamental frequency, the third has the frequency thrice that of the fundamental frequency and so on as shown above.

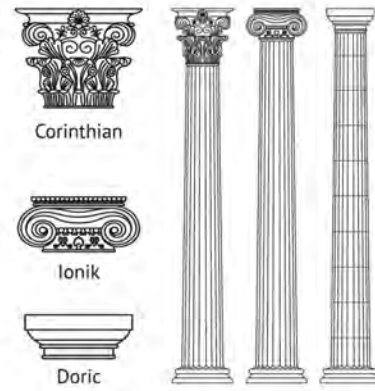


fig. 12: Doric, Ionic and Corinthian column orders

In architecture, the principles of harmonics influenced the design of buildings, with architects striving for proportion and balance in their structures. This led to the development of architectural orders, such as the Doric, the Ionic and the Corinthian, each with distinct characteristics that embody the principles of harmonics. In modern times, the harmonics plays an important role in architecture, with engineers using the principles of vibration and resonance to design buildings that can withstand seismic activity and other environmental stressors. The harmonics of a building can also affect its acoustic properties, making it essential for architects to consider the effects of harmonics when designing performance spaces, such as concert halls. Overall, the principles of harmonics have been an integral part of architecture and design throughout history, influencing the form and function of buildings and shaping the built environment.

The legend of the Pythagorean hammers is often used to illustrate that mathematics and music are interconnected, and that mathematical principles can be applied to musical harmony. By understanding the mathematical relationships between musical notes and frequencies, musicians and composers can create music pieces that are harmonious and pleasing to the ear. Harmonics is still an important concept in music theory and is used to explain why certain musical intervals sound pleasing and why others sound dissonant. Pythagoras (570-490 BC) revealed that harmonic tones can be produced when the lengths of vibrating strings can be expressed as integer ratios (for example 2 to 3, 3 to 4), and so, the smaller integers, the more balanced and harmonious tones are.

According to the legend, Pythagoras was travelling and came across a blacksmith's shop. As he was observing the blacksmiths at work, he noticed that each of their hammers made a unique sound when they struck the anvil. Intrigued by this, Pythagoras realized that the sounds could be related to the sizes and weights of the hammers. He took the hammers and used them to create a musical scale, now known as the Pythagorean

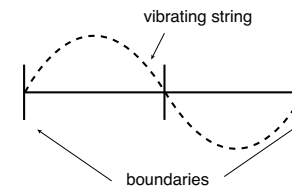


fig. 14: a string is vibrating because of the tension and boundaries that affect the tension and produce vibrations



fig.13: Gaffurius, Theoria musicae (1492), Pythagoras exploring harmony and ratio with various musical instruments

scale. This was one of the earliest examples of tuning musical instruments based on mathematical principles and is said to have laid the foundation for the study of musical harmony and harmonics.

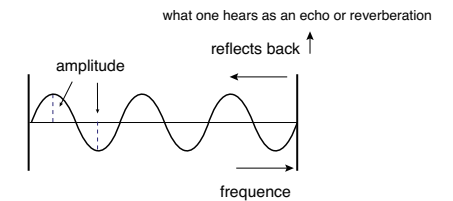


fig.15: reflection of a frequency affects the form of a sound-wave. As a result, one hears it in a form of reverberation or echo)

SPATIAL ACOUSTICS

“Every building or space has its characteristic acoustic qualities and sounds of intimacy or monumentality, invitation or rejection, hospitality or hostility. A space is understood through its echo as much as through its visual shape.”²⁴

Spatial acoustics or the acoustic concerning the interior with a human being as the main perceiver is a field of acoustics that belongs to a scientific study of psychological responses associated with sound. One can also categorize it as psychophysics, which involves the scientific study of sound perception and audiology (how humans perceive various sounds). Psychoacoustics is an interdisciplinary field that combines numerous disciplines, including psychology, acoustics, electronic engineering, physics, biology, physiology and computer science. One could also relate acoustics to the very similar quantum physical domain of optics.

Acoustics primarily examines the pressure and frequency ranges in the sound wave as well as how the wave interacts with its surroundings - diffraction, interference, reflection or any combination of the three terms can be used to describe this interaction. The entire sound spectrum can be split into three categories: audio, ultrasonic and infrasonic. The auditory range, which may be heard by the human ear for example, is between 20 Hz and 20,000 Hz. There are several uses for this range, including music and verbal communication. The extremely high frequencies, 20,000 Hz and above are referred to as the ultrasonic range. The higher the range of the frequencies, thus the shorter the wavelengths. The lowest frequencies on the other end of the spectrum are referred to as the infrasonic range. Important to note that earthquakes, which are classified as infrasonic sounds and essentially are the invisible release of energy, also make a distinctive sound. Simultaneously, they transmit the energy that is further manifested in the

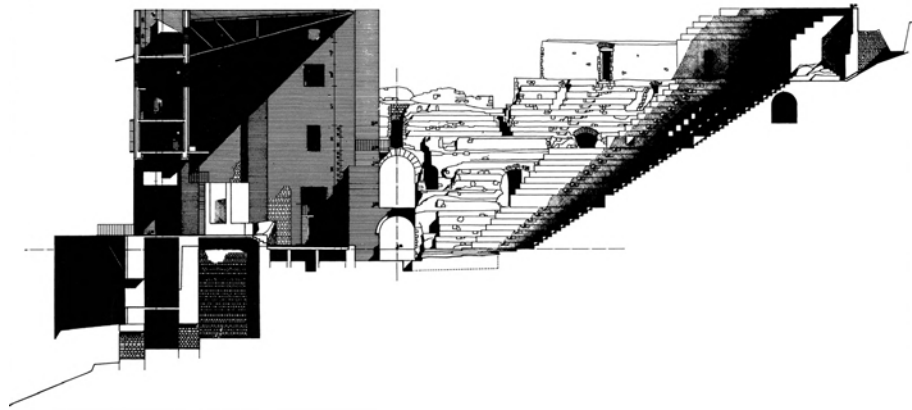


fig.16: Roman theater of Sagunto, nowadays Valencia, Spain

form of a sound within the architectural object. Depending on the object's materiality, the only visible indication of this geological phenomenon is seen in the form of cracks or sometimes even more significant devastation. One could describe it as an invisible force, visible only in its final form – a damage. Without a particular organization and morphology of space, there can be no reverberation, resonance or natural filtration. Applied acoustics shows how space, volume, shape and materials all determine the propagation of sounds.²⁵ “For just as musical instruments are brought to perfection of clearness in the sound of their strings by means of bronze plates or horn $\eta\chi\epsilon\iota\alpha$, so the ancients devised methods of increasing the power of the voice in theatres through the application of harmonics.”²⁶

Le Corbusier and Renzo Piano affirm that “sound is a voluminous body.” This “voluminous body,” if put in a specific context, provokes certain sensations. For example, a specific type of music has orchestrated and predetermined a distinct type of acoustic properties and, therefore, a unique architectural space, but also the other way around. From the ancient Greek and Roman theaters all through to the Gothic cathedrals and Baroque concert halls in which Bach was composing. In this particular case, music was very much influenced by the predetermined architectural and acoustic properties, characteristic for that period of time. Generally in that period of history, rooms were much smaller, less reverberant and therefore the musical outcome was more dynamic and rhythmical. Following the opera houses, where the orchestras and the music had to be louder than the noise of the, often loud, audience. And then the new, more contemporary music halls, where the music sudden-

ly possessed extreme dynamics, which was not the case before. The quiet parts had to be heard, the music had to be less rhythmic and more textural. While talking about music as jazz, which was played in clubs and relatively small rooms that were clamorous and the audience was up on their feet giving the whole room another ambience. The music played had to be loud enough to be heard above all the noise and cacophony of the crowd. Since the invention of electronic devices, such as microphones and radios, much of the correspondence between architecture and sound has changed or has even vanished. The music suddenly diverged from the analogue and live performance (which was in co-relation to architecture) to one that is explicitly prerecorded. It does not need to be played in a particular spatial environment anymore. Nowadays, electronic music is played on powerful sound speakers or at live concert halls, sometimes even in awful (acoustically speaking) interiors, such as sports stadiums and arenas. As if the form of sonic expression became more of a social diction than the musical one. The space became a generic, unimportant medium in this sound manifestation. A more prominent role in a musical performance inherits its scaled companion - the sound system. Architecture is no longer an instrumental body that resonates with or signifies the music. As much as music influences our emotions and states of mind, the space acoustics plays an essential role in how one will comprehend the environment through its sonic showcase. “The echo of steps on a paved street has an emotional charge because the sound bouncing off the surrounding walls puts us in direct interaction with space; sound measures space and makes its scale comprehensible. We stroke the boundaries of space with our

²⁴ J. Pallasmaa, *Touching the World: Vision, Hearing, Hapticity and Atmospheric Perception*, p.19

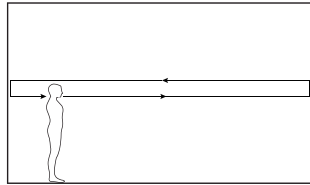
²⁵ J.F. Augoyard, H. Torgue, A. McCartney, D. Paquette *Sonic Experience: A Guide to Everyday Sounds*, Montreal & Kingston, McGill-Queen's University Press, 2005., p.8

²⁶ M. Vitruvius, *The Ten Books of Architecture* (Book V, chpt III: The Theater: Its Site, Foundations, and Acoustics), p.139

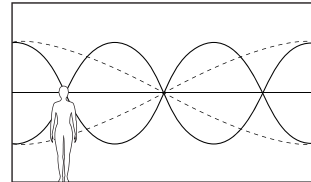
ears.”²⁷ Since the sensation of hearing and speech are one of the main instruments of communication, echoes in space can sometimes appear as troublesome acoustic oddities, which complicate communication. Nevertheless, our speech sounds different in the open space than indoors: this can easily be realized in any of the rooms of our home. If curtains, paintings and carpets are removed from the space, our speech will have a different acoustic impression. A considerable difference is observed in the spacious halls. The connection between the mind and acoustics is crucial because the brain decodes and interprets the information that sound waves carry to and from the ear. Brain waves that slow down or speed up in reaction to various auditory inputs may significantly alter how one thinks, feels or even acts. This relationship may be seen in

everyday settings where listening to a song can either make one’s foot start tapping or make one feel peaceful and tranquil. The mechanism by which the acoustics influence the mind and fundamentally the body is apparent when looking at how the central nervous system, which includes the brain and the spine, is affected by acoustics.

*“Sound is a mechanical wave of frequencies. I experience every sound as part of an indivisible whole of my being. For me, music is a construction of sounds that form a particular narrative, concept, and complete work. I associate emotions with both music and sound.”*²⁸



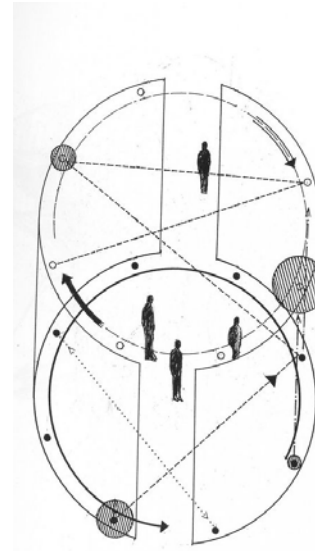
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18

fig 17: Parallel surfaces generate flutter echoes
fig 18: Spatial proportions create standing waves

²⁷ J. Pallasmaa, *Touching the World: Vision, Hearing, Hapticity and Atmospheric Perception*, p.19
²⁸ Quoted from the interview with Dora, p. 87



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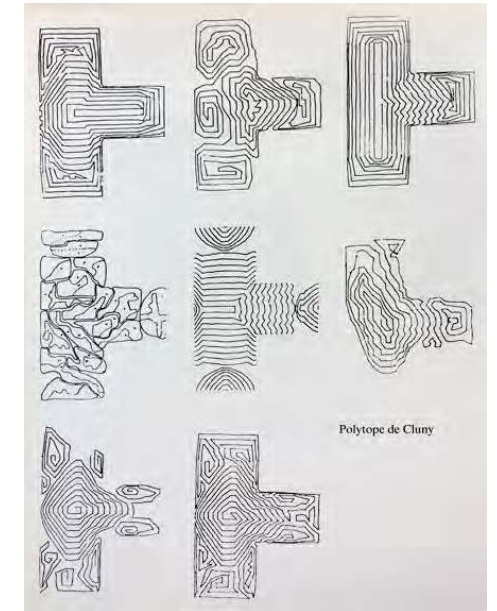


20

Architects Bernhard Leitner (fig. 5&6) and Iannis Xenakis (fig. 7) were working with the medium of sound in space. Whereas Leitner was more interested in the sculptural and artistic side of sound, and its impact on the human psyche and perception of sound, Xenakis was besides a composer and was intrigued by the relation of space, sound and time. Leitner is considered one of the pioneers of sound installation art.

Xenakis’s project *Polytope of Cluny* (fig.7) was a multimedia show and as such considered as one of the first immersive architectural environments. He built shapes and volumes with music and light, and most of his compositions were based on mathematical principles and the theory of “Probabilities”.

fig 19: Bernhard Leitner, *Le Cylindre Sonore*, 1987, Paris
fig 20: Bernhard Leitner, *Wing Space*, 1996, New York
fig 21: Iannis Xenakis, Floor plans of *Polytope of Cluny*, 1972, Baths of Cluny, Paris



21



Echoing Soundscapes: Listening the Anthropocene

“Wir leben alle ohne zu esoterisch zu werden, aber Du lebst in Deiner Welt, ich lebe in meiner Welt, und wir treffen uns, wir negotiate, wir probieren uns zu verstehen - jetzt grad in diesem Moment. Aber das ist alles ein Kompromis, das ist alles ein Austausch, der auch anders gehen könnte.

...
Und für mich das klangliche ist immer das zuhören (Sounding und Listening, beides zusammen) - also man nimmt auch den Teil in diesen possible Worlds, als etwas was auch empower kann. Das sind die Möglichkeiten die Tür aufzumachen, zu sehen wie vielschichtig die Realität ist, und wie viel Realitäten wir ausklamern.”

— SALOMÉ VOEGELIN (GESRPÄCH MIT ANIA MAURUSCHAT, 2021.)

Eng translation:

“We all live without becoming too esoteric, but you live in your world, I live in my world, and we meet, we negotiate, we try to understand each other - right now in this moment. But it’s all a compromise, it’s all an exchange that could go differently.

...
And for me, the sounding is always the listening (sounding and listening, both together). So you also take the part in these ‘possible worlds’, as something that can also empower. These are the possibilities to open the door, to see how multi-layered reality is, and how many realities we exclude.”

II

In geography, the term sound is used to refer to a smaller body of water, typically connected to a larger sea or an ocean. The etymology of the term derives from the Anglo-Saxon word *sund*, which means “swimming”, as well as “gap”, suggesting the meaning of the verb “to separate”, in German *absondern, aussondern*. This particular condition in geographical terms is very much present as well as in

the communication within the sound. To separate is to create a distance, to suppress and sustain one’s own thoughts and prejudices in order to listen and form an opinion. Sounding and listening are in themselves very material and at the same time very intimate acts. While talking, my voice is resonating in your ears and vice versa. If one could observe the notion of hospitality through sound and sonic as a model, it might be assumed that there was a certain playful generosity to it. It is not about the exhaustion of the other (of the receiver), it is about living with the other in the present moment. It is about attuning with the other, about resonating within sounding and listening. Or as in the words

of S. Voegelin: “You live in your world, I live in my world, and we meet, we negotiate, we try to understand each other - right now in this moment. But it is all a compromise, it is all an exchange that could go differently.”¹ Coming back to the geographical relation to sound, sonic could be as well treated as a description of audible environments - sonic landscapes, or so-called *Soundscapes* (German - *Klanglandschaft*). The word soundscapes, with the suffix -scape (shape, form, scene), characterizes a specific audible field, similar to the landscape, where land is clarified with its -scapes. This sonic “event” is a sensation, a provocation, as well as a narration of the invisible or immaterial.

What one defines by the term Ecology (from the Greek *oikos* - house, habitation, dwelling) is the caring of the shared habitat, relationships between the living organisms, human and non-human (interplay of biological and technological) and therefore holistic engagement in cultivating a healthy and sustainable (future) ecosystem/s. In its classical Greek use, the word *oikos* did not refer to the family, rather it was the



fig. 23: Dennis Oppenheim, *Annual Rings*, between Canadian and American border, 1968.

“Concentric circles shovelled out of the snow with a river intersecting them. The circles (and the title) evoke the growth of a tree, the river also serves as a political border between two countries, and also the marker between two time zones. The annual rings of the tree are at once natural and connected while also being artificially separated by the arbitrariness of physical borders and political temporal decisions. The piece intersects natural and unnatural borders with the environment and forces us to examine why and how we seek to order the world.” [from the article: *Land Art: Annual Rings*, Dennis Oppenheim, Accessed on: 05.01.2023., <https://classified.substack.com/p/land-art-annual-rings-dennis-oppenheim>]

word for “home”.² Therefore *Oikologia* (ecology) in its original form would etymologically represent a natural environment, a territory we create for ourselves and others around us. There is, nevertheless, a distinction between a political and a scientific ecology, as M. Serres states (quoted by C. Watkin): “In political discourse ecology is the ethical desire to preserve nature, understood as a wild and virgin space, protected from the ravages of humanity. In science, ecology (*oikos logos*: knowledge of the milieu, the habitat) is quite a different thing. Defined by the biologist Ernst Haeckel at the end of the nineteenth century, it is a highly sophisticat-

ed science that tries to gather all the geological, chemical, biological, vegetal and animal interactions that constitute a milieu, for example the biotope of Mont Ventoux.”³ The main criticism towards the Anthropocene is the significant human impact on the earth’s geology and ecosystems. In this host-guest relationship between the human and non-human, where the sides are always perplexed, as Timothy Morton in his *Dark Ecologies* (2016) states, one has to move beyond the anthropocentric framework and rethink the concepts of nature and ecology while stepping away from the notion of the human as the ultimate modulator⁴ of the planet.

²A. Mitropoulos, *Contract and Contagion: From Biopolitics to Oikonomia*, New York, Minor Compositions, 2012., p.51

³C. Watkin, *Michel Serres: Figures of Thought*, Edinburgh, University Press, 2020, p.331

⁴*Modulor* is an anthropometric scale of proportions devised by the architect Le Corbusier in 1948.



fig.22: Max Neuhaus, Untitled, Domaine de Kerguéhennec, 1986–1988

¹S. Voegelin (Interview with Ania Mauruschat, 2021.), [Last accessed: 05.12.2022., https://soundcloud.com/salom-voegelin/gesprach-ania-mauruschat-und-salomevvoegelin-2021?utm_source=clipboard&utm_medium=text&utm_campaign=social_sharing]

“Today the mantra human-centred design is chanted again as the way to approach any question, as if the human is a specific knowable entity. It presupposes a kind of transparent human, which is such a fragile, utopian or even dystopian idea.”⁵ Modulor (Le Corbusier, 1948), as a “universal anthropometric scale”, based on a healthy male proportion, fails as such to reconsider the systems (and dimensions) outside of those patriarchal norms. The architecture was never oriented towards just a masculine body, nor just towards human beings solely (taken for example animal shelters on farms or other agricultural typologies) and is constantly evolving due to current conditions and should always re-think and respond to the existing societal and natural challenges. What if architecture, in its various scales, is already interrogating its position in relation to natural surroundings, in the post-anthropocentric framework? The author of the Thesis would like to propose that a specifically architectonic notion of Echology could lend itself as a helpful instrument for such a reconsideration of concepts of nature and ecology, in that it can take into account the echoes as a positive anomaly of any constructed space and, at the same time, portray a provocative sonic contingency of the passive “steady ground”. A contingency of the “steady ground” in the sense that it temporarily disturbs the observer/listener, or at least stimulates confrontation of time and space and its participant. To observe the phenomenon at its odds means fundamentally reconstructing the existing patterns and rethinking new possibilities. Echology, which thus implies caring for another, “gardening” the plenty of the given but also provoking a disturbance, moving in a periodic cyclical motion.

Throughout the term, consequently emphasising the notion of the echo in a given topos (because the place, in this case, is always fixed - the echo is what gives it an illusionary extension). If a closer look at the echo as a (spatial) sound phenomenon was taken, one might notice many facets of the echo in space and time. When it comes to sound - to resonate - means to become audible, exposed. Without bounds or resistance, there is no vibration and therefore neither is there the resonance. Resonances generate time and reveal topological barriers. This research will use the notion of echologies to expand on its traditional architectural role of the visual and the physical by viewing it as a device of self-reflection, participation and repetition, leading to four main aspects of the echo: Mirroring, Interruption, Cyclical Repetition and Sonic Volumes. The participative, collaborative and plural side of the sound widens the field of vision and thus opens up quite new perspectives. The sound as a physical, intangible and ephemeral sensibility demands a mental engagement in the present moment and encourages the called ones to observe, to re-orientate and thereby to develop creative and critical anticipation. Ecologies of hearing the Anthropocene reclaim a potential period of sound, listening and active perception as vehicles to access new ways of inhabiting the planet in the current ecological crisis by stimulating hospitable manners of care. How could one, with respect to others and acknowledging the Phonicene⁶ as the era of listening, expand his/her sonic vocabulary within the framework of the predominant visual one? How can one grasp the prevalent visual regime and its policy to understand the world from another distance, or a different perspective?

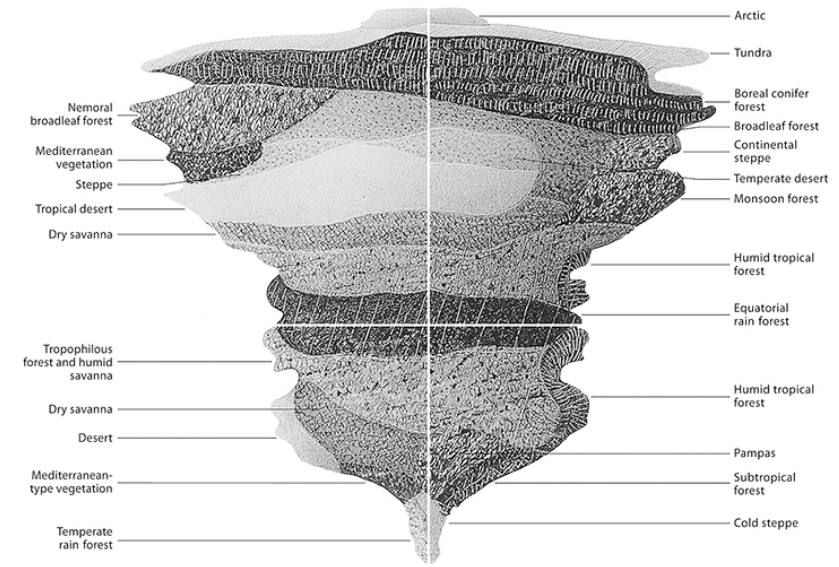


fig. 24: Gilles Clement, *Theoretical continent*, “Superimposition of the major climatic zones with their assumed vegetation, irrespective of continents. Virtual Pangaea corresponding to a possible biological reality as the result of planetary intermingling.”, *The Planetary Garden*, 2015

⁵B. Colomina, M. Wigley, *Are we human? Notes on an archaeology of design*, Lars Müller Publishers, 2017., p.102

⁶A term coined by Donna Haraway, here mentioned by Vinciane Despret: “Phonocene means trusting the musicality of the world (including its rumbles) and try to learn from it. And it also means leaving the sphere where the logos of the Anthropos owns all privileges to renew a link to language other-than-human ones.” (Despret 2020); excerpt from the introduction to the lecture: Despret, Vinciane. “Phonocene”: Bird-singing in a Multispecies World.”, RIBOCA2 and suddenly it all blossoms: Public Programmes Online Series of Talks and Conversations, 2020., <https://www.rigabiennial.com/en/riboca-2/programme/event-language>

“Instead, we can recognize the visuo-centrism that determines this historical dualism and can appreciate how the anthropocentric is tied up with visuality, in order to find the unthought not in philo-sophy but in the thought of sound, which opens vision maybe not to truth but to its plurality.”

— SALOMÈ VOEGELIN,
The Political Possibility of Sound, 2018.

What is a word for

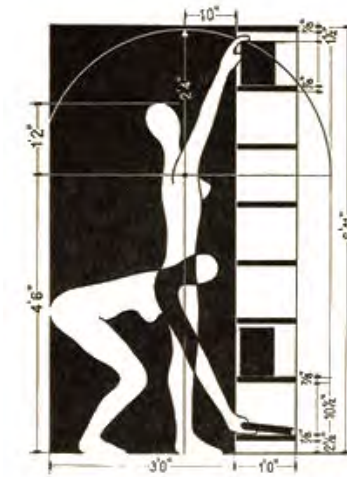


fig. 25

a female modulator?



fig.26: Detail of "Daphne turning into a laurel tree", René-Antoine Houasse, Versailles, 1677

"You at once notice that every plant, every tree has its rhythm. And even several rhythms. Leaves, flowers, fruits and seeds. On this cherry tree, flowers are born in springtime along with leaves that will survive the fruits, and which will fall in the autumn, though not all at once. Henceforth you will grasp every being [chaque être], every entity [étant] and every body, both living and non-living, 'symphonically' or 'polyrhythmically'. You will grasp it in its space-time, in its place and its approximate becoming: including houses and buildings, towns and landscapes."

- HENRI LEFEBVRE, *RHYTHMANALYSIS: Space, Time and Everyday Life*, 1992.



fig.27: Veduta di Palermo by Francesco Lojacono, 1875. Manifesta 12 Palermo Atlas by OMA, 2017, Courtesy OMA, for Manifesta 12 "Planetary Garden: Cultivating Coexistence", Palermo

ASSEMBLAGE

*Man can live anywhere. Other living creatures cannot.
They regroup in habitats (biotopes) that correspond to their needs.
Each major planetary climatic zone defines a biome,
a collection of compatible forms of life.
Within each biome are found a multitude of biotopes —
natural assemblages— together with organized territories —
cultural assemblages.*

Gilles Clement, *The Planetary Garden*, 2015

INTERMINGLING

*Wind, currents, animals bring together creatures living at great
distances from one another. Man, the essential vector of such
meetings, accelerates the natural process of intermingling at
the global scale. His action reduces and sometimes removes the
barriers of isolation. Intermingling is a threat to diversity even
though it produces new situations and new creatures.*

Gilles Clement, *The Planetary Garden*, 2015



fig.28: Formafantasm: Cambio – Serpentine Galleries, 2019. Val di Fiemme, Italy 2019. The image shows the damage to natural forests caused by an extreme storm. Photo credit: C41 Productions

“To assume everyday life to be governed by beliefs and superstitions, there have to be rites and objects, symbols and sacred places; every civilization has produced its own. Everything you see there—the guide was pointing to the cosmographic symbols and ritual objects—all that sacred inventory does more to explain the hole in the ozone and air pollution than any objective analysis of the environment. The way we live our everyday lives is an expression of our convictions. For some people, water is what is used for washing cars, for others it makes the rice grow, for others still it purifies the body. The person who washes cars doesn’t think about the rice, and even less about the rituals; the river that flows below his house doesn’t have the same meaning for him that it has for the farmer or the

priest. It’s not only their use of water that separates them, it’s an idea of water, a culture of water. The universe is not what we see, but what we believe. Beliefs generate practices. In our country—and increasingly worldwide—drinking water is being sold for the price of wine. We’re beginning to worship it like Bacchus. “

— GILLES CLEMENT, *PLANETARY GARDEN*, 2015

new narratives

*“New affects require new languages:
what do you call that haunting
feeling of ecological memories of
landscapes transfigured by violent
development? Eco-nostalgia?
Remembrance of trees past?
Geo-physical semiotics? Portrait
of a young wasteland? Colonial
transfigurations? Scar wars?
Terrestrial delirium? And how
should we describe that sinking
feeling at the thought of the
unsustainability of our future?
Postanthropocentric nausea?
Extinction-attraction syndrome?
Global obscenities overload?
No country for any human?”*

— Rosi Braidotti & Maria Havlajova,
The Posthuman Glossary:
Introduction, 2018

Echologies Multiple Realities



“I am interested in this sound that is inside this little shell. It is a sort of architecture. Can we read this shell as an architecture prototype, because you try to enter inside that shell? You put the seashell next to your ear, it doesn’t completely surround you, but it produces an interiority somehow, and it is very sonic because it has the sound in it, which is supposed to be the sea. With the shell, proximity, as well as tangibility, interaction and contact also happen. You need to participate in this to hear the sound.”⁷

fig.29: Seashell; seashells could be observed as a prototype of miniature “sonic architecture”

If one would observe the notion of hospitality with the help of sound and sonic as a model, it might be assumed that there was a certain playful generosity to it. It is not about the exhaustion of the other (of the receiver), it is about with-nessing (being with the other) in the present moment. It is about resonating, and syntonizing throughout sounding and listening. Within this realm, sonic goes beyond empathy, not just by putting oneself in the position of the other but by attuning with the other as well. How to think of hospitality and host-guest relations in the terms of resonance and sonority? How can one comprehend the policy of the visual regime and see the world from a different perspective? The concept of Echology, which encourages echoes as an anomaly and (sonic) contingency of the passive, steady ground, will be introduced in relation to the scale of architecture as an amplifying tool.

⁷ Quoted from the interview on the page 111

This discourse will use the notion of Echologies to expand on its traditional architectural role of the visual and the physical by viewing it as a device of self-reflection, participation and repetition, leading to four main aspects of the echo: mirroring, interruption, cyclical repetition and sonic volumes. One such approach will be explored through and reflected upon the work of Vinciane Despret and Salome Voegelin. Sound as a physical, intangible and ephemeral sensibility demands a mental engagement in the present moment and encourages us to observe, to re-orientate and thereby creating creative and critical anticipation. How to think and talk of sonic architecture within the framework of a predominantly visual vocabulary? These theoretical gestures will try to provide a different insight into our perception of sound in the man-made environment.



fig.30: Sara Gossett, Unzipping the Wilderness (Highway in Brazilian forest), Brazil, 1972

*a poem made by author

Image is more seductive than the written word. But in its presence of easily accessible information or ignorantly confident thoughts,

suppressed, and sustained from one's own thoughts and prejudices or at least to make the second one. It doesn't leave much space for interpretation as the written words do. and the absence of withheld anticipation.

The Persuasive Power of the Image
or
The Immediacy of the Visual

Sound is, therefore, the most genuine one - one needs to be silent, Words are unpretentious they require constant engagement.

[sound, listening, sonic sensibility, attunement, empathy, echology]

Supressed Voice

mirroring

The first elaborated trait of Echology would be mirroring, through which the echo is a reflecting, resonating sonic instrument, invoking the perceiver's empathy and engagement. A vibration or an oscillation, the movement back and forth in a regular rhythm, suggests a distance, a gap, a void, separation, and a certain interval or passage of time. In this lapse of time in which the voice is reflected, there is a particular distance from which the voice originates. Exactly in this very gap is where the voice of the potential other is situated. One is to be silent in order to hear, to give a voice to the other else. Simultaneously the act of mirroring pertains to a certain awareness of the *acteur* - it could be said as "What one gives to the other, is what reflects back to oneself". Therefore, this exchange between the giving and receiving demands a mental engagement of the audience (from the Latin *audientia* - "hearing, listening" or

audibilis - "that may be heard"), implying active participation of the listener and the observer. The synchronous interplay between the bodies that produce and hear sounds. One cannot passively observe one's unsteady surroundings, which is precisely the property of a sound. The nature of sound is that it is omnidirectional and therefore occurs differently than for example, light. The diversity of sound can be easily distinguished even when one hears various sounds at the same time because it possesses a multi-form identity. In other words, there is a temporal depth characteristic to its distributing range. Opposing to the light which overlaps and is seen as one light.⁸ The omnidirectional nature of sound penetrates all matter, leaving dispersed waves but also disrupting correlations between space and time.



"When it comes to sound and it is no accident that sound gives us the paradigmatic term 'resonance-this is most properly an appeal: it makes itself heard, which means that in showing itself it also shows distance, the distance from which it originates. Sound is spatial, it spreads through the air (or another medium) of which it is the vibration. Whereas the visible moves through space and in certain regards cancels it out, the sonic marries with distance and assimilates it."⁹

fig.31: John William Waterhouse, *Narcissus*, 1903, illustrates the myth of *Echo and Narcissus* from Ovid's *Metamorphoses*

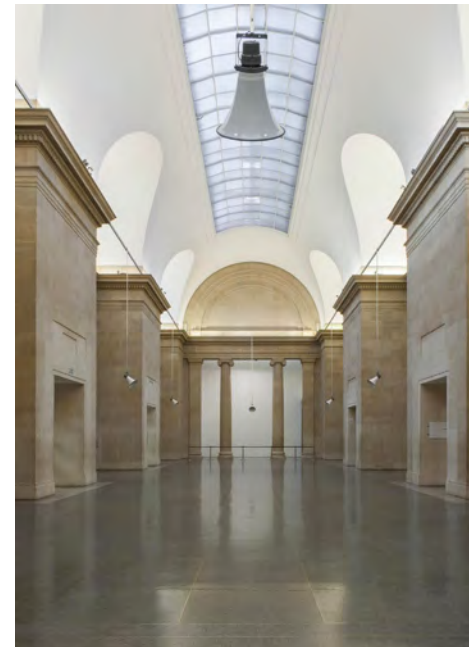
⁸ Elias Zafiris, *Mathematical Thinking for Architects*, 23.10.2019., Master Module at TU Wien WS2019/20, Meta-Architektur, Talk: *Mathematisches Denken für Architekt*Innen*

⁹ J.L. Nancy, *Resonance of Sense* included in *Spectres II: Resonances*, Europe, Shelter Press, 2020., p. 15

Copia, mimic - Impersonated echo

To proceed further on, what echoes invoke through this multiplying moment is the *copia*, imitation, mimic - a replica. Hence as well impersonated, anonymous (nameless) voice and sound. Sound, which is dispersed, deconstructed, re-formulated and importantly, uncontaminated and uncorrupted. It is detached from its own origin, authenticity and/or integrity. A voice which is reflected multiple times in a room, an echo of an echo, does not belong to its originator anymore. It is altered and modified by its environment. This creates a moment, a possibility of new interpretations and new formulations. The captured reflected sound provides many inexhaustible scenarios, depending on the perceiver in a given moment. There is a particular novel virtue considering the medium of sound. The characteristics of the medium, along with the methodologies they offer, suggest novel, intersectional ways to register an ecosystem while constituting evidence that destabilizes the primacy of the visual as generative of proof (Schuppli, Ganchrow). This Echology could be interpreted as a way of nurturing the soundscapes (sound environments) around us, cultivating a polyphony of dispersed sounds that are compromising (altogether) in attunement. Or as M. Serres names it, the “universal acoustics”, a new universal language helping us to see things from a different angle, becoming accessible to many.¹⁰ It is a language which would make future systems visible and possible. A cosmopolitan, participative approach towards the obstacle of sound. One could, on this occasion, provide the term *sonic Anthropocene*, as a more engaging and critical discourse in practicing

active listening, external within just the anthropocentric realm. On that account, to reflect and to act on the Anthropocene sonically involves engaging with another modality of experience that “brings into the world novel relations, it shifts paradigms and builds new formations” (Kanngieser 2015). Such arguments resonate very well with a later term ‘*Phonocene*’, coined by Donna Haraway, here interpreted by Vinciane Despret in her recent emerging art installation: “The fact of inscribing our time under the sign of the Phonocene is not to forget that when the earth rumbles and squeaks, it is because it also sings. It also means not forgetting that these songs are disappearing, but that they will disappear even more if we do not pay attention to them. It evokes the inventive forms of cohabitation and orchestration developed by animals, giving an account of the formidable power of “sung territories”.¹¹ As well as Haraway puts it: “The imposed silence, has allowed us to hear the sounds, and this is the first step towards trying to generate a more plural ‘us’ that is meaningful to a personal journey.”¹² Those silenced, hushed voices or as Salomé Voegelin calls it “Echography of the inaudible” should be presented as a playful, generous way of grasping the information, giving it some space and re-forming it in a creative, inventive manner. “Such an echography of material practice does not produce a visible geography, an organization of the invisible on a map, but explores the unseen reverb of reflection where plural causes become visible and their consequences thinkable, and where other voices can make themselves heard rather than theorized.”¹³



32

DISEMBODIED AND SPECTRAL SOUND

In her works Susan Philipsz (fig. 32 & 33) uses the medium of sound and mainly her voice by recording it, fragmenting and re-composing it and afterwards placing it in various settings. Although each piece is distinct, the narratives and motifs are often familiar, exploring well-known themes of loss, longing, hope and return. One might interpret her work as an example of the previously mentioned impersonated, copied voice, which seeks the engagement of a participant and therefore reformulates new interpretations and narratives in each observer. In addition to evoking emotional responses, these universal themes also aim to temporarily close gaps between the individual and the collective, as well as

between internal and external settings. The soundscapes that Philipsz creates are echoes of the past, the present and the future. Deconstructed and impersonated voices in her sound installations reverberate in a unique way, firstly according to its acoustic setting, and secondly regarding the listener’s inner thoughts and feelings. Soundscapes of certain acoustic milieus sometimes evoke characteristic and unexplained impressions and sentiments, thus resonating with every observer in their own, unique way.

“Another example that comes to my mind is the music at the outdoor pool. The sound, which, as far as I remember, bounced in all directions and actually created an impression of great vagueness, left me with an image of nostalgia, of not belonging. A feeling that I cannot describe as pleasant, but not overly unpleasant either.”¹⁴



33

¹⁴ Quoted from the interview with Dora, p.97

¹⁰ M. Serres, *Musik*, Berlin, Merve Verlag, 2015.

¹¹ V. Despret, *Phonocene: Bird-singing in a Multispecies World*, RIBOCA2 and suddenly it all blossoms: Public Programmes Online Series of Talks and Conversations, 2020, <https://www.rigabiennial.com/en/riboca-2/programme/event-language> [Last accessed 27.02.2023.]

¹² D.J., Haraway, *Staying with the Trouble: Making Kin in the Chthulucene*, Durham, North Carolina, Duke University Press, 2016.

¹³ S. Voegelin, *Political Possibility of Sound*, 2018., p.21

interruption

If the echo of simultaneously produced sounds is not very well orchestrated it becomes, a following aspect of Echology - a provocative echo, an interruption. A polluted, painfully unclear, noisy disturbance. It is an unwilling disruption, disorder, and cacophony of unorchestrated sounds. Something to which Despret relates as “*Anthropocacophony*” - noises made by humans.¹⁵ But not necessarily destructive or harmful. It is, as Serres states, that sometimes disorganised noises introduce disorganisation into the existing structures. These disturbances are as well messages in the chaotic system.¹⁶ “Communication theory is in charge of the system; it can break it down or let it function, depending on the signal. A parasite, physical, acoustic, informational, belonging to order and disorder, a new voice, an important one, in the contrapuntal matrix.”¹⁷ They are the provocative echoes of the current times, demanding new solutions, new (social, political) constructs, and new orders. Again invoking the participated harmonization towards the (firstly mentioned) balanced syntonization. As a function of time and system, the noise and the message alter roles in the system depending on the observer’s position and the actor’s behaviour. They also interact with one another. They order within the chaos or vice versa.¹⁸ As with every unpredictable occasion or moment of crisis, thus lies an opportunity for finding new solutions by breaking the old patterns. As Voegelin emphasises the notion of recognition that reality has always more sides and only through an empathetic manner of trying to understand the world from a different perspective and, through constant repetition of those, only then positive reformulations can be established. Only through the active collectiveness, engaged

in a plurality, not solely an individual “I”: “Agitated, on a precarious ledge, we are teetering towards a groundlessness that does not seek this logic but enjoys the substance of the phenomenon; and that does not hold a word for ground or its expectation, but exists through our individual and collective agencies and in perpetual re-forming, in the disorder of an unexplainable world. This is being in the time-space refrain of “I” which through repetition but never the same, dissolves into an “us” of people and things in restless concatenation carrying, rather than standing on a groundless ground...”¹⁹ What Serres refers to as a parasite (or a noise) is as well a contingent interruption or a distortion of the message. To explain this, one has to accept the fact that order comes from disorder - they are always relationally defined. Order and disorder are not entirely opposed entities, but they always appear in close relation to each other - there is no one without the other. They intertwine and stimulate each other. Chaos as an antithesis is not complete and utter chaos, but a locally determined concept relating to the concept of the cosmos. Utter chaos can never be put on a scale but will remain forever unweighable and unmeasurable. It can be Nothing or a dominant Something.²⁰

¹⁵ V. Despret ‘*Phonocene: Bird-singing in a multispecies world*’

¹⁶ M. Serres, *The Parasite*, Baltimore, John Hopkins University Press, 1982.

¹⁷ *Ibid.*, page 6

¹⁸ *Ibid.*, page 66

¹⁹ S. Voegelin, *Singing Philosophy: Deviating Voices and Rhythms without a Time Signature* (Text score 2), p. 286

²⁰ Paul Klee Notebooks, Vol 1: *The thinking eye*, tr. Ralph Manheim, London, Lund Humphries, 1961, p.3



34



35

“GROUNDLESS GROUND”

In Jean Cocteau’s films from the ‘50s, the one repeating and characteristic metaphor always shows in the form of a mirror as a threshold to another world. It is the moment of the protagonist’s transcendental life transitions while facing a mirror. The mirror turns itself unexpectedly into a liquid or a “groundless ground”, which takes the protagonist into another vast dimension. As in an obscure dream without any textures, colours or any vivid essence, space appears as a dark intimidating environment. For him, mirrors are portals into another realm, in parallel to the life one knows, reflecting the unchangeable passage of time.

In “Blood of a Poet”(figures 36 & 37), a

camera (behind the protagonist facing the mirror) rotates for 90° and suddenly vertical mirror becomes a horizontal ground - a play of switching the position/perspective, typical for Cocteau’s movies where the ground becomes unsteady terrain, in which the actor (and the audience) are disturbed by its instability/uncertainty. This horizontal mirror thereafter becomes a (swimming) pool through which the actor falls and finds himself in a vague dark space. Those mirrors or unending dimensions behind them echo and represent our unpredictable inner worlds, perplexed and undiscovered. One could say that the echo (at least the interrupting, provocative one) could be this type of disturbance. Echo that happens multiple times until it becomes just an



36



37

fig. 34 & 35: still images from the movie *Orpheus* (French *Orphée*), Jean Cocteau, 1950. [mirror becomes a moveable liquid through which Orpheus enters the Underworld]

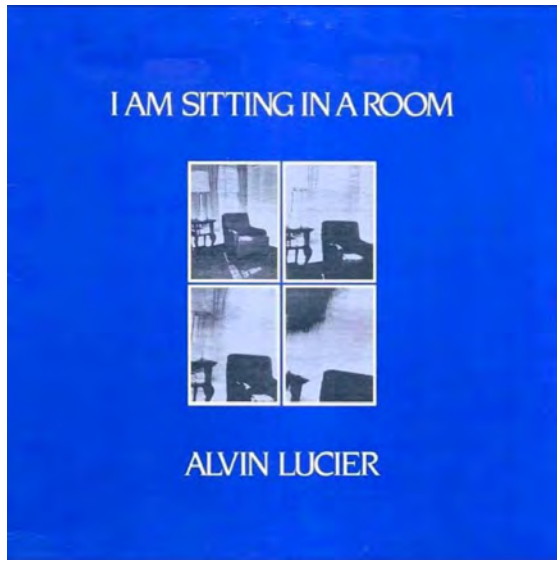
fig. 36 & 37: still images from the movie *The Blood of a Poet*, Jean Cocteau, 1950, [mirror becomes a horizontal pool through which the protagonist enters another world]

irregular, noisy, disturbing sound.

When something becomes irregular, it throws itself out of order, out of a habitual rhythm and it provokes.

“It is symptomatic of a disruption that is generally profound, lesional and no longer functional. It can also produce a lacuna, a hole in time, to be filled in by an invention, a creation. That only happens, either individually or socially by passing through a crisis. Disruptions and crises always have origins in effects on rhythms: those of institutions, of growth, of the population, of exchanges, of work, therefore those which make or express the complexity of present societies.”²¹

²¹ H. Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life*, English translation: London & New York, Continuum, 1992., p.44



“Instead I decided to use speech; it’s common to just about everybody and is a marvelous sound source. It has a reasonable frequency spectrum, noise, stops and starts, different dynamic levels, complex shapes. It’s ideal for testing the resonant characteristics of a space because it puts so much in all at one time.”²²

fig.38: Alvin Lucier, I am sitting in a room, 1969; Mary Lucier – Polaroid Image Series, 1970, used on the front and back cover of Alvin Lucier’s I Am Sitting In A Room LP, Lovely Records, NYC, 1981.

COPIES: PERPETUAL RE-FORMING

Following the notions of mirroring and interruption or specifically copia and disorder, one might refer to Alvin Lucier’s sound art piece “I am sitting in a room”, as a combination of both concepts.

During the performance of the piece, Lucier records himself reading aloud from a manuscript and then replays the tape recording into the space to record it again. The updated recording is then played back, followed by a new take. Certain frequencies of the recording are amplified while others are reduced due to the room’s unique size and shape. The words eventually lose their meaning and are soon replaced by the distinctive resonating frequencies of the room. The first recording of “I am sitting in a room” was made at the Electronic Music Studio at Brandeis University in 1969. The

first performance of the work was in 1970 at the Guggenheim Museum in New York. In collaboration with his partner Mary Lucier, the performance featured projections of Polaroid images (fig.38) that had been degraded like the voice - her polaroid pictures offer equivalent to Alvin Lucier’s soundwork, recorded “in the living room of his home in Middletown, Connecticut”. By perpetual, repeating process of re-recording the sound, what is consequently produced and heard in the end, is a new re-formulated sound. Through the specific acoustic properties of the room, the sound is modulated and affected, and through the repetition of those, it will affect every following recording. In a way it stands as a “sponge” of its sonic milieu, absorbing important and filtering out unimportant resonant frequencies of the area, never knowing what will result as a consequence.

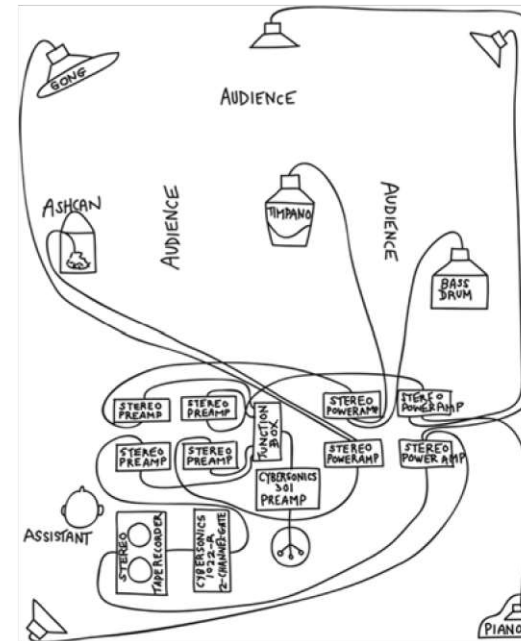


fig.39: Graphic Score for Music for the solo performer. From Kahn D. Earth so und Earth signal: Energies and Earth magnitude in the arts. Los Angeles: University of California Press; 2013. p. 87. Image courtesy of Alvin Lucier.

“If the dimensions of a room are in a simple relationship to a sound that is played in it, that sound will be reinforced, that is, it will be amplified by the reflections from the walls. If, however, the sound doesn’t “fit” the room, so to speak, it will be reflected out of phase with itself and tend to filter itself out. So by playing sounds into a room over and over again, you reinforce some of them more and more each time and eliminate others. It’s a form of amplification by repetition. Thinking of sounds as measurable wavelengths, instead of as high or low musical notes, has changed my whole idea of music from a metaphor to a fact and, in a real way, has connected me to architecture.”²³

“Actually, there’s no such thing as “high” notes or “low” notes, we simply borrowed those terms from the visual world to describe something we didn’t understand.”²⁴

²² A. Lucier, S. Douglas, *Chambers: Interviews with the composer*, Middletown, Connecticut, Wesleyan University Press, 1980., p.35

²³ Ibid., p.37

²⁴ Ibid., p.35

periodic cycles

This dimension of Echology demonstrates the nature of the movement of the sound. To be more specific, the reverberation, the resonance of an echo or multiplied echoes that operate in periodic motions, in a cyclical repetition. They are perpetually developed cycles. Everything has a frequency (everything vibrates) on a certain level. Frequency captures the number of repetitions and how fast or how slow the circulation happens. Energy is proportional to frequency, and frequency is in itself a periodicity or circulation, which means that it does not depict a closed circle but circulates to infinity. Reverberation is a complicated series of echoes of many surfaces that combine together in the ear, allowing one to hear a sound.²⁵ Throughout these frequently repeated, infinite cycles, one could pay attention to specific rhythms and patterns which are thus developed. As Lefebvre suggests: “Rhythms imply repetitions and can be defined as movements and differences within repetition.”²⁶ In natural life processes and

Cohabitation

biorhythms, one could apply this manifestation of repetition that comes in cycles: “Cyclical repetition is easily understood if one considers days and nights – hours and months – the seasons and years. And tides! The cyclical is generally of cosmic origin; it is not measured in the same way as the linear. The numbering systems best suited to it are duodecimal, which is to say base twelve: the twelve months of the year, the twelve hours of the clock-face, the 360° of the circumference (a multiple of twelve), the twelve signs of the zodiac and even a dozen eggs or oysters, which means to say that the measure by twelve extends itself to living matter in direct provenance from

nature. Cyclical rhythms, each having a determined period or frequency, are also the rhythms of beginning again: of the ‘returning’ which does not oppose itself to the ‘becoming’...”²⁷ It is, nevertheless, important to make a distinction between the rhythms, time-space relations of the South and the ones of the North. A time does not “repeat” in the same way, nor does it have the same meaning in the different poles of the Earth. The Mediterranean, considered a “slow history”, is a history of constant repetition, cherishing its rites and ceremonies, ever repetitive cycles. In the Nordic (or as well oceanic towns), on the other hand, one could find more regulated, restricted times.



fig.40: behavior of water is similar to the sound, it spreads in repetitive cycles until it interfaces an obstacle

²⁵ E. Zafiris, *Talk: Mathematical Thinking for Architects*, 23.10.2019., Master Module Meta-Architektur/Meta-Architecture at TU Wien, WS2019/20

²⁶ H. Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life*, Tran. Stuart Elden and Gerald Moore, London & New York, Continuum, 1992., p.90

²⁷ Ibid.

Regardless of this distinction in social practices, one could divide them to the public, representative and introverted, more intimate rhythms. “Rhythms ‘of the other’ would be the rhythms of activities turned outward, towards the public. One could also call them ‘the rhythms of representation’; more restrained, more formalized, they would correspond to frontal expression in discourse. The rhythms ‘of the self’, in turn, are linked to more deeply inscribed rites, organizing the time turned moreover towards a private life, therefore opposing self-presence to representation and, as such, quieter and more intimate forms of consciousness to the forms of discourse...”²⁸ By nurturing the rhythms of the Self or the rhythms of the Other, one creates habits, social conducts, values, ideologies, system and policies. The political power, for example, knows how to utilize and control those rhythms in times when needed. Rites and ceremonial habits shape the mentality of the majority within a culture. In healthy societies where the rhythms of the Self and the Other resonate with each other and are balanced and well adjusted, and therefore harmonized and structured. Take then, for instance, the behaviour of birds which throughout their constant patrols occupy the territory of their closed habitus. Through constant repetitions, they appropriate the space for their own needs. “When observing a bird in the process of setting up its territory, it is impossible not to notice the endless repetitions of these patrol flights (like the songs, everything is based on repetition). We described right at the beginning how the bird chooses a high point, then begins to fly to and fro within a space which gradually, as a result of these repeated comings and goings, these

rhythmic patrols, forms the appropriated space.”²⁹ This scenario of repetition and “returning” of the cycle/s, challenges the concept(s) of habit through the overlapping of the persistent model and what it is in the process of appropriating and adapting. What Catherine Malabou remarks as a habit is a twofold meaning (in French) of the word itself, firstly as “to fold”, and secondly “to yield, bend, give in under pressure”. She defines a habit as a “plastic operation which transforms the organism into an instrument that resists change by adopting it and adapting to it.”³⁰ The vibrating string is vibrating, resonating, exactly because of this resistance, boundaries which are opposing the string itself. The habit is the intermediate, vague space between the subject and itself - it possesses a notable characteristic of plasticity, it is formable. In other words, the habit is in a way a process of adaptation, a repeated change. The living being is able to assimilate the change and transform it into internal quality. What was initially only a submission becomes with repetition the power to initiate movement, and the activity becomes more and more prompt, and increasingly easy - to quote her further: “It costs less to fold a paper when it has been folded already.”³¹ There is a similar example in Harraway’s description of symbiotic relations in the Posthuman approach where it is hard to distinguish what is contained (a medium) and what is containing (a matter, substance - chemical, biological). The notion of a “cyborg” for example comes from those questions of identity and organisms.³² It is a concord of parts that are not equal but are in a stable equilibrium, inside the process of a constant evolutionary framework. The living, polyrhythmic body is made up of

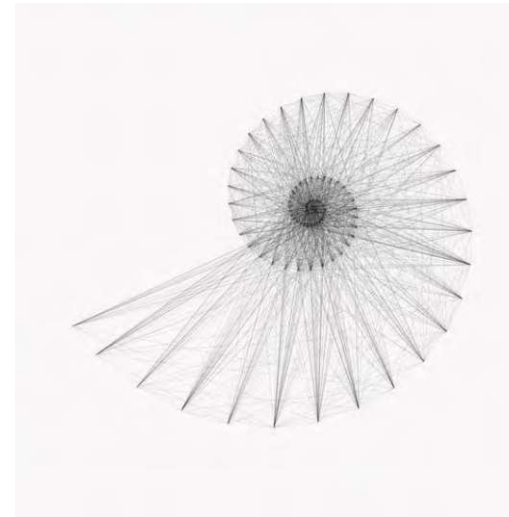


fig.41: Frederik Skatar, *Fibonacci Spirals*, Studies of Fibonacci spirals, 2012

various rhythms, with each “part,” or organ or function, having its own. Those rhythms constantly interact, maintaining a substantial equilibrium that is continuously disrupted but consistently recovers.³³ It seems that the human, in a parasitic host-guest relation to the planet Earth, does not always rethink his role as a temporary guest in relation between him/her and other species. Within the multi-species typologies and the sonic as a model of understanding and perceiving, Echology of periodic cycles could reclaim the Anthropocene as a potential period of sound, a listening and active perception. Insofar as vehicles access new ways of cohabiting with the planet in the current ecological crisis, by stimulating hospitable manners of care. As well as

“REPETITION PRODUCES NEWNESS”

“For thought without invention doesn’t count; it copies and repeats. It will only find through this training, which therefore is a must for the researcher as the universal model for the conditions of discovery. Inspiration never comes without perspiration. But, once again, training forms a paradox since by repeating the same action, the same research, the same concern that wakes us early in the morning, it makes the body or the world change and promotes the new. No doubt what the professionals call ‘being in the zone’ marks the attainment of this strangeness.”³⁵

Malabou elaborates by quoting Aristotle: “Having is making a distinction between the man who HAS a garment and a garment that is HAD” - the way in which we live our lives is the way in which we wear our coat, we are adapting the coat to the living our life. One should not forget the origin of the word habit - from the Latin *habere*, “have, having”: I have my own life, in the sense of habit. That is exactly applicable to the notion of routine - “Most of the things we do in our daily life we are not aware of how or why we do them, but our body is aware, it knows. We are in a way becoming alien to our own body.”³⁴

²⁸ H. Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life*, 1992., p.95

²⁹ V. Despret, *Living as a Bird*, 2021., p.104.

³⁰ C. Malabou, *The relation between habit and the fold*, EGS. Saas-Fee, Switzerland. August 12 2017. Public open lecture for the students of the Division of Philosophy, Art & Critical Thought.. Last accessed: 16.12.2022.; <https://www.youtube.com/watch?v=EglV1eVTrpU> [Last accessed 05.12.2022.]

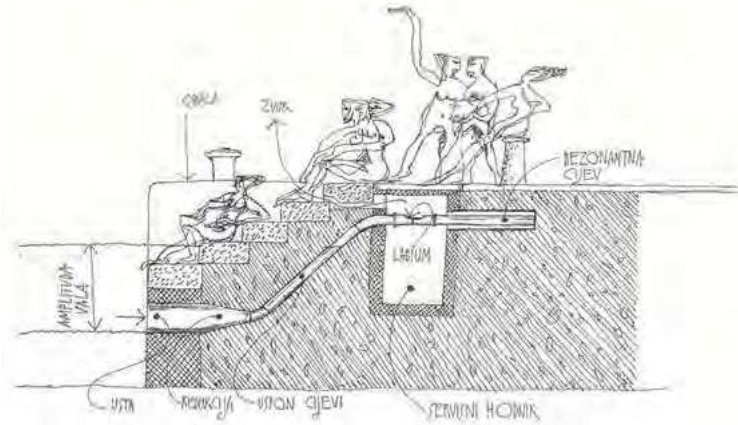
³¹ *ibid.*

³² Vera Bühlmann, *Talk: Mathematical Thinking for Architects*, 23.10.2019., Master Module Meta-Architektur/Meta-Architecture at TU Wien, WS2019/20

³³ H. Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life*, 1992., p.85

³⁴ C. Malabou, *The relation between habit and the fold*

³⁵ M. Serres, *Hominiscence* (from the chapter: “How Our Body Changed - Paradox: Repetition produces newness”), London, Bloomsbury Academic, 2019, p.32



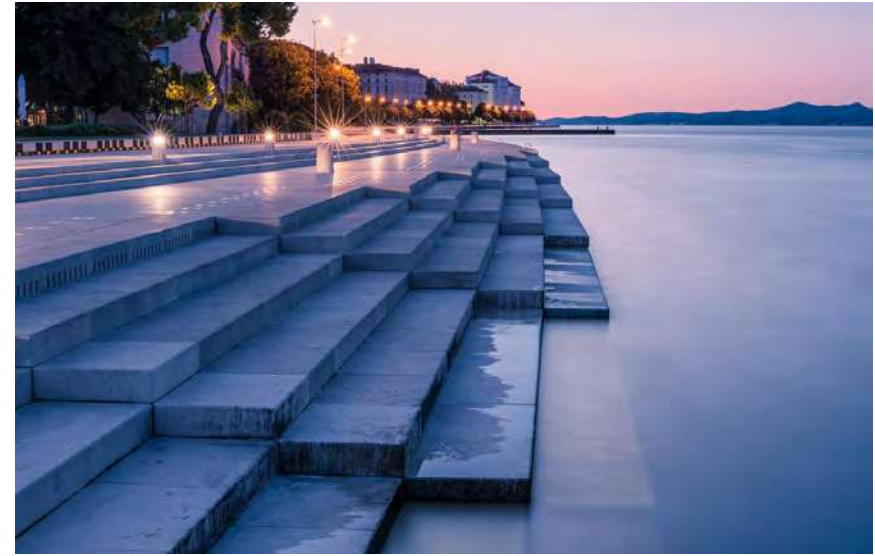
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43

“Waves come in succession: they take shape in the vicinity of the beach, the cliff, the banks. These waves have a rhythm, which depends on the season, the water and the winds, but also on the sea that carries them, that brings them. Each sea has its rhythm: that of the Mediterranean is not that of the oceans. But look closely at each wave. It changes ceaselessly. As it approaches the shore, it takes the shock of the backwash: it carries numerous wavelets, right down to the tiny quivers that it orientates, but which do not always go in its direction. Waves and waveforms are characterized by frequency, amplitude and displaced energy. Watching waves, you can easily observe what physicists call the superposition of small movements. Powerful waves crash upon one another, creating jets of spray; they disrupt one another noisily. Small undulations traverse each other, absorbing, fading, rather than crashing, into one another.”³⁶

³⁶H. Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life*, 1992., p.85



44

NATURE AS A PERFORMER

“The Sea Organ”, known as “Morske orgulje” in the Croatian language, is a piece of architectural sound art and experimental music instrument located in Zadar, on the Croatian coast, that produces music through the sea waves and tubes beneath a series of massive marble steps. The Sea Organ was designed by architect Nikola Bašić and completed in 2005. It is a 70m long natural music instrument

with 35 organ pipes placed beneath the concrete. The musical pipes are placed so that the seawater and wind motions make melodic sounds that passers-by can hear, thus achieving a dialogue with nature and promoting architectural and environmental coherence. The seaside tides and winds are often unpredictable, so this organ monument produces a never-ending concert of various music varieties, with Nature engaged as the performer.

fig.42.: Nikola Bašić, section of the *Sea Organ*
fig.43 & 44: Nikola Bašić, *Sea Organ* by unsteady (left) and calm (above) weather, Zadar, Croatia, 2005

Delayed Sound: *Klapa* singing

Contrary to light, sound always relates to time. Delay in sound is very common in different music styles. Echo and reverberation are, for instance, two types of delay. Canon in singing, or rounds is one such example of mirroring the previously produced voice with a delay. It is a compositional technique, based on the principle of imitation, in which an initial melody is imitated at a specified time interval by one or more parts, either in the unison (i.e. the same pitch) or at some other pitch. Melodically, the original direction may be reversed, so that in imitation the song is read backwards (retrograde), or the intervals, while remaining unchanged, are made to travel in the opposite direction (mirror) or both (retrograde mirror). One could say that the architecture is the mediator, an instrument, reverberating its various tones, directly or indirectly influencing the (dis)harmony of the space. Of the sonic commons. Of the soundscapes between remoteness and intimacy. “In opposition to the linearity of vision, listening is largely polar/spatial: listening happens in the round. The

kind of information gathered by the ear is on the order of environmental gestalt; the auditory apparatus privileges the whole over the part in the parsing of the auditory scene.”³⁷ Most of the time the acoustics of the space dictates how the sound is going to reflect, so the more echoey the space, the more possibilities there are to play with a delay (echoes) of sound. Hence it relies very much on the architecture in which the sound is being produced. Space either enhances or absorbs sound and echo, so here lies the importance of architecture as a resonator and amplifier of sound. Echoey spaces, therefore, provide a possibility for purely vocal, a *cappella* singing style, without any instrumental or electronic accompaniment. Such an example of a capella singing style derives from Dalmatia, Croatia, so-called “*klapa*” (sg.) or “*klape*” (pl.), a form of traditional a cappella choir singing. In Latin, later as well as Italian, a *cappella* means “in a chapel or choir style.” The word ‘klapa’ in Croatian originally means a group or a team of friends. The singing style traces its roots to

littoral church singing. The motifs in general celebrate love, wine (grapes), country (homeland) and the sea. The main elements of the music are harmony and melody, with rhythm very rarely being very important. In 2012, *klapa* was inscribed by UNESCO as an Intangible Cultural Heritage of Humanity. “Bela Bartok’s work, about the area once known as Yugoslavia (1951:1—93), suggests general characteristics of the songs of the Southern Slavs that can be related to the *klapa* singing.”³⁸ Before the 1600s, scholars believed that all “chapel style” music was sung a cappella. According to recent studies, in the past, some voices may have been doubled or replaced by instruments. A cappella is a term used today to designate a vocal-only performance. The type of singing in *Klapa* requires an echoey environment because they are performed almost exclusively without instrumental accompaniment but also because the delay in sound plays a crucial role in their performance. First, the leading voice (tenor) leads the melody and lyrics of the song and four, five or more other singers follow accordingly

and respond to each other. Through prolonged reverberation, the sound becomes multilayered - each earlier voice is extended, so the next one follows and gradually they form a continuous polyphony of melodic notes, relating to each other - deep voices acting as the basis (bass, baritone), higher ones (tenor) leading the choir. Whereas echoes are usually troublesome oddities, which complicate regular speech and communication and even certain types of singing, for *Klapa* (or a cap-

pella in general) singing, it is a beneficial phenomenon of the acoustics, meaning they are usually performed in very reflective spaces of a certain shape and material. One such example is the Vestibule (The Rotonda) of Diocletian’s Palace in Split (Croatia). The Vestibule was built at the beginning of the 4th century AD, as the original part of the ancient palace. It is a circular hall, once topped with a dome, 17 meters in height and 12 meters in diameter. Built as a grand meeting hall only for select-

ed audiences of higher social and political status, nowadays a noticeable acoustic phenomenon lending itself to singing voices. Other than that, the concerts are very often performed in churches and cloisters, due to their specific echoey acoustics. This interesting manifestation of sound, which reverberating spaces offer, could be recognized as a powerful tool to observe architecture as an instrument of various sounds and frequencies.



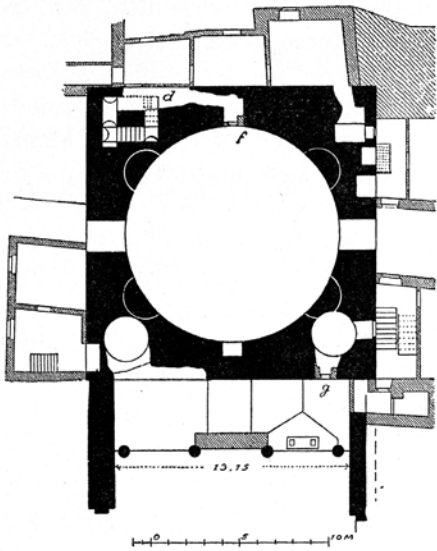
fig.45: *Klapa* performing in Vestibule (Rotonda), Diocletian’s Palace, Split, Croatia

³⁷ S. Cluett, *Acoustic Projection and the Politics of Sound*, Department of Music, Center for Arts and Cultural Policy Study, Princeton University, Working Paper Series, 2010, p.5

³⁸ J. Čaleta, *Klapa singing: A Traditional Folk Phenomenon Of Dalmatia*, Institute of Ethnology and Folklore Research, Zagreb, 1997, p.136



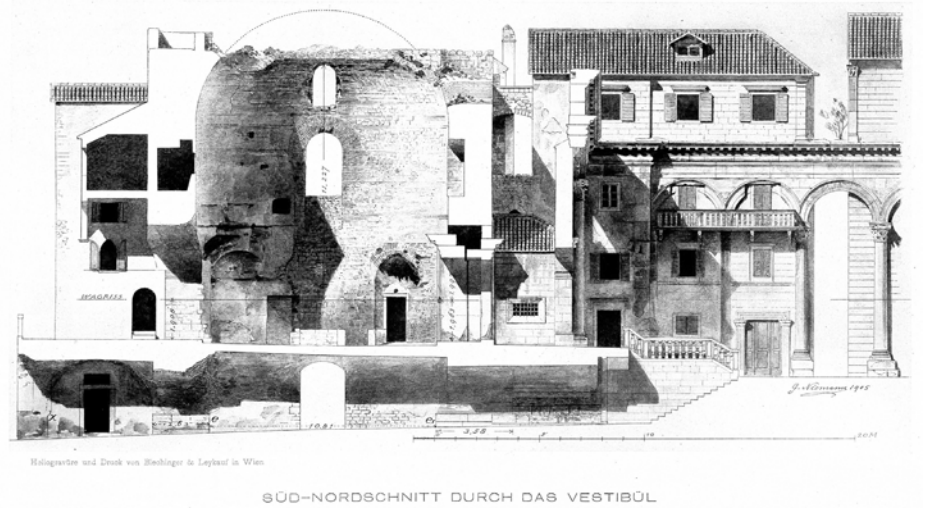
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“Only the leading voice, *prvi tenor* (first tenor, the leader of the group), leads the melody and lyrics of the song. He initiates the singing. The second voice, *sekondo* (second tenor,) immediately joins in at a third below. The third voice *bariton, daje ulja pismi* („gives oil to the song“ - [synonym for the soul]), completes the triad. The fourth voice, *bas* or *basso profundo* (bass), defines the harmonic functions of tonic, dominant and subdominant. He challenges himself in low and strong singing (*profondo*).”³⁹

³⁹J. Čaleta, *Klapa singing: A Traditional Folk Phenomenon Of Dalmatia*, p.136



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fig. 46: The Vestibule (The Rotonda/Atrium), Diocletian's Palace, Split, Croatia, 284–305 AD, image from nowadays
fig. 47: Floorplan of the Vestibule, Österreichisches Archäologisches Institut, Verlag: Alfred Hölder, Wien, 1910
fig. 48: cross section of the Vestibule with surrounding buildings, Heliogravüre und Druck von Blechinger & Leykauf in Wien, Rekonstruktionszeichnung aus: Niemann (1910)

One might compare architecture to an amplifying instrument of its sonic milieu, given that Harmonics rules were utilized for better acoustics in the ancient Greek and Roman theatres, along with other architectural typologies. To clarify it, in the words of Vitruvius: “As a result, the ancient architects, following in the footsteps of nature, perfected the ascending rows of seats in theatres from their investigations of the ascending voice, and, using the canonical theory of the mathematicians and that of the musicians, attempted to make every voice uttered on the stage come with greater clarity and sweetness to the ears of the audience. For, just as musical instruments are brought to perfection of clarity in the sound of their strings through the use of bronze plates or horn, the ancients devised methods of increasing the power of the voice in theatres through the use of harmonics.”⁴⁰ Additionally, sounding vessels (positioned in a particular order) were as well of important role as a resonating device: “On this principle of arrangement, the voice, uttered from the stage as from a centre, and spreading and striking against the cavities of the different vessels, as it comes in contact with them, will be increased in clearness of sound, and will wake a harmonious note in unison with itself...”⁴¹

Along with the vessels, theatrical masks were apparently as well enhancing the performer’s voice. One might describe it as a prototype of a microphone: “Ancient drama was largely based on theatrical speech. According to Aristotle, acting was a matter of voice having three important qualities: volume, harmony and rhythm. All these qualities are especially important for communication in outdoor theatres. Since the actor’s voice was the most important

theatrical element, the mask is considered as an instrument to enhance the voice presence over the entire theatre space and endow the voice with a decided directional delivery.”⁴² In the beginning, Greeks used the same word, *prosopon*, for both - mask and human face: “Moreover, during the Classical period, ancient Greeks used the same word for the mask and the human face: “*prosopon*”. This approach did not change until the second half of the 4th century BC when Theophrastos used for the first time the word *prosopeion* to describe a mask.”⁴³ The word “mask”, originating from “*Persona*” (Lat. *per sonare* - to make one louder), is contradictory in a way that it expands the voice of the performer, which is in the opposition to the fact that it is mainly - the mask (supposed to be “masking”, hiding). It does not hide one, it makes one even louder, more outstanding, and more prominent. On the other hand, it stands as a resonator, so, in this perspective, it is not just a symbolic mask. It is firstly of a performative usage (sonic - as a microphone) and secondly of a symbolic one (as a character in the theater).

sonic volumes

⁴⁰ Vitruvius, *Ten Books on Architecture*, (Book V, chapter III: *The Theater: Its Site, Foundations, and Acoustics*), p.139

⁴¹ Vitruvius, *Ten Books on Architecture*, (Book V, chapter IV: *Sounding Vessels in the Theater*), p.143-144

⁴² F.Kontomichos, C.Papadakos, E.Georganti,T.Vovolis,J.N. Mourjopoulos, *The sound effect of ancient Greek theatrical masks*,University of Patras, Proceedings ICMC, Athens, 2014

⁴³ Ibid.

“Being honeyed”

A final characteristic of Echology is more related to its materiality and intangible “viscosity”. It is found in the in-between spaces, of the “sonic volumes”, “(...) not as a measure of decibels but as the space of the environment’s material and temporal expansion that creates an invisible interactivity of things in which we live as interbeings, as being in relation with everything else; inhabiting the in-between of sound.”⁴⁴ They are the sonic volumes, in which the space itself becomes an intensity rather than an architectural structure, metamorphing its reverberant, sonorous character. And as Voegelin further states: “...sound in its invisible mobility and depth, provides access into the possibility of a visual world, where its singular actuality is illuminated and fragmented into the mobile and plural processes of its production, which gives us the insights and tools to resound time and space with different echoes that resonate in their blindspots and black-outs.”⁴⁵ With an echo, interiors are not merely rational, constructive parts of the architecture, they become ephemeral soundscapes,

providing a dimension of the spacious, extended volumes. Those soundscapes change then according to the movements and actions of us and others within the space, which therefore influence how one perceives the architectonic spaces in their staging.⁴⁶ Salomé Voegelin elaborates further on this notion of the sonic volumes through the example from Maurice Merleau-Ponty’s idea of “being-honeyed”: “Honey is a slow-moving liquid; while it undoubtedly has a certain consistency and allows itself to be grasped, it soon creeps slyly from the fingers and returns to where it started from. It comes apart as soon as it has been given a particular shape, and what is more, it reverses the roles, by grasping the hands of whoever would take hold of it.”⁴⁷ The proportionality of his phenomenological reflexivity is expressed by being honeyed. The only way I can feel the honey is through its stickiness. In my “honeyed” hands, it manifests as a complex phenomenon with no clear structure but a demanding nature that cannot be grasped as a distant thing.⁴⁸ Similar to how sound bounces back, finding

its way throughout different interiors (from the corridor, towards the hall or a narrow staircase), reflecting back in a more or less echoing form, depending on the material substance of that one which it is reflected from. Each space is full of sounds, each object has its own resonance and frequency within the space. Through the bodies that move and use the space, they give a particular sonorous/audible character to the space i.e. - sound in time and space. In its formless form, adaptable to changes, it does not become something else, something different, only in its reflected shape it modifies itself.

By its etymological origin, echo additionally means huge, vast, roomy, spacious, voluminous, deep indicating the relation to 3-dimensionality, therefore affirming the sonic illusion of the enclosed space. It is an illusion of the extended space perceived through the sonic sensations. To support the argument, an example of what Voegelin describes as the moment of realization of the sonic sensations, which she portrays as the sonic volumes while walking through the museum with her students and

applying the exercise of listening and observing: “Our walking-sounding-listening became a form of co-habitation of ephemeral rooms that do not remain rooms but become ‘volumes’, triggering an understanding of the exhibition space not as a construction of walls, floors and ceilings, windows and doors, but as a dimensionality that has a capacity: the capacity of the work and the capacity of our experience of it.”⁴⁹

Following the Echologies, Soundscapes, on the other hand, extend, and at the same time specify the territory of the acoustic environment. The word soundscapes, with the suffix -scape (shape, form, scene), illustrates a specific audible field. Similar to the landscape, where land is broadened with its -scapes. This sonic entity is a sensation, a provocation, as well a landscape and a narration of the invisible, immaterial. Here the sound gets another, specified dimension in the soundscape, provoking the audio-visual imagery. Therefore sonic landscapes or soundscapes provide a possibility for one to become aware, to dive into the viscosity of the immaterial, intangible sonic volumes.

Any space can be perceived

through sound - we can all sense spatial geometry one and can picture the depth and height of space even with our eyes closed. The sound reflected off walls creates an aural stimulus through which one becomes aware of the surrounding space, its properties and its shape. Space thus becomes audible (from the Latin *audibilis* - “that may be heard”). It is expressed with an aural manifestation which parallels visual and tactile ones. Through the act of perceiving we grasp the unique structure of things, and their unique way of being that speaks to all our senses simultaneously: the perception of an image is an experience that involves the observer completely, as an individual and with all his/her senses. Therefore, the process of perceiving the space involves the merging of our senses of sight, hearing and touch to produce an integrated, continuous and consistent mental representation of the phenomena one is experiencing. Intangible property of the sound in space - the sonic volumes, in which the space itself becomes an intensity rather than an architectural structure, metamorphing its reverberant, sonorous character. With an echo, interi-

ors are not just the rational, constructive parts of the architecture, they become the ephemeral soundscapes, providing a dimension of the spacious, extended volumes. Additionally, Henri Lefebvre emphasises the significance of architecture (throughout the movement and societal habits) as an amplifier of the sound, as an instrument of those sonic volumes: “Architectural volumes ensure a correlation between the rhythms that they entertain (gaits, ritual gestures, processions, parades etc.) and their musical resonance. It is in this way and at this level in the non-visible, that bodies find one another. Should there be no echo to provide a reflection or acoustic mirror of presence, it falls to an object to supply this mediation between the inert and the living.”⁵⁰

⁴⁴ S.Voegelin, *The Political Possibility of Sound: Fragments of Listening*, 2018, p.10

⁴⁵ Ibid.

⁴⁶ Ibid.

⁴⁷ Maurice Merleau-Ponty, *The World of Perception*, London and New York: Routledge, 2008, p. 41

⁴⁸ Ibid.

⁴⁹ S.Voegelin, *The Political Possibility of Sound: Fragments of Listening*, 2018, p.55

⁵⁰ H. Lefebvre, *Production of Space*, Basil Blackwell Ltd, English translation first published 1991.



fig.49: *New Light* (the curve of the altar), Ellen Barratt, The Swiss Church London, 2020

Sound as a Voluminous Body

Measured by its length and height,
predetermined by its posture,
Reverberant,
spacious tone.

Once defined component,
now a consequential issue.

That what stands in between,
is called *a s o u n d*.
That what forms the pitch and timbre,
is what architecture does.

Certain volumina,
certain corporeal features.

Always shaped by defined material components.

Walls,
floors,
ceilings,
doors.

A narrow corridor,
or rather, an excessive patio.

Once exposed to noise,
an ear adapts to its disturbance.

Silence,
not the same as absence.

With every further repetition,
Echo *fills the space*.

[sonic volumes, being-honeyed, echology]

*a poem made by author

Extension of the Space and Body

In her book *“Living as a Bird”* the Belgian philosopher, psychologist and ethologist Vinciane Despret describes the singing of birds as marking and signing their territory. Through cyclical repetitions of their patrol flights and thus the creation of the sonic “walls” between different species of birds, they form their appropriated space.⁵¹ “The bird’s song will therefore be expressive power, ‘extensive’ power, and it is not impossible that the power of this song, its rhythm and its intensity, will to some extent determine the possible extension of what will become a territory, in a way similar to that achieved by patrolling an area by continuously flying to and fro. In other words, the bird’s song becomes one with the space - quite literally. The song is the expressive mode through which a sung space takes shape and becomes the bird’s body.”⁵² To put it in another way, the space and the bird’s song merge. Through the expressive medium of song, a sung space assumes the form of a bird and becomes its extended body.⁵³ The bird might be said to be sung by its song if the song is an extension of its body, just as the spider’s body transforms into its web and forms new relationships with its surroundings.⁵⁴ Additionally, as well as it is a spider’s extension of its own body, it is as well enlarging its territory, occupying it through this own bodily extension. But not marking its territory in a way that Serres points it out as contaminating it in order to appropriate it and make it yours.⁵⁵ As Despret argues further: “The song functions to some extent like a spider’s web. The web woven by the spider extends the limits of the spider’s body in space; it is the spider’s body and all the space caught in

the web, which becomes the web-space, the body-space, this space which was until then the milieu or the surroundings becomes a property of the spider not in the usual sense, but in the sense that it possesses certain particularities.”⁵⁶ One could draw a line from birds and the sound or echoes of their voices, read as an extension of their bodies, to what exactly happens as a phenomenon of echo in spaces - (illusionary) extensions of the interior volumes. As well as marking the territory in birds through their singing, one could say that a human in a way signs the territory by producing sound, noise or, simply, by giving it a voice. When exactly does something become a territory, a property? Once it is enclosed? Once that one puts the walls around it and declares it “theirs”? When contaminated by noise and assigned? While producing sound and noise, one correspondingly defines a space. One marks the territory in a way. One vocalizes the space and gives it a certain rhythm, tone and gesture - specific to one’s own individuality. That is a certain volume formed in the vocalization of words, sounds and voices, giving shape to the empty, unoccupied space. It plays a symphony together with the architecture of the space, with the architecture of one’s biology in the given time. “It is about finding the theories which are more in tune and better in tune, both in the sense of being attuned to a richer and more diverse reality and in being more closely attuned to birds and to their performances than was the case with previous theories. It is the realization that a territory is an ensemble made up of many different powers. And knowing how to respect these.”⁵⁷

“SOUND - SPACE , BODY - SPACE ”

The resonance, a condition of an oscillating body, is an appropriation or modelling of spatio-temporal conflicts manifested as a vibration. By establishing its boundaries, be it in the form of fixed strings, open space or a concert hall, one affects the outcome of it. The works of Bernhard Leitner focus on the audio-physical perception of environments and things that are shaped in both form and content by sound movements. The main topic is the connection between the human body and

built-in acoustic structures. He introduced the installation as an art form, allowing the installation space to emerge through sound. His sculptures and installations, which he calls “sound-space objects,” result from extensive, creative and complex processes. By investigating how the body is affected by sound frequencies, volumes, movements and combinations, he engages in what could be considered fundamental scientific research. He also explores the effects of posture on acoustic perception and sketches potential spatial figures, such as cubes, corridors and fields.

Leitner generated “spatial models in an invisible (new) geometry” by placing sounds and series of sounds in diverse, precisely performed movements. The installation is a spatial fragment, a spatial volume to be read as a unified object. By implementing a body in this context, this unified spatial object becomes an extension of the body and the space through which the limits of “invisible new geometry” could be explored. Through sounding, they become sonic volumes, invisible to the eye but recognized and understood by the ear.



fig.50: Bernhard Leitner, Spiegelgalerie/Gallery of Mirrors, Tyrol Landesmuseum Ferdinandeum, 2003.-2005.

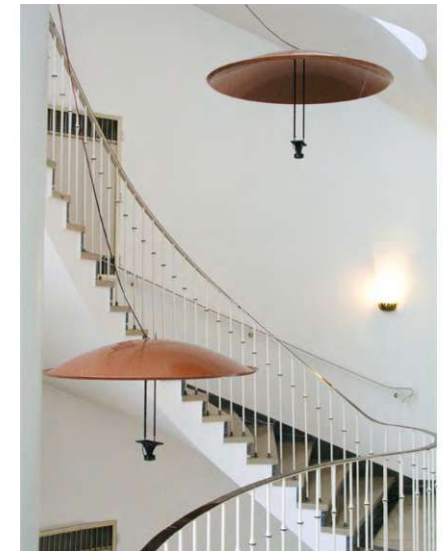


fig.51: Bernhard Leitner, Kaskade/Cascade, Allianzbuilding at Kurfürstendamm Berlin, 2006.

⁵⁷ Ibid., p.160

⁵¹ V. Despret, *Living as a Bird*, London: Polity, 2021, p.97

⁵² Ibid.

⁵³ Ibid., p.98

⁵⁴ Ibid.

⁵⁵ M. Serres, *Das eigentliche Übel*, Berlin, Merve Verlag, 2009., p.9

⁵⁶ V. Despret, *Living as a Bird*, p.97



fig.52: Atelier Leitner - Sound Columns 1999

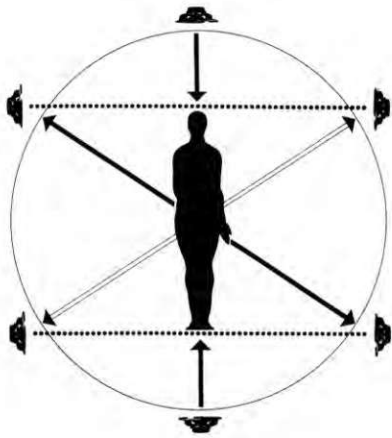


fig.53: Bernhard Leitner , "relationship between sound, space, and body"

„Tonhöhe“

Grenzen
der Architektur
betonen,
vertonen.
Die Höhe des Baues
mit anderem Sinn
versinnlichen.
Die Kuppel
mit Klang füllen,
ihr in Raum-Gewicht
geben.
Mosaik und Kuppel,
Oben und Unten
verbunden,
gleichzeitig hören.
Über das sichtbare Innen
in einen anderen Raum
hineinhören.
Den Hall der Kuppel
absenken zum Mosaik.
Aufsteigen
eines Posaunenstoßes
aus dem Mosaik
in die Kuppel,
wo er anschwellend
und zeitgedehnt
als Raumkrone
die Kuppel entgrenzt.
Zeit-Vermessungen
der vertikalen Geometrie
des Fischer von Erlach.
Zeit-Architektur.

-Bernhard Leitner

Ethereal side of Sound

A cup is
a holder
of a liquid,
but just for
a moment.
As much as
a corridor
is an amplifier
of an ephemeral
sound ambience.
Soon,
both will find
their own way
to get back
to that
formless form,
its permanent
aggregate state.
An intangible,
impalpable
shape.

[sonic volumes, being-honeyed, echology]

*a poem made by author

The Wisdom of the Composer: Syntonization

As an intangible and ephemeral sensation, sound compels us to be mindfully present and invites us to listen and reorient, encouraging creative and critical anticipation. This suggests that while thinking of architecture, one should consider those sonic vectors that present dimensions not only in regard to scales in the spatial, coordinated space but in its temporal sense as well. The material components of the space, such as walls, ceilings, and built floors, possess different acoustic qualities, which adequately produce various kinds of echoes - both of different lengths and frequencies. Similar to the architecture of an instrument, where a musician either blows air into it, hits on it, or picks up the instrument's string. Consequently, it produces a particular sound fully responding to, or better to say, reflecting the kinds of environment it has been placed. The acoustic qualities of the built space could be observed as extensions of musical instruments that suitably match the musical repertoire. A phenomenon of Klapa (a capella) singing in particularly echoey spaces emphasizes a powerful notion of architecture seen as an amplifier and instrument of its sonic milieu.

The four elaborated architectonic models of Echologies attempt to expand the traditional architectural role of the visual and the physical by viewing them as a device of self-reflection, participation and repetition, namely the four main aspects of the echo in a time-space relation: Mirroring, Interruption, Periodic Cycles and Sonic Volumes. The aspect of Mirroring that includes introspection through withheld anticipation, suppressed by momentarily distancing and by practising active and engaging listening and by offering room

for the Other's voice. It is about balancing the rhythms of the Self and the rhythms of the Other. The act of mirroring pertains to a certain awareness of the host and the guest, by cultivating a polyphony of dispersed sounds that are orchestrated in attunement. Dimension of Interruption as a disruptive but innovative and creative provocation. It demands coordinated communication by opening up new interpretations as a response to the moment of crisis, mostly in collective agencies and in the perpetual re-forming of the novel, flourishing perspectives. Periodic cycles or a cyclical repetition that come and go, establish themselves through perpetual re-forming, as a moment of appropriation, of forming the territory, of formulating coexistence with the other through rites and responsible care within the non-anthropocentric framework. Lastly, maybe the most architectonically applicable dimension of Echology - the subversive property of the Sonic Volumes - as the model of rethinking predetermined systems, through which architecture becomes a spatial instrument that articulates temporalities in the same way as a musical instrument articulates sounds in time. There is no distinctive hierarchy between those registers of Echology, contrarily they possess complementary characteristics. While they frequently engage in spatial interactions, they do not exhaust each other. Instead, they grasp, deepen, project, reproduce, scale up, interrupt and sometimes even intertwine one another, hence stimulating novel outcomes. Architecture as, in its essence, a holistic creative field, consisted of political, economic, cultural, technological, scientific,

and even religious institutional powers, could lend itself as a helpful instrument for a reconsideration of concepts of nature and ecology (of hearing). The echoes stand as oddities of any constructed space and at the same time, they are a depiction of a provocative sonic contingency of the passive, steady ground. So in the sense that they temporarily disturb the perceiver or at least stimulate confrontation of time and space. To observe the phenomenon at its odds means fundamentally reconstructing the existing patterns and rethinking new possibilities. One could assume that there is a playful generosity to the idea of hospitality, if one were to examine it by using sound and sonic as a paradigm.

It is about with-ness—being with the other in the here and now—rather than the other becoming exhausted. It is about resonating and syntonizing while sounding and listening. Within this realm, sonic goes beyond empathy, not just by putting oneself in the position of the other but also by attuning with the other.

The sound's participatory, collaborative and pluralistic aspects open up new ideas by enlarging the field of vision. Ecologies of Hearing the Anthropocene reclaims a future era of sound, listening and active perception as vehicles to access novel ways of inhabiting the earth in the current ecological crisis by encouraging hospitable habits of care.

Resonating Voices

(A set of interviews)

III

Chapter III - “*Resonating Voices*” is imagined as a collection of individual and unique descriptions, associations, memories, impressions, triggers and everything that the sound invokes in one. The interviewees have different backgrounds and professional interests but are all in some way related to music, sound, architecture and design. At an individual level, they offer authentic and personal interpretations and observations of sound and “sonic worlds,” and on a collective level - a spectrum of dispersed sentiments to which one can relate to a certain extent. Everyone can distinguish space around oneself and determine its spatial geometry through its reverberation and resonance. Listening to a reflection of an echo in space makes one aware of the room’s height, width, texture and propor-

tions. Echoes reflect, transform and return back to oneself while extending far into the distance. An echo and its copy are delivered to us, reflected off surfaces and diffracted by the edges and boundaries. They are contingent and provocative but, at the same time, modifying, captivating and responsive. According to the Quantum Physics, everything vibrates at a certain frequency. Without bound, there is no vibration and, therefore, no resonance, either. When something resonates, it makes itself heard, “...which means that in showing itself it also shows distance, the distance from which it originates.”¹ Resonances generate time and reveal topological limits. Harmonics from one string can merge with harmonics from another one, to generate new harmonies in a secondary layer, as much as the voice of one within the voice of the second and the third creates a polyphony in unison. No combination is ever the same - different mixtures, tones, and characteristics always create different outcomes. By combining different perspectives and new formations, consequently novel realms are established. Through each individual story, one can gain another

perspective on sonic perception. To resonate is to evoke the past - echo is already in the past but occurs in the present. It is omnipresent because, at the same time, it happened in the past, appears in the present and resounds in the future. So are those conversations encrypted in here and now, which become the past, potentially stimulating and sparking the reader’s interest. Such is the plethora of resonances collected in the pages below: a cornucopia of voices, events, sensations and feelings that interconnect and greet one another. Everyone may resonate differently and possess a unique history, but in order for us to all feel resonance at the same time, we all are bound to be willing to accept it. The concept of the welcome appears in all of the interviews that follow, flourishing the human aspect of resonance, an aspect crucial to all creation, interaction and community of thought. Resonance is thus in this context also considered to be an act of attention, listening and exchange. “It must come and go. To take place necessarily means opening up a place.”²

¹J.L. Nancy, *Resonance of Sense* p. 15

²Ibid., p.13

“My voice is my own instrument”

Penelope, opera singer

#Interview

How do you perceive sound? What is it for you and what is your relation to it?

As an opera singer, my whole job is to create a sound, so it is a very physical experience. For me, singing is (at least in this operatic career), how to make the most beautiful, pleasing sound. And it's interesting because as a singer, you shouldn't listen to it when you're singing. **We often think of sound as something to be perceived with our ears, but if I perceive it with my ears while I'm singing, I'm doing something wrong. Because just the act of witnessing your sound distorts it in some way.** If I concentrate on the sound rather than how this feels, I am listening to myself and not giving my voice to others. It's just an experience for me. Because how I hear myself in my head is different from how you would hear me. And that's something that can also be very difficult. It's like that when we hear our own voices on recording, and we think, “who is that? That's not me?!” **So, my sound experience is very physical, and it is like a physiological sensation.** I feel it in my breath, I feel the vibration in my body, going through my throat and mouth. Also, when I teach - because people are so caught up in how they sound - I start by doing elementary lessons. Like, for example, in classes we start by producing sound and noises, going like: “ommmmm”, and not focusing on how that sounds at all. There is no right or wrong, just how it feels in the chest, the “Bruststimme” (chest voice), but also how it vibrates in your head and your cheeks. So as a singer, sound is a physical sensation, but also, having said that, you know I am not usually alone when I sing. I have other instruments next to me. So in the Opera House, we always practice with the piano before we get to the stage with the orchestra. And that is so interesting because you get used to how the piano sounds as one percussive instrument (that's what piano is classified as - a percussive instrument). And afterwards you get to the orchestra, which is an entirely different timbre (a texture of the sound). So for example, oboes or wind instruments all have a different timbre than, for example, the string instruments, and then there are the percussions. Also, all instruments are in a way trying to mimic the voice. For instance, for the cello it is said that it is the closest thing to a human voice because of the sound's color and all the strings that mimic the vibrato of the voice. So, once you are on the stage and listen to all of these different timbres, you really understand what the composer meant to write because it's not just all of the instruments are confined to a piano, it's the different textures that are coming out. **And so that is my favorite process in putting in on an opera, is that when you hear and realize, “oh, this is what the composer meant,” and how it changes when you have these different instruments. So my perception of sound is entirely different, having the voice with the orchestra.**

It seems like a very complex transition, as starting from one instrument, and afterwards you have this spectre of sounds and sonic textures, or as you said - timbres. It seems challenging to synchronize and attune your own voice with the whole orchestra, to find a perfect balance in unison.

It is complex, because, if we talk now about the room in which we sing, we practice in one kind of space, and then we get on the stage. **Then it's the conductor's job and people listening and the audience during the rehearsal period to tell us how this sounds in**

The figure consists of two parts. The top part is a musical score for '2. Thema' in G major, 3/4 time. The melody is written on a treble clef staff, and the piano accompaniment is on a bass clef staff. The score includes dynamic markings such as *ff*, *fz*, *p*, and *pp*. The bottom part is a point-based translation of the melody, where notes are represented by black circles of varying sizes and positions, connected by a dashed line to show the melodic contour. A solid line above the points shows the pitch contour. The figure is labeled 'Fig. 11¹' and 'Das 2. Thema in Punkte übersetzt.'

¹ Bei diesen Übersetzungen ist mir Herr Generalmusikdirektor Franz v. Hoesslin mit seiner wertvollen Hilfe beigestanden, wofür ich ihm meinen herzlichen Dank ausspreche.

Fig. 54

the hall, and to attune us, because, you can't really hear. You get a perception from your voice going out and then reflecting back at you, but you don't honestly know how this resonates in the space on the other side of room. You have to, again, trust the feeling. You have to trust your breath control, your breath support, and that you're shooting the sound out because as soon as you try to be loud, you'll start pushing, and you'll begin to distort the sound, and that's not good. You have to trust that it does project because, as you know, we opera singers don't use microphones, so a considerable part of it is learning how to project. Then there is also the orchestra positioned under the stage, usually under the pitch, which is good because otherwise, if they were above the same level as us (singers), it would be challenging to compete the voice and the orchestra. So since they are positioned lower, under the stage, the sound comes out into the room. And the conductor's job here is tough, trying to synchronize the singer with the orchestra and have them all be at a reasonable level.

As an opera singer and a performer, how well do you think you perceive the reflection of the sound that you are producing?

I had an experience recently in the church that was so echoey that people in the audience who were from the theatre said to me, "just don't worry about the text, the audience isn't going to understand it anyways." So, it can be really nice because you also don't have to worry so much about the projection **as soon as you go "aahhh," it fills the space.** So that is nice if you're feeling a bit tired or weak, you **open your mouth and produce a sound, and it resonates with the space.** But I like something in between, so the opposite of that is a room that has a lot of soft, absorbing materials, like Volkstheater in Vienna, for instance. They say if you can sing in there, you can sing anywhere. Because the whole interior is in velvet, the seats and how the stage is built are acoustically dead. You get a sensation as if you're singing to a pillow. A sound doesn't reflect back at you. And that is a terrible experience for a singer because you must completely trust the feeling alone. Otherwise, you will push and hurt your voice. As if you think, "I

"So as a singer, sound is a physical sensation, but also, having said that, you know I am not usually alone when I sing. I have other instruments next to me. So in the Opera House, we always practice with the piano before we get to the stage with the orchestra. And that is so interesting because you get used to how the piano sounds as one percussive instrument (that's what piano is classified as - a percussive instrument). And afterwards you get to the orchestra, which is an entirely different timbre (a texture of the sound)... So, once you are on the stage and listen to all of these different timbres, you really understand what the composer meant to write because it's not just all of the instruments are confined to a piano, it's the different textures that are coming out. And so that is my favorite process in putting in on an opera, is that when you hear and realize, "oh, this is what the composer meant," and how it changes when you have these different instruments. So my perception of sound is entirely different, having the voice with the orchestra."

really need to be loud. I can't hear anything," that is something you don't want when it's so much fabric to soak up the sound like a recording studio. That is really unpleasant. **So yes, if I think about my ideal space, I think about singing in an opera house because the opera house is obviously built for this, but the one that is not too big. So the opera houses in Europe are generally tiny on the ground floor, circle-shaped, or square, that is not so wide. It is more this nice circle that goes really high up.** And so, if you are in the audience and think, "I don't really care about seeing it so much. I really want to get the best sound," you would go up. That's the best sound because the voice is soaring up. If you care more about looking at the stage, you would be on the ground floor, but that is the worst acoustically. Then, for example, the Metropolitan in NY is a huge opera house with around 5.000 seats, and you go inside this building and it feels like a giant barn. It doesn't feel like it is built for the voice. As a result, you can't hear many singers because it is too big - so that is not really ideal for the voice. **What is suitable for voices is a smaller space, like around 700 until a maximum of 2.000, I would feel**



fig. 55: Volkstheater, Vienna, Austria, 1889

"They say if you can sing in there (Volkstheater), you can sing anywhere. Because the whole interior is in velvet, the seats and how the stage is built are acoustically dead. You get a sensation as if you're singing to a pillow. A sound doesn't reflect back at you. And that is a terrible experience for a singer because you must completely trust the feeling alone. Otherwise, you will push and hurt your voice."

comfortable with, and smaller ground space and then go really tall and have a dome shape. And then it is just a pleasure to sing. I would define joy as just where you feel that you are singing and the voice is resonating without you having to strain. You get a good amount of feedback, but not too much where you would feel overwhelmed. You can hear the orchestra clearly, and it's just a lovely experience because you can trust your body. So I would say that's my favorite place to sing. Of course, it does change a little bit if you are doing a recording. The recording is a tricky matter because only certain voices sound well recorded. They tend to be smaller voices that have more of a darker tone. So for example, my voice has a lot of what I call metal in it. It's very bright, even you can tell that my voice is very far forward. Often with Americans, it's a bit nasally. And this gives what you would, as an audience, describe as a "ping." It's right in the front, instead of feeling like it's in the throat or at the back of the mouth. There are different singing techniques, and Americans are definitely taught what's called 'the mask.' Russians tend to have a much darker tone, Americans tend to be very bright, Germans are a bit in the throat, and for example what one would say that is the best for singing would be Italian. Or the languages that are close to Italian. Because it is forward, and the way one speaks Italian, one can go straight from speaking to singing. **The 'a' vowel is very bright but also has a lot of what is called 'chiaroscuro' - brightness and depth.** So my voice, for instance, tends to go too bright instead of too dark. The singers that tend to have more metal, like me, project more easily over an orchestra but won't sound as good on the recording, for example. So there are advantages and disadvantages, and it really comes with: how you were born (just how your voice is biologically), what language you speak, and then what your technique is. Some people teach singing to push it down the larynx, some teach it to be really high palette and in the cheeks, and so on. And interestingly, depending on the language you speak, your whole musculature, your pharynx, is shaped by it. So, for example, your pharynx is different than mine, and that's why we can't get rid of accents because we are physically formed this way.



fig. 56: The Metropolitan Opera House, New York, 1966



fig. 57: The Metropolitan Opera House, New York, before renovation around 19th century

How would you describe the best acoustically speaking room (try explaining materials, height, etc.)?

So for me, I like a live, bright space, because it has some feedback. You can hear the echo of your voice returning back to you, and then, as previously mentioned, not too big or too tall. So for instance, our theatre in Detmold - Landestheater Detmold, has a lot of wood, it only has a slight velvet (like at the Volkstheater), and it has this nice balance of materials. But then again, I would also say what instrument accompanies you, so like I said, as with orchestra, you can't have a space that's too live because the textures of different instruments would go mushy. You wouldn't be able to hear the articulation. Whereas if you have just a singer and the piano, then you can have, for example in recital halls that are more live than the opera houses generally, they have a bit more echo because it is just a voice and a piano. But then also it depends on what kind of singer you are. Some singers prefer more echoey spaces and some prefer more acoustically "dead" spaces. For example, if they have a really colossal voice, then it is better to have space that's a little bit more absorbing the sound so that it is not too overwhelming for the listener, otherwise, it can be just too much. But I like something in the middle. **Sometimes we even perform**

in the atrium (inner courtyard) of the theatre, and we do concerts there, and that's completely fine because there are walls on every side, so the sound is just reflecting from side to side, and that is great. So courtyards are fine, but if it is open air, the sound just dissolves. I'm not too fond of that. It just gets lost, and then you need to use a microphone, and we need to be trained to use microphones, so it always feels weird.

How do you feel as a singer, being a performer - producing and giving the sound to the audience, but also being a medium through which sound resonates? In this sense, you are as much manipulating the sound, as much as the space you find yourself in is modifying the sound that you produce.

Well, there are a lot of layers, and that's the thing about being a singer, is that you can't just focus on the sensation. For example, you know when you see an instrumentalist, and they have their eyes closed and move very passionately with sometimes weird gestures. As a singer, you can't really do that, you have to give a message to the audience, and it has to not just be about you. So in a way, I find it more complex than being an instrumentalist because you have to project some message, too. **So there is a physiological aspect of it, as creating, manufacturing the sound, but also making it mean something,** and making it beautiful, so that has to be something that's uniquely you that you add to it, something that comes from the finest level of feeling. There were times when I would close my eyes and hear or feel a lot, but then it didn't project to the audience. Because you always need to think about yourself and how it is coming across to them, which is a tricky

balance. Because also, if you are thinking about them, then it's not genuine. **So you also have to feel something special and honest but not keep it to yourself. To share it with them and share it with the space. You really have to have a separation between me as a person and then me as an instrument.** And that isn't easy, I have to say. Because the instrumentalists carry their violins, or they have their piano, and then they can leave. But with us singers, our instrument - the voice, is there all the time. We must always think about it and take care of it.

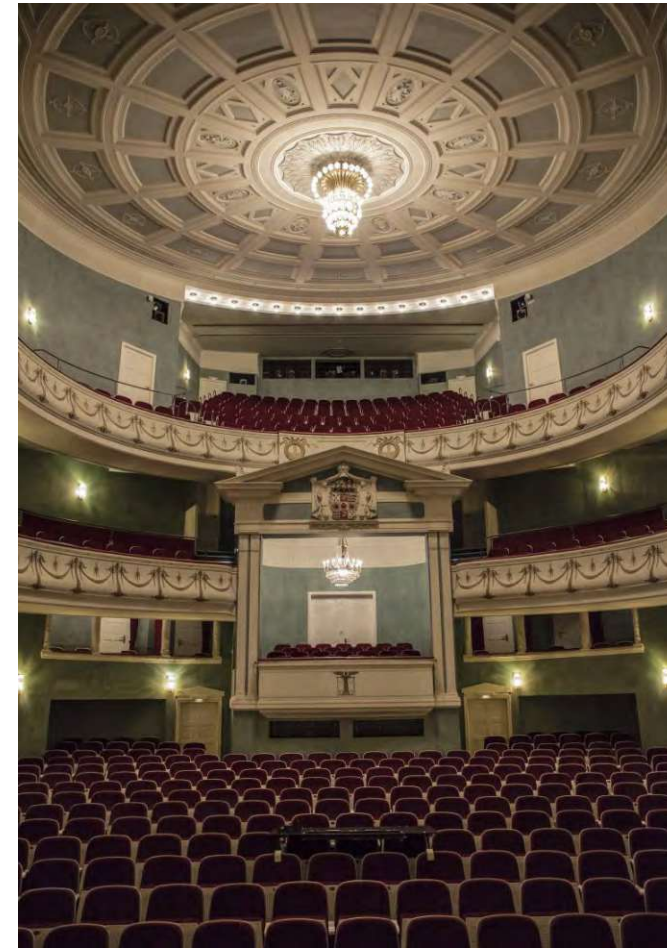


fig.58: Detmold Theatre (Landestheater Detmold), Detmold, Germany, 1825

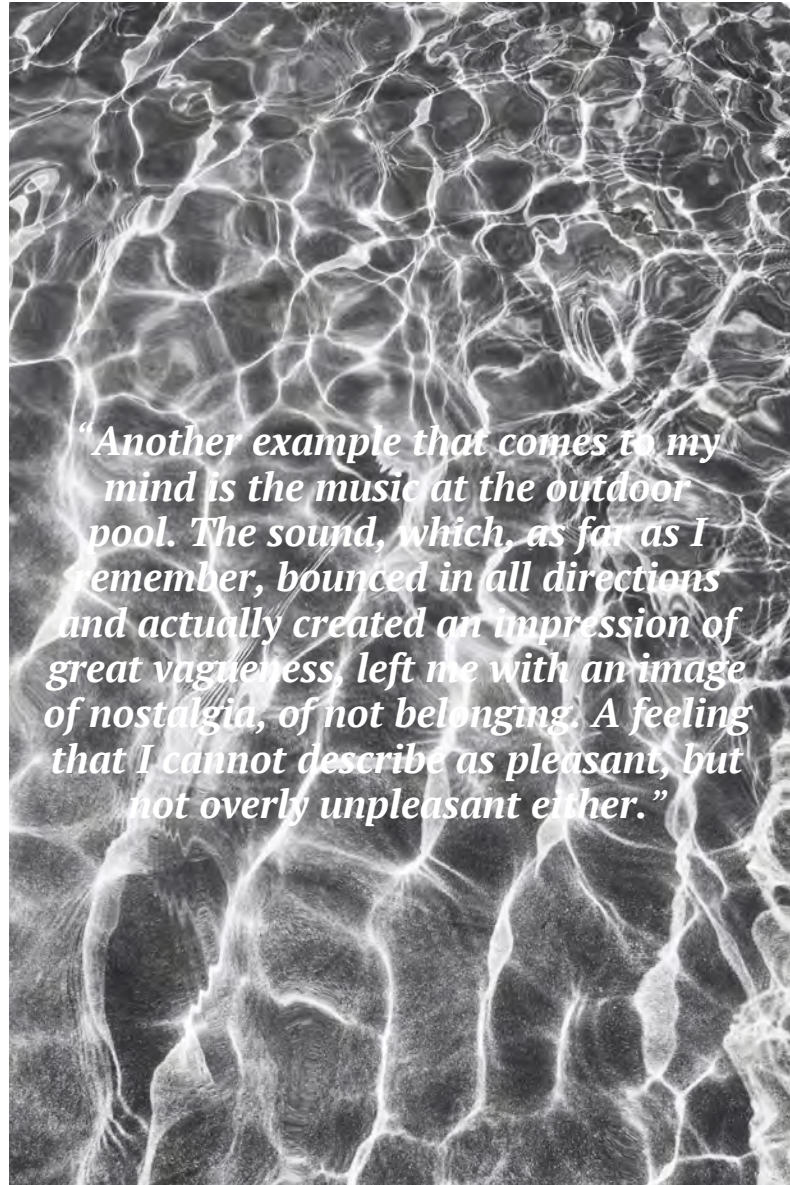


Fig. 59

How do you perceive sound? What is it for you and what is your relation to it?

Music became an integral part of my life very early on. I performed in musical performances in kindergarten, and at seven, I entered a music school. Although I knew how to play simple compositions on the guitar, violin, and harp, over the years, I perfected the motor skills of my fingers, so it was logical for me that the piano is the one on which I feel the greatest pleasure. My mother was a singer and violinist and often performed, so there was always music at home. I continue secondary music school - majoring in piano and theory department. When I was about 13 years old, I discovered ‘music’ and bands, and later, because of my interest in music, I started working in the radio profession. Music shows that aimed to present exciting, new music were my *modus operandi*. In one period of my life, I did occasional engagements as a DJ, but I soon gave up. I couldn’t reconcile my philosophy of music as a private, intense experience with the DJ’s role as an entertainer. Coming to formatted radio has changed how I think about music and sound. In a professional sense, the focus became the quality of radio audio production and all its technical components, as well as the quality of music communication through on-air narratives. The sound took on new, layered nuances that I had not been able to perceive before. Parallel to my position as program director, I also work as station voice of another radio station. It is the moment I meet new challenges of sound, specifically of my vocal characteristics and manipulation of it. “Station voice” or “character voice,” in my case, was one of the more demanding challenges I faced. In the studio, you stand in front of the microphone, put on your headphones, and immerse yourself in the fictional character you are trying to convey with your vocals. That’s the moment where spontaneity stops. What you think you want to let out of your throat becomes something unknown. This is where long-term work begins, after which results follow.

To come back to your question, **sound is a mechanical wave of frequencies. I experience every sound as part of an indivisible whole of my being. For me, music is a construction of sounds that form a particular narrative, concept, and complete work. I associate emotions with both music and sound.**

Would you say that harmonic or disharmonic sounds affect you more?

Throughout history, music has developed in a certain way. **What the human ear recognizes as ‘harmonic’ is often associated with mathematics. What sounds right in harmony is also right mathematically. Mathematics is probably the biggest reason most people can agree on whether something sounds good or whether they hear meaning in the sound constructions we perceive as music today. We took mathematical patterns (especially from classical music) and transferred them to how we make music today. Our ears have been trained for thousands of years to hear.** I noticed that minor tendencies affect me more strongly. ‘Mol’ (from Latin *mollis*, *molle* = soft) is the name of the tonal family that characterizes a distinct diatonic scale. This applies to my performance, for example, while playing and listening to music. Every

music genre has specific rules that are appreciated or considered superficial. For example, what is valued in jazz, does not pass in commercial pop or ‘matj rock.’ Each person can somehow recognize oneself in certain regularities and find something that suits one in a particular genre. Let’s not forget the dimension of creating personal identity through culture, image, and historical context, which significantly influences the creation of musical taste. It is actually very rarely what actually suits our ears the most. Mostly it’s something that we perceive as impressive in childhood, especially puberty, as something that our parents and friends listen to, something that someone ‘sold’ to us. Personally, I have never attached myself to a particular genre. The reason is that I experienced the construction of sounds in each genre differently. Therefore, the satisfaction derived from not restricting one’s own ear is excellent. For example, jazz, which is not ‘clear’ to most people even in the later stages of life. Precisely because the regularities and characteristics of jazz deviate from most of what our brains are used to. Experimental music plays with the idea that it defies regularities, which is why today it is often ‘unlistenable’ to the average ear.

Radio, a medium that exists on a virtual level, I don’t see you on the radio, but I can hear you - what does that mean to you? More freedom, or do you miss the palpable side of the sound exchange between you and the audience?

In the last few years, radio, like other media, has gone through and is still going through the convergence process. By definition, media convergence is a process based on digital technology that dissolves traditional boundaries between media. What does this mean specifically for radio? In addition to the auditory dimension, media consumers also get a visual one - for example, through social networks. In short, most radio consumers know what the person behind the microphone looks like. **If we take into account that television is ‘rigid’ in terms of its professional standards (gestures, dress, way of speaking) which often seem ‘distant’ and sometimes cold to people, we can conclude that, compared to radio, the audience experience it less personally. On the radio, the manner of speaking and the attitude are much more personal and natural.** No matter how objective one is, according to journalistic standards, the personal attitude of the presenter is often encouraged in program politics. This means that the character of the performance itself is more intense, although it is not visible to the eye. It is heard and felt much more intensely than in other media (my personal opinion). **Also, people are more inclined to identify with radio brands than television ones. Radio is available to them at all times (applications, internet). It is the fastest medium and has informal and often local communication with the outside. The listener is an equal participant in the program, and the presenter usually counts on that, which is why I conclude that the character of the performance is very palpable here.**

Do you think that the medium through which sound is transmitted affects our experience/perception of sound?

If we talk about audio technology, most people not involved in audio production, music, etc., would not feel any significant differences between cheap and expensive headphones. This is where we come back to hearing training, that is, individually. Let’s talk from the context of the radio. The sound quality here depends on signal quality, the transmitter, the quality of the tapes, and other technical equipment. From the perspective of someone who is sensible to auditory experience, each of these items affects my experience of the sound. But if we return to the purpose of radio and why people consume radio, this quality will be of minor importance for the sound experience.

Do you think space affects the sound and our perception of it? Are there spaces that you associate with pleasant or unpleasant sounds?

Yes. I recently started paying attention to the sounds coming into the apartment I moved into last year. At first, the train sound really bothered me (the apartment is near the railway line). After a few months, I didn’t perceive it as much anymore, and now I’m genuinely happy when I hear a train passing by or the horn blowing. Sometimes it even bothers me if I don’t listen to it for a long time. It is also connected with the fact that I started to perceive the new apartment as a home and that my associations with that space are primarily favorable.

Could you provide me with some references that were/are inspiring to you, from the aspect of sound/acoustics? Try to describe them as best you can through associations.

We often spent time in Park Maksimir (Zagreb) as children. My grandparents live in a house above Maksimir, so during our childhood, we often heard stories about the creatures in the forest and the buildings we found there. Some of these stories influenced my later perception of sound.

1. “Jeka” Pavilion (Pavilion of Echoes)

The only preserved pavilion in Maksimir Park, also known as the Lantern temple, was built after 1840, according to Franz Schücht’s design. On the twelve-sided stone base, the wooden rocks are separated by semi-columns with capitals made of stylized leaves. There are ten semicircular windows and two entrances. The pavilion was built in honor of the goddess Echo, so it successfully reverberates echoes, which makes it a unique attraction that is also contained in its name. (source: <https://park-maksimir.hr/treatment/paviljon-jeka/>)

The Jeka Pavilion was an essential part of our Maksimir walk. Even as kids, we knew that passing through the pavilion was an opportunity to have a memorable sound experience. In the earlier stage of childhood, it was an opportunity to scream as loud as possible. For some reason, it was liberating for us, even at that age. In the later stages of childhood, we would tap our feet, clap our hands and listen to how the echo would return to us

“Sound is a mechanical wave of frequencies. I experience every sound as part of an indivisible whole of my being. For me, music is a construction of sounds that form a particular narrative, concept, and complete work. I associate emotions with both music and sound.”

“What the human ear recognizes as ‘harmonic’ is often associated with mathematics. What sounds right in harmony is also right mathematically. Mathematics is probably the biggest reason most people can agree on whether something sounds good or whether they hear meaning in the sound constructions we perceive as music today. We took mathematical patterns (especially from classical music) and transferred them to how we make music today. Our ears have been trained for thousands of years to hear.”

and reverberate through the pavilion. Today, I sometimes walk through the pavilion and listen to the echoes of footsteps.
associations: *play, freedom*

2. Church of Saint Jerome

Located next to Maksimir Park, we often went there on Sundays for the Holy Mass. The church was where every sound could be heard: children’s whispers, coughing, cooing, pews creaking, the sounds of mom’s heels... We always took care not to leave a trace of any sound behind us except for praying in harmony with the others present. **Later, when I sang in the church choir (Church of Our Lady of Lourdes), I felt awe at the acoustics that echoed in the church premises.**

associations: *awe, humility*

3. Well

There is still a well in the northern part of Maksimir. Although it is closed today, it was open for a long time. A witch (Babaroga/Baba Yaga) lived in the well, at least according to the story of my grandparents. Reckless children who leaned too far into the well would be pulled into the well by Babaroga. Even as kids, we didn’t fully believe in the truth of this story, nor in the existence of a the witch, but you never know, so we were careful. Often leaning down, we proved to each other who was braver and louder. The sounds we made inside the well, to anger Babaroga, mysteriously echoed and eventually got lost in the stone and ended up somewhere at the bottom. Next to the well, there was also a wooden handle that we would turn and thus create even more noise to wake up and annoy Babaroga.

associations: *defiance, fear of the unknown*

4. Maksimir Stadium

The first football match I attended impressed me the most, **precisely because of the acoustics of that magnificent, colossal space.** The stands



fig. 60: Pavilion 'Jeka' /'Pavilion of Echoes'/'Latern-tempel', Franza Schücht, Maksimir Park, Zagreb, 1840.



fig. 61: interior of the 'Pavilion of Echoes'/'Latern-tempel'

echoed, so although I could make out almost all the shouts from three sides of the world, **the sound bounced unusually and came with a slight delay from the east to us in the west in waves.**

associations: *strength, togetherness*

5. Maksimir forest

Going down from Bukovac to Maksimir Park, I knew every tree and every hill on that path, which I had already crossed a thousand times. The wind, the whispering of the trees, and the dwarves hiding in the hollows of the trees. These were all sounds that followed me through the woods. The biggest mystery was the mushrooms. My grandfather assured me that once upon a time when my mother would walk through the forest, she would take out her violin and play for the gnomes. The mushrooms responded to the sound and swayed to the rhythm of the melody, and sometimes she would crouch next to them and sing just so we could see how they would dance. Children's imagination has done its job. The closer I got to the center of Maksimir, the echoes and sounds turned from the forest's magic into the murmur of visitors, ice cream sellers, and elephants from the zoo.

Would you associate (dis/harmonic) sounds with specific materials or a particular type of room?

I would say that it is rooted deep in our psyche from the early childhood. What we associate with unpleasant will probably be accompanied by unpleasant sounds. I remember having



fig. 62: interior of Church of St. Jerome, Zagreb, Croatia

such a tremendous psychological resistance to the space (apartment) that I often heard unpleasant sounds in the form of vibrations and whispers in my dreams, which gave me big chills. **Our brains amplify unpleasant sounds when we have unpleasant emotions or states. Another example that comes to mind is the music at the outdoor pool. The sound, which, as far as I remember, bounced in all directions and actually created an impression of great vagueness, left me with an image of nostalgia, of not belonging. A feeling that I cannot describe as pleasant, but not overly unpleasant either.**



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fig. 63: Maksimir Park, pathway next to the lake
fig. 64: Maksimir Park, promenade facing the main entrance



64

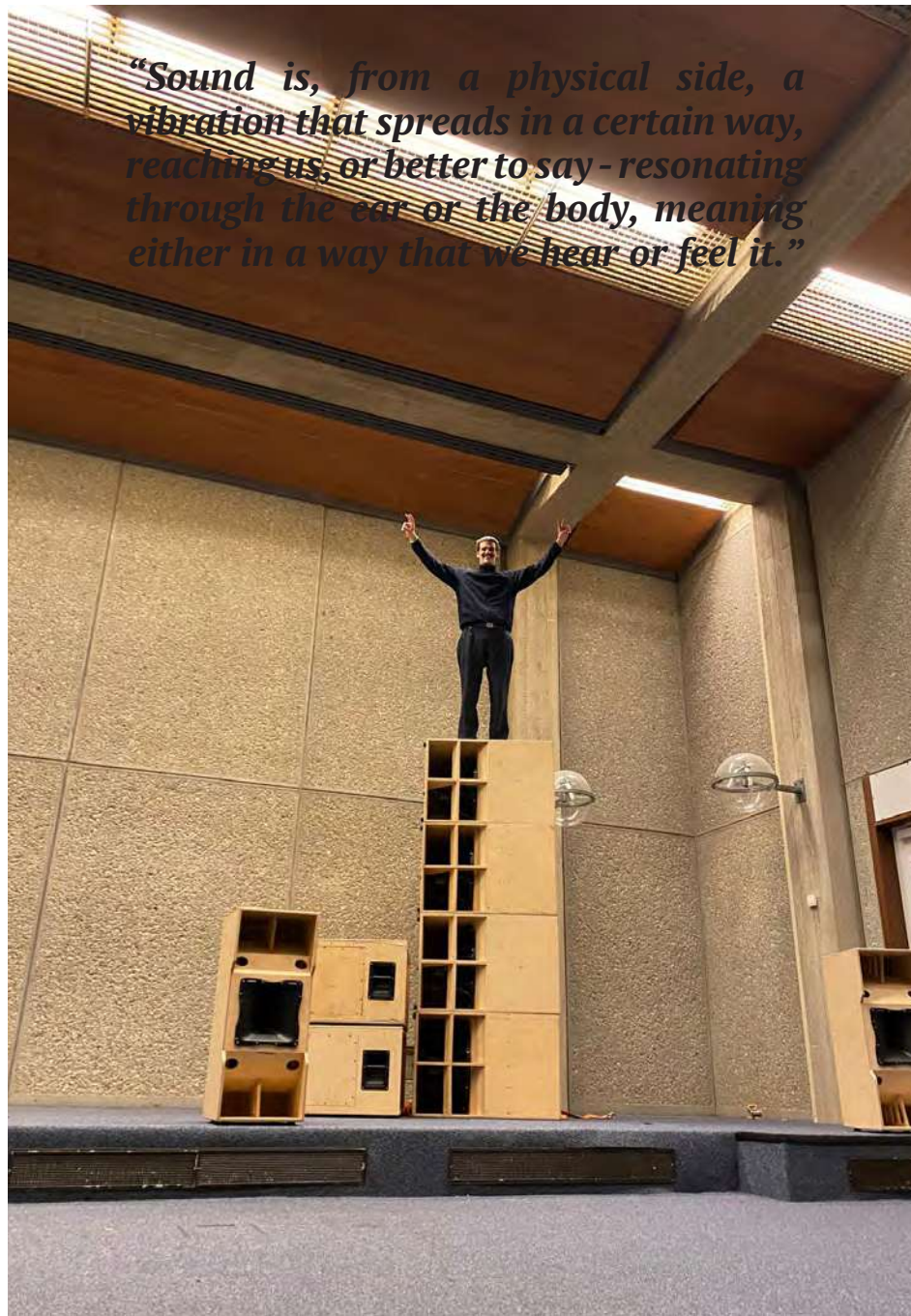


Fig. 65: Ivan with his selfmade sound system

How do you perceive sound? What is it for you and what is your relation to it?

For me, the sound is a matter that I am currently studying, which I am interested in, and which is my work subject. **Sound is, from a physical side, a vibration that spreads in a certain way, reaching us or better to say, resonating through the ear or the body, meaning either in a way that we hear or feel it.** And how does the sound affect me? Well, since the sound is everywhere, it always has a particular influence. Even in an anechoic chamber, you can hear some version of the sound. I am for instance now in the harbor, where it is usually silent, even though it is pretty close to the city. You don't hear the murmur of the town, you don't hear noise, neighbors, you don't hear that kind of information, so it creates a very relaxing atmosphere. But for example, next to the harbor there is a shipyard in which a huge ship is being repaired since we arrived here. So that ship buzzes through the night, which creates unpleasant sounds. Then the opposite of it, if I think of pleasant sounds for example, it was raining yesterday evening, and since I currently live on a boat, that overall impression, together with the sound of rain, creates one harmonic ambience.

Now that you've already mentioned it, since you've been living on a boat in the port of Amsterdam for a few months already, in nature, so to speak, you experience everyday sounds in a completely different way. I can assume that it is very relaxing to listen to the sounds of water, waves, weather changes, and the sound of rain, as you mentioned. I believe that this also affects our mood and psyche in some way.

It certainly is, I agree. Indeed it affects a certain sonic environment or how you feel in the space. But I think that what one actually perceives (hears) also has a lot of influence, because in the city, for example, I sometimes don't mind the noise but sometimes it really bothers me. For instance, when the tram passes and the apartment shakes, when the space sounds like it's going to fall apart, it definitely creates some stress for me.

How would you describe the connection between space and sound?

They usually go hand in hand, literally. From a sound system side, which is my domain of work, the goal is somehow to reproduce music that has been recorded or a live performance that is currently happening as precisely as you can. To achieve that, the sound system must first be arranged, weighted, and tuned correctly, which is remarkably influenced by the room and its acoustic properties. So actually, with the same sound system and with the same settings, without changing anything - if you put it in a different type of space, or in a different position, you would always get a different result. **Shortly, the space dictates how good or bad the sound can reflect and resonate in the room by reproducing it. So if your goal is to produce as accurately as possible the original (for example, the music you want to reproduce), space will always play a significant role. Different acoustic environments can contribute to actual experiences, and other acoustic environments can totally ruin everything you want to do, so the space**

affects how good something can sound. But there is, of course, another extreme of this example, which is if you are doing a sound installation that does not necessarily concern the reproduction of something that has previously been recorded. If it concerns more an artistic approach to space and sound, where for example, you have an area that is very echoey and the sound is reflected from everywhere, then you are actually not interested in transmitting information from the speaker to someone's ear. You are, in this case, more interested in accommodating a room so that it sounds as an immersive experience that is based on an inaccuracy of the sound and emphasizes the acoustics of the room that makes that sound unique. What this would mean is that the ambient sounds in the installation, would significantly influence the sound environment. Since the room echoes and reverberates, maybe it would create another layer of that sound, or contribute in some way to that music/sound piece in some unpredictable way that will fit perfectly with that context. So I think this question, "the connection of space and sound," is fundamental. I also believe that what someone actually wants to do as a result is very important - what is the idea, what is the intention, is it something artistic or something technical. I think there are various options and one should always think about them.

How would you describe the ideal, acoustically speaking, room? For example, one of the first interviewees told me that the ideal room for singing for her would be "a bit echoey, but not too much, not a huge space, wood as a material..." What would you, as a sound design artist, say whether desirable or undesirable from the acoustic aspect of the space?

Let's say I would follow up on the described space for singing, I would have a very similar answer. And besides, sometimes the area dictates the acoustics in the room so much that you can't avoid it, and sometimes it is so absent that it becomes the other extreme. But for my sound system and what I do, I'm interested in precision in the context of the sound I make and that it's as defined as possible. For that, I need certain materials, a specific space in which it can happen, or just a certain number of people. It is easier for me to answer what I don't like than what I do, because in most cases I'm in the similar type of spaces where a room rarely sounds good. It is very rare that I actually have a space that suits me acoustically. In most cases, I work, for example, with a relatively high space that is full of concrete, glass, sometimes wood, and bricks. These are primarily materials that are pretty reflective, for example, when you turn on the sound in that space, the sound is reflected in several directions. And mostly if I had an option where I could choose, I would most likely choose such a space as a mixture of wood, and some soft, absorbing materials. Because when you have too many reflective surfaces, the sound bounces off from many different sides, and your brain also receives a lot of information that is difficult to distinguish where the sound is coming from. And that is where this inaccuracy happens, which I'm not a fan of. For example, high frequencies can very often sound very harsh to the ear, it is difficult to achieve volume without being too loud, and the bass, on the other hand, very often behaves in a way where it actually sounds totally wrong from what it was intended to do - it just creates noise and bounces. So in some rooms where these problems do not exist, where there are soft materials, where the sound can "breathe"

and develop, there is an entirely different atmosphere, and it is much easier to control the sound. On the other hand, in those acoustically difficult spaces, it is challenging to make something sound good, to actually have the sound under control.

Can you clarify what you describe as "soft" materials?

Literally, everything from foam, mattresses, tapestries, and furniture are all materials that absorb the sound. For example, if you enter an empty warehouse made of metal construction with concrete floors, and if you drop a hammer in such a room, you will experience a stress attack (from noise). Whereas, for example, if that same hammer falls on the carpet in, let's say, the apartment where you live where there are a lot of soft materials, that sound will not be so aggressive and intense. So these soft materials, or types of materials, which don't necessarily have to be smooth, but do affect the sound in a sense that they don't amplify it, but the opposite.

Do you have any examples of spaces that are/were acoustically very good, or acoustically very bad?

I have two recent examples from my own experience. The first was an event at the University (Royal Academy of Arts, Den Hague), which was situated in a tent that had several issues. The sound waves would bounce and return, and if you would stand in the middle of a tent, it could happen that you wouldn't be sure if the sound is coming from one side or the other, and that is usually pretty confusing and tiring. Another problem in that space was that all the bass (low frequencies) were coming out of a tent. That is for instance, something I still need to gain more experience with. And because the tent was set up outside in the inner courtyard, it was supposed to be as quiet as possible outside the tent and as loud as possible inside, but exactly the opposite happened.

The second example is more closely related to the question itself. For the third year in a row, we are doing a festival called "Traumburg," located in a basement of one castle in Germany. In that castle, I work on a stage with a sound system. The space is quite specific since it is in the basement, full of reflective materials, and in the middle, there are two rather large columns, and the ceilings are vaults and arches like in churches. And it all reverberates a lot as if you were in a church. And so the first year, they invited me to come from the Netherlands to Germany with my sound system, and I told the organizers that it wouldn't make too much of a difference if they booked me or a local sound system company because the acoustics in this space is literally impossible to surpass. And in fact, the idea to make an acoustic intervention in that space arose in the first year. The echo in the room is so strong that you literally cannot hear the person standing and talking next to you. After some time, it becomes very exhausting, and it is not the most pleasant place to be there, let alone turn on the sound system and somehow adjust it to sound good. Eventually, with the intervention we achieved the desired results, where it was possible to talk while the music was playing at a high volume. It is quite an interesting example of how, with an inevitable intervention, the acoustic setting can be changed and directed

to where it needs to be and how you want that space to sound.

In principle, a lot of what I do has a technical basis because physics plays a huge part in the sound, of course, and certain things that you can't influence, but after that physical part, there is an artistic part that actually affects how the sound will be applied in a space. So in this example of the basement in Traumburg, it was complicated to adjust the acoustics of the space in order to reduce the spots where the sound is not heard at all, or where some interferences between the sound and the space occur. We always had the same problem in the corner, which is that the bass would accumulate in the middle of the dance floor, so you have a different amount of bass, and when you move to the corner, suddenly a massive amount of bass is present, and you can't change that. And then I actually, with these technical interventions, decide how I will re-orient the setting and adjust it so that the people are placed in the part where the sound is good and the problematic spots are used as a passage, or as a space where the equipment will be left, and this is where the artistic part actually begins. How to arrange the room,



fig.66: Ivan's sound-system at the event in tent, inner courtyard of KABK (Hague, NL)

how to orientate and direct it, how to place the DJ desk or live performers in such a way that the sound works properly and that it has some sense. So in general, how the space can be used to its maximum, taking away the defects that space has from the technical side and then the sound system can perform at its best.

The same thing happens with the interference of sound, people,

movement, and space - and that's what architecture really is about. You are in this case the director, conductor of the event, of the overall scenography, and the atmosphere in the space.

That's quite a lot of architecture, I would agree. I think the same applies to the fact that how people enter that space, what is the relationship between sound and space, how that sound is placed in the room in general,

how much space there is to walk to the bar, what is the interaction between the audience and someone playing, how the sound is placed, how high or low it is placed in the space - all these parameters that are very often ignored, these are some things that are very interesting to me and that I study and from which I personally think that there comes a certain precision and difference between the experience where you can see whether someone is thinking about it or not thinking at all.

The last question is concerning your approach to work, i.e. what kind of process is behind each project - where do you start from? Do you always start from that side of physics, calculating technical spatial parameters and then approach it artistically, or does it always depend on the context? Do you always have a desired goal from which you start, or do you approach projects more as a particular experiment?

Well, I always try to spend so much time as possible in the space that is new to me. Often, for example, you would have an intuitive impression that a particular room will be suitable, but

if you spend longer time in that space, you start to notice some defects and flaws. So, whenever I enter a room, I spend enough time in that space without turning on any devices, just to get used to it. **I would somehow describe that part more as understanding the area - what is that space actually, what is the sound like inside, what is heard, how does it feel, if the room is high or low, etc. I actually try to collect some information and follow some intuition of what is actually happening there.**



fig.67: Ivan's sound-system at the music event



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It's mostly that first part where I try to make some connection with that space. I'm trying to get to know myself and what are the characteristics of that area that interest me. And then, the next step I do is to try to imagine what kind of sound system would fit in this space, considering that the sound system is actually quite robust and quite dominant in the room (whatever it is, unless the room is enormous, of course). It also somehow dictates from that physical side as an object; depending on where you position it. It can affect how that space will look or on that different orientation (for example, in the context of this castle I mentioned). So I always try to think about how something could fit as well as possible in that specific context, size, and sound. With the sound from that technical side (a particular sound and a particular design), I also try to think in the same way that the size and shape of that system fit into a specific space, that it "blends" with it. So, for example, when you

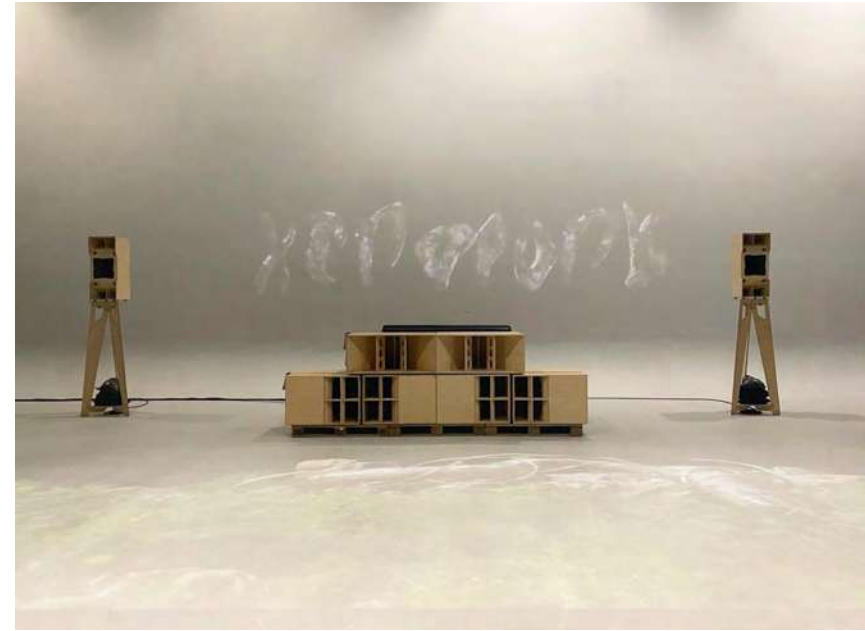
enter that space, the sound system should not be too dominant and striking, but everything should be harmonious and fit well together.

How do you come to the form and design of your sound system? To me, it looks like a miniature architecture.

It's a lot about physics and design. For bass frequencies, the box must be significant because the speaker has to move a lot of mass for these low frequencies to be released because low frequencies have the longest waves. In contrast, high frequencies have short waves, and then, in fact, for low frequencies, the speaker and the box should be much larger than for high, which dictates the visual part of that sound system. Usually, these basses are pretty large and unwieldy, while boxes for high frequencies are generally smaller, more elegant, and do not have to be heavy. The shape is actually entirely dictated by physics (technical aspect).

Do you work more alone, or do you sometimes collaborate with others?

Most of it is collaborations, but also, in most cases, I have my hands open to doing what I want because that's actually what people call me for. It rarely happens that someone already has an idea of what they want to do and then calls me just for that. So it's usually always a collaboration where I propose something and explain why I think something would work that way. If someone disagrees with that, I try to argue why something could cause problems and why something shouldn't be done, but I'm also always flexible to try something new. It is usually a conversation between two or more parties about how to do something so that it works as best as possible.



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fig.68 & 69: Ivan's sound system in different settings

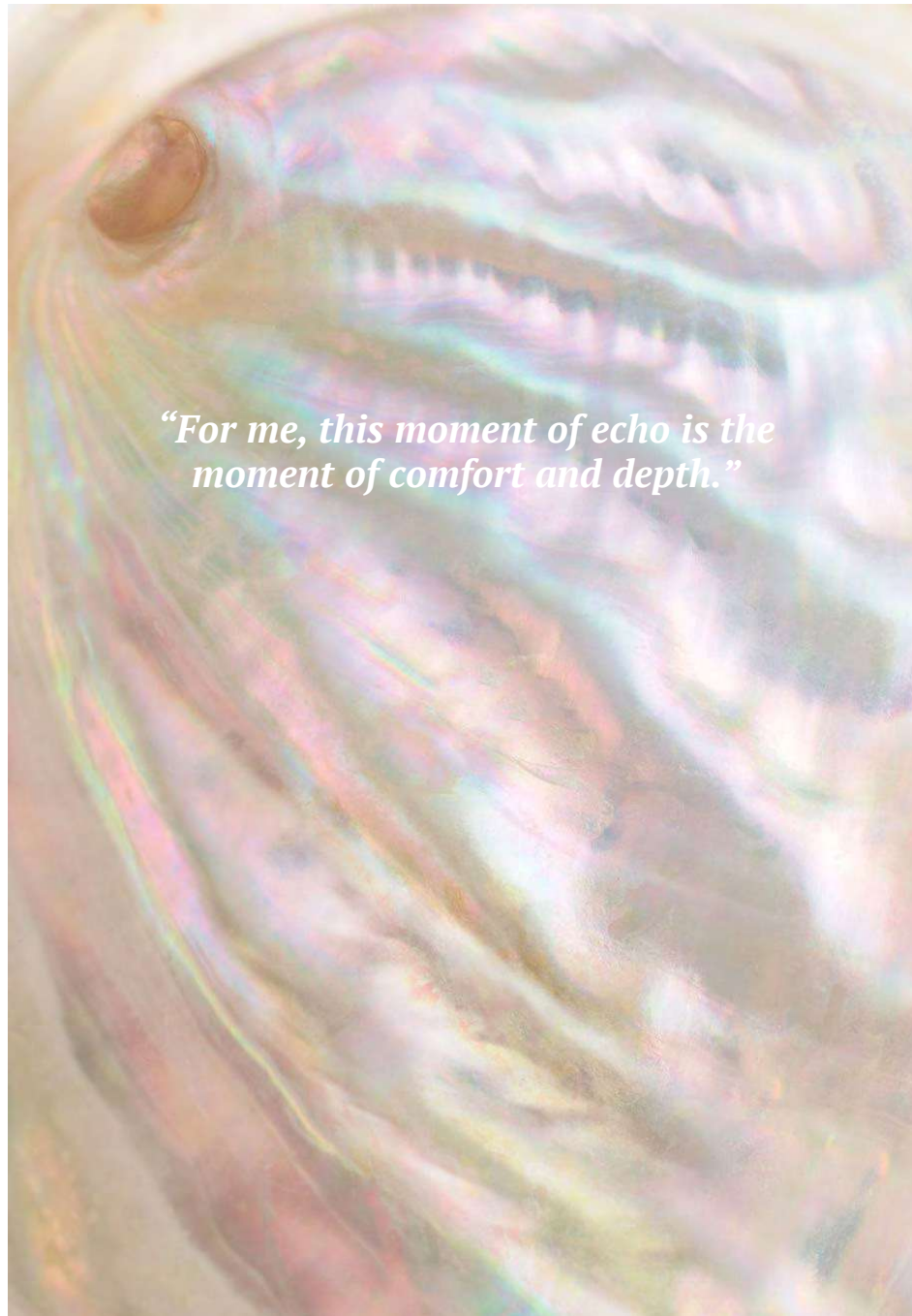


Fig. 70

Which type of sensations do you notice the most in the space: visual, auditory, tactile, etc.? Would you say that these sensations affect our perception of architectural spaces?

It is all about the vision for me. But I am sure that on an unconscious level, many other elements are there at work, all that you would call tactile and non-visual. I think I am less aware of them, but this does not mean that they have a minor impact on how the space is perceived. So I would say that all these different senses, with which we perceive the room, operate in an underlying manner that makes it very hard to then identify and to systematize them. So I think the visual one, in my case, is obvious, but also the sense of smell, so called olfactory.

How do you perceive sound? What is your relation to it?

Something I can say about how I perceive sound was one year ago when I moved here into one apartment in Vienna, which was stunning, huge, with high ceilings and big windows. I entered the first day and said, "ok, I like it, I will take it," then I entered there the first day of moving in, and there was such a traffic noise from the outside that I couldn't stay more than 48 hours in the apartment. There was this street crossing, and it was so noisy and loud all the time. The noise was so present that I obsessively started tracking down the decibels through the whole apartment while trying to imagine my life there with all this noise the entire time. I was listening to the cars and trucks passing, trying to concentrate on the work. But to be honest, it never happened to me to be that sensitive to sound. I lived in Barcelona, and there were many sounds, but I couldn't resist this place. So after those 2 painful days, I returned to the flat where I was previously living.

Since you were speaking about this negative association and experience, could you also reckon a positive one?

My mother is a pianist, so I listened to the piano throughout my childhood. And whenever I hear a particular type of music, I always think of her. It always reminds me of her through these piano melodies. She doesn't play it anymore, but when I hear a particular piano music piece, I associate it with a nostalgic moment that I would define as good. But maybe to compare it to this negative (disharmonious) sounds from the previous example, I would say that I was more affected by the violence of those noisy traffic sounds. Maybe because it became irrational, because there wasn't actually that much sound. It was more that I got obsessed with that disturbance. And it was coming in waves because of the traffic lights. Sometimes it was quiet, and then suddenly, the loud noises again. So to answer the question, I guess the disharmonious sounds are the ones that affect me more, and I am then more aware of them. So for instance, when the tram was passing, the house itself was trembling a bit. So the vibrations, the trembling, and many things made it very uncomfortable. In this environment, one feels very exposed. It is interesting because when you listen to a sound, one might think that the one who produces the sound is exposed to the listeners' ears, but instead of that, I felt exposed by having to listen to all that sound. So that's also something interesting, to understand sound as something

that makes you feel too exposed to the source of the sound, to the outdoors of the house.

Would you say that the material quality of the space affect the sound and our perception of it?

Yes, for sure. Something that is also interesting is that not only is the sound amplified depending on the walls that are a part of a built construction, but the distribution of the space itself might make this sound more intense. So when I was in this uncomfortable flat, there was no furniture, so everything was literally sound. Not only because of the echo but because there is no furniture means that there are not many visual anchors, and then sound becomes a dominant sense just because of the absence of other elements on the “stage.” If there had been more furniture, even if the sound level had been the same, then the sound would have had less presence in my being because there would be other things to perceive. But it was only the empty space. As if one is exposed to that noisiness. So yes, to return back to the question, there is not only this physicality as in physics and bouncing off the sound, but also in a way as how you are accommodated in the space.

Speaking of echo in space, how would you define it?

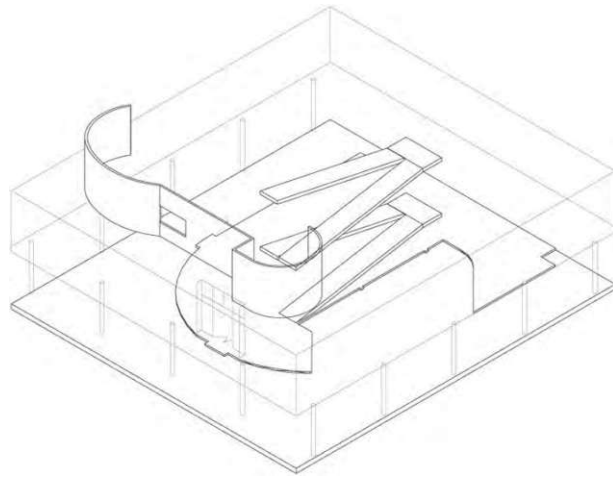
For me, this moment of echo is the moment of comfort and depth. One could describe it as an imaginary “sonic pillow”. I find a lot of comfort in this feeling of the voice returning back more calmly. One could explain it as the reverberation that surrounds us and embraces us a bit. And this often happens in the church, which is very common, but also in the mountain. You feel somehow in the company of this echoing voice. So for me, for sure, this moment of echo is the moment of comfort and depth, that is why I would use the image of a sonic pillow that you land to, and it “sings” back to you. Something that is my voice mitigates to accommodate me where I am. Although, it does not need to be my own voice. It can be any voice that produces these low-tone voices that accompany the main one. And then the moment of the repetition is also crucial, that you listen the same, so there is no novelty in it. And also this is very comfortable somehow. It gives me more impression of the sonic depth. Like you are surrounded, embraced by this soft, velvety sonic sensation.

Is there any art piece (it could be a building, but as well as sculpture, installation, image, literature, musical work, or your own experiences and associations) that you would relate to the notion of the sonic architecture?

If you are familiar with the Modern movement in architecture, for example, Vila Savoy of Le Corbusier. There is this notion of transparency called “Phenomenological Transparency”- which is not the transparency of, for example, glass. **It is an idea of the collage of different elements that are, in a way, overlapping and circulating one on top of the other. And if you imagine yourself inside the Vila Savoy, and you have this kind of prominent architecture throughout the building, I would say that it is a sonic experience in the sense that you accumulate different visuals that are distinguishable in synchrony, as a sound is. Not because the sound is literally happening there but**

because of this game of transparencies, opacities, overlapping, and reflections. All this gives me an impression of this distinguishability in synchrony of elements that are all together, but still, I can identify and recognize them. That would be, for me, a sonic architectural experience. Not because there is a particular sound in it but because the elements occur in sonic terms, in a sonic key. This distinguishability in synchrony is a characteristic of the sound. I guess this is a very personal impression that can happen in any space where you accumulate different layers of the room. But in the Modern movement, with all this obsession with transparency and overlapping, it is not about the literal transparency but about a game of superimpositions of experience. For example, when one walks through that ramp, one can see something of the outside: there is a window - one suddenly sees more of the exterior space, there is a glass in the middle, so one starts having different layers that are all present, but one can still differentiate them. So that would be, for me, a way of reading architecture in sonic terms. So it is not like light; for example, there can be 3 or 4 focuses of them, and then all of them merge into one. So I think that there are some buildings in Modernity, especially with Le Corbusier, but also with Walter Gropius. Also, some of the facades from Corbusier play very much with that. The idea of the collage, or the idea of Purism (that Corbusier was working on), is all about these different elements where they tangle in between, but you can still see them. In Cubism, it is more accumulations of many perspectives, it is more fragmented, whereas in Purism, there are those objects that are very simple and kind of merge, but not entirely. And it is always bi-dimensional. You never have perspective, only things that move like that (layered). And then it is interesting to see how Le Corbusier does this also with architecture. Because of this experience in the movement, one has these different elements that are showing up. And I think of this situation in sonic terms, according to the synchronicity. And this is then very well connected to the tangibility of sound. I like a lot this idea of the texture of sound. What was I saying about the echo? Is it because the echo gives a specific texture? It is almost like a velvety texture. It wouldn't be like a metallic texture. It would be, at least for me, the soft, velvety one.

In general, it is not that I am aware of echo very often, but **when I feel the echo that is very evident, I always feel very much comforted. As if I am discovering the verticality that I didn't perceive before.** The verticality in the sense of more depth. The amount of accommodation that it offers me in its depth or vertical dimension. **Because the sound is suddenly not just the two-dimensional “metallic surface” of one voice, but it suddenly has more layers. This can be, for example, the canon in music, when they sing with a bit of delay concerning the previous voice.** This is then also an exciting situation. It has an echo in it. And then delay in sound is also significant. Because this delay is then the depth as well. I would say that this has a lot to do with the “tangibility of sound”.



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“Phenomenological Transparency”
of Le Corbusier’s Villa Savoye in sonic terms

fig. 71: Axonometry of Villa Savoye, circulation and overlapping
fig. 72: perspective of the interior facing the exterior space of Villa Savoye, Le Corbusier, 1928-1931

Could you provide me with some references that were/are inspiring to you, from the aspect of sound and acoustics?

So one for sure would be this that I already mentioned with Le Corbusier and the transparency, which I know is not sonic *per se*, but it could be interpreted precisely so because it produces gestures and effects characteristic of sound. Also, something that I was lately thinking about, and I don’t know if it is a common thing that people are familiar with. You know, at the beach when I was a kid, if there was a seashell, they would say to me “if you put the seashell next to your ear, you will hear the sea.” **I am interested in this sound that is inside this little shell. It is a sort of architecture. Can we read this shell as an architecture prototype because you try to enter inside that shell? You put the seashell next to your year, it doesn’t completely surround you, but it produces an interiority somehow, and it is very sonic because it has the sound in it,** which is supposed to be the sea. There is sound, and there is architecture. It is like an umbrella. The umbrella is the most simple example of the most precarious architecture. Something that you can share with somebody and that you can enter inside, and it protects you. **But with the shell, proximity, as well as tangibility, interaction and contact also happen. You need to participate in this to hear the sound.** So yes, I see something in the shell, a sort of embracing design. The seashell tries to embrace you next to your ear with this kind of sound, and it is an architectural experience as well. And the fact that the sound that one hears, is interpreted as the sea, and for a particular reason it doesn’t sound foolish that it is the sound of the sea. Because at the same time, you listen to the waves of the sea. I never try to do this at home, for example, when I am entirely decontextualized. It would be

interesting to do the same while I am in the street or somewhere else, I am sure that it does not have the same power then. The power also comes with context.

“Probably you are familiar with the Modern movement in architecture, for example, Vila Savoy of Le Corbusier. There is this notion of transparency called ‘Phenomenological Transparency’- which is not the transparency of, for example, glass. It is an idea of the collage of different elements that are, in a way, overlapping and circulating one on top of the other. And if you imagine yourself inside the Vila Savoy, and you have this kind of prominent architecture throughout the building, I would say that it is a sonic experience in the sense that you accumulate different visuals that are distinguishable in synchrony, as a sound is. Not because the sound is literally happening there but because of this game of transparencies, opacities, overlapping, and reflections. All this gives me an impression of this distinguishability in synchrony of elements that are all together, but still, I can identify and recognize them. That would be, for me, a sonic architectural experience. Not because there is a particular sound in it but because the elements occur in sonic terms, in a sonic key. This distinguishability in synchrony is a characteristic of the sound.”



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fig. 73: Amédée Ozenfant, *Still Life with Bottles*, 1922

fig. 74: Charles-Édouard Jeanneret-Gris (Le Corbusier), *Still Life*, 1920

fig. 75: *Nature morte du Pavillon de l'Esprit Nouveau*, Le Corbusier, 1924

“The idea of the collage, or the idea of Purism (that Corbusier was working on), is all about these different elements where they tangle in between, but you can still see them. In Cubism, it is more accumulations of many perspectives, it is more fragmented, **whereas in Purism, there are those objects that are very simple and kind of merge, but not entirely... And I think of this situation in sonic terms, according to this synchronicity.**”

“I am interested in this sound that is inside this little shell. It is a sort of architecture. Can we read this shell as an architecture prototype because you try to enter inside that shell? You put the seashell next to your ear, it doesn't completely surround you, but it produces an interiority somehow, and it is very sonic because it has the sound in it, which is supposed to be the sea. There is sound, and there is architecture.”



fig. 76: Seashell, author unknown

“You are hearing ambient or background noise that has been increased in amplitude by the physical properties of the seashell...“hard, curved surfaces” inside shells reflect soundwaves, causing the waves to “bounce around” inside the shell. Consequently, the shell “acts as a resonator, boosting certain sound frequencies, so that they are louder than they would be without the seashell placed next to your ear,” The frequencies that we hear will depend on the size and shape of the seashell.”

[from the article “*Why do seashells sound like the ocean?*”, <https://www.livescience.com/33041-why-do-seashells-sound-like-the-ocean.html>]

Sonic Glossary

a cappella: without instrumental accompaniment. A cappella arrived in English from Italian sometime around the late-18th century. In Italian, a cappella means “in chapel or choir style.” Cappella is the Italian word for “chapel”; the English word chapel is ultimately (if independently) derived from the Medieval Latin word *cappella*, which is the source of the Italian *cappella* as well. Scholars once thought all “chapel style” music written before the 1600s was performed a cappella, but modern research has revealed that instruments might have doubled or substituted for some voices back then. Today a cappella describes a purely vocal performance.¹

acoustics: the science concerned with the production, control, transmission, reception, and effects of sound. The term is derived from the Greek *akoustos*, meaning “heard.”²

acoustic ecology: Ecology is the study of the relationship between living organisms and their environment. Acoustic ecology is thus the study of the effects of

the acoustic environment or **soundscape** on the physical responses or behavioral characteristics of creatures living within it. Its particular aim is to draw attention to imbalances which may have unhealthy or inimical effects.³

Anthropocene (Epoch/Era): relating to the current age, viewed as the period during which human activity has had the greatest influence on climate and the environment. The name Anthropocene is derived from Greek and means the “recent age of man.”⁴

Anthropocacophony: noises made by humans (*anthropos* - human + *cacophony* - a harsh discordant mixture of sounds.), defined by Vinciane Despret referring to the **Phonocene**, a potential era of sound⁵

attunement: to bring into harmony (from **tune:** to adjust in musical pitch or cause to be in tune // correct musical pitch or consonance)⁶

aural: relating to hearing.⁷

canon (in music) / or also called **rounds:** musical form and compositional technique, based on the principle of strict imitation, in which an initial melody is imitated at a specified time interval by one or more parts, either at the unison (i.e., the same pitch) or at some other pitch. Such imitation may occur in the same note values, in augmentation (longer note values), or in diminution (shorter note

values). Melodically, the original direction may be reversed, so that in imitation the tune is read backward (retrograde), or the intervals, while unchanged, are made to move in the opposite direction (mirror), or both (retrograde mirror).⁸

cacophony: an unpleasant mixture of loud sounds⁹

celestial Bodies: an aggregation of matter in the universe (such as a planet, star, or nebula) that can be considered as a single unit (as for astronomical study) / “Man must regulate his senses to the *Nous* underlying the revolutions of the celestial spheres and make straight the irregularity and disorder in the view of attaining harmony.”¹⁰

chaos: a state of disorder and confusion.¹¹

cohabitation: from **cohabit:** (*habitare* =) to live together or in company / to exist together¹²

common goods: ‘bien commun’ (‘common good’, in the two senses of ‘good’ as ‘benefit’ and as ‘possession’), insisting that his aim is to find a better definition of the common good such that ‘jurists and politicians will decide which are the organisations that foster it the most’¹³

common topics: means of invention developed by Aristotle that are useful for developing arguments on any issue or in any field of discourse; they are conjecture, degree, and possibility.¹⁴

consonance and dissonance: in music, the impression of stability and repose (consonance) in relation to the impression of tension or clash (dissonance) experienced by a listener when certain combinations of tones or notes are sounded together. In certain musical styles, movement to and from consonance and dissonance gives shape and a sense of direction, for example, through increases and decreases in harmonic tension.¹⁵

cosmos: the universe considered as a system with an order and pattern.¹⁶

concord: a simultaneous occurrence of two or more musical tones that produces an impression of agreeableness or resolution on a listener / a state of agreement.¹⁷

delay: In its generic sense, this effect refers to any delay between the emission of a sound and its repetition. Echo and reverberation are thus two types of delay. As an electro-acoustic effect, delay can be applied at the level of milliseconds; generally it is less than a second. Delay is used to give depth to a sound or to spatialize it in the stereophonic field.¹⁸

diffraction (of sound): the spreading of waves around obstacles. Diffraction takes place with sound; with electromagnetic radiation, such as light, X-rays, and gamma rays; and with very small moving particles such as atoms, neutrons, and electrons, which show wavelike properties. When

*“The suggestion is that, inspired to find a theoretical ‘language’ capable of integrating and addressing sound art, we do not need to work around the visuo-centric nature of Western philosophy and its requisite hierarchies and values, bending its canons towards invisible and indivisible matter. Rather, we can acknowledge the dualistic tendency of thought as a consequence of its visuality and fostering anthropo-centrism and come to practice a different variant in the unthought of sound. Thus we can engage in the new materialist project as a quasi-sonic project. In listening to sound we are always already in matter: an embodied ear that sounds and hears through its own simultaneity with ‘what sounds’ as an unseen and inter-existing ‘what is’. From there we can come to understand matter and meaning in a different way, diffracted and simultaneous, invisible and indivisible, not as excess and not as becoming, but as a practical interbeing in the world not of signs and symbols, texts and culture, but of inarticulate intensities, indeterminate and indivisible, contingent and transforming.”*²⁹

*“Instead, we can recognize the visuo-centrism that determines this historical dualism and can appreciate how the anthropocentric is tied up with visuality, in order to find the unthought not in philo-sophy but in the thought of sound, which opens vision maybe not to truth but to its plurality. In other words, I take Meillassoux’s ancestry from which according to him an ‘irremediable reality’ accessible only via science and the mathematical can be drawn, as a cause to articulate the nonhereditary of a sonic science fiction, from which a contingent and simultaneous reality can be performed that does not differentiate but acknowledges difference and the in-between.”*³⁰

sound of various wavelengths or frequencies is emitted from a loudspeaker, the loudspeaker itself acts as an obstacle and casts a shadow to its rear so that only the longer bass notes are diffracted there.¹⁹

discord: a group of musical notes that give an unpleasant sound when played together / the state of not agreeing or sharing opinions.²⁰

distortion: in acoustics and electronics, any change in a signal that alters the basic waveform or the relationship between various frequency components; it is usually a degradation of the signal.²¹

echo: a phenomenon observed in nature, is the simple or multiple repetition of a sound emission, linked to a reflection in the space of diffusion. The term comes from Echo, a mythological nymph condemned to never speak first, but only repeat the last syllables of others. The psychogenetic significance of this effect was underlined as being possibly as important as the mirror stage.²²

ecology: A combination of words echo + ecology, as in acknowledging and encouraging the notion and phenomenon of echo (in its spatial and metaphorical sense) [definition made by author]

echography: “In response and taking up on Dyson’s suggestion of the echo of an autonomous voice that contrasts with the study of harmony and meaning and instead explores a plural

sense, I want to propose an ‘echography’ of the inaudible: the practice of silent voices in the space of breathing that opens politics to the possibility of the political.”²³

ecology: the relationship of living things to their environment and to each other, or the scientific study of this. “In political discourse ecology is the ethical desire to preserve nature, understood as a wild and virgin space, protected from the ravages of humanity. In science, ecology (oikos logos: knowledge of the milieu, the habitat) is quite a different thing. Defined by the biologist Ernst Haeckel at the end of the nineteenth century, it is a highly sophisticated science that tries to gather all the geological, chemical, biological, vegetal, and animal interactions that constitute a milieu, for example the biotope of Mont Ventoux.”²⁴

ephemeral: lasting for only a short time.²⁵

ethics: any set of guides or standards for human conduct.²⁶

ethos: the character or reputation of a rhetor: “According to Aristotle, rhetors can invent a character suitable to an occasion—this is invented ethos. However, if rhetors are fortunate enough to enjoy a good reputation in the community, they can use it as an ethical proof—this is situated ethos.”²⁷

flutter echo: A flutter echo (écho flottant) is the localized emergence, in the reverberation of a room, of a specific frequency and its harmonics that re-

*“Sound, as a sonic sensibility and concept, pre-emptly and cancels these questions by remaining unseen and offering the real another truth: not that of ‘the “right” links in the totality of the intelligible order’, what is in and what is out of its visual regime, but of the in-between of listening not to ‘this’ or ‘that’ but to what they do together. It produces the truth of the mobile and the inaudible simultaneity of interbeing that cannot be observed from a distance but has to be generated in the encounter, not to hear what I think of it, but to make room for its own voice.”*⁴²

“And Irigaray makes a language from caresses that as gesture-words produce a world full of neo-logisms of the feminine that do not produce a certain sense but are the material of expression itself, which is driven into speech by my inability to grasp the other in language. All three propose a performative criticality: the practicing and doing of linguistic and cartographic matter to challenge the representational and figurative sense of the real, to contest its power, and to break ‘humanities’ own captivity within language’.

*...In such a garden resonates the song of the birds, those who celebrate the present moment, who assure the passage between here and there, between earth and sky. Messengers, they announce if the site is livable. When the universe is not habitable, the birds, if only for a time, are mute. As soon as the danger draws away, they again communicate the celestial: nearby, they tell the distant.”*⁴³

mains stationary between two parallel and reflecting walls.²⁸

Fluxus: the name given to an international network of artists, composers and designers noted for blending different artistic media and disciplines in the 1960s. They have been active in Neo-Dada noise music and visual art as well as literature, urban planning, architecture, and design. Fluxus is sometimes described as intermedia.³¹

harmony: a pleasant musical sound made by different notes being played or sung at the same time. (“singing in harmony”)³²

harmonics: of or relating to musical harmony or a harmonic. / also called *overtone*: one whose vibration frequency is an integral multiple of that of the fundamental. / a component frequency of a complex wave (as of electromagnetic energy) that is an integral multiple of the fundamental frequency³³

imitation: an ancient rhetorical exercise wherein students copied and elaborated on the work of revered or admired authors. / the repetition by one voice of a melody, phrase, or motive stated earlier in the composition by a different voice³⁴

New Materialism: New materialism is an interdisciplinary, theoretical, and politically committed field of inquiry, emerging roughly at the millennium as part of what may be termed the post-constructionist, ontological, or material turn. Spearheaded by thinkers such as Kar-

en Barad, Rosi Braidotti, Elizabeth Grosz, Jane Bennett, Vicki Kirby, and Manuel DeLanda, new materialism has emerged mainly from the front lines of feminism, philosophy, science studies, and cultural theory, yet it cuts across and is cross-fertilized by both the human and natural sciences.³⁵

onomatopoeia: / on o ma to PO ee ya / a trope that uses words to suggest sounds.³⁶

partition spectrum: in physics, the intensity of light as it varies with wavelength or frequency.³⁷

Phonocene: For Despret the Phonocene is defined as a potential era of the ‘phonos’ or a sound, which is taken from Harraway’s concept of *Chthulucene* - an alternative name for the Anthropocene era ; for Despret it means “trusting the musicality of the world (including its rumbles) and try to learn from it. And it also means leaving the sphere where the logos of the Anthropos owns all privileges to renew a link to languages other-than-human ones” (Despret 2020).³⁸

polyphony: in music, the simultaneous combination of two or more tones or melodic lines (the term derives from the Greek word for “many sounds”). Thus, even a single interval made up of two simultaneous tones or a chord of three simultaneous tones is rudimentarily polyphonic. Usually, however, polyphony is associated with counterpoint, the combination of distinct melodic lines.³⁹

*“In this way, the project of materialism and realism gets focused on the **issue of visibility, its processes of differentiation and distancing, inclusion and exclusion, as well as its intrinsic anthropocentrism manifest in the visibility of my own body and the invisibility, to myself, of my location of looking: my blind totality. Thus new materialism and speculative realism come to focus on the question of hierarchy and ideology: whose authoritative gaze determines the invisible, and what can make its processes of differentiation and valuation visible, as in recognizable and intelligible, within a visual regime and politics? And from there they can ask how we can grasp this regime and its politics to see a different distance.**”*⁴⁹

*“I would like to imagine echography as a more agonistic and playful dispersion. Thus while I am inspired by **her notion of another echo that resonates in the gap of the breath, as a way to hear the political actuality and produce a political possibility, I aim for a sonic practice whose voice does not rise against harmonic tonality, the dominant self, but sounds itself, and whose clamour therefore, cannot be silenced in its opposition, but whose possibilities are inexhaustible: generative of an unfamiliar world that sounds actuality’s hidden pluralities without reducing those into the notion of impossibility as ‘the profoundly unrealistic’ opposition to a rational world view.**”*⁵⁰

*“Sound plays a substantial role in how we interact with or have been targeted by systems of power and control. The function of sound within the discourse of power can be heard clearly, and has grown stronger precisely because it has escaped the scholarly gaze.”*⁵¹

psychoacoustics: a branch of science dealing with the perception of sound, the sensations produced by sounds, and the problems of communication.⁴⁰

resonance: in physics, relatively large selective response of an object or a system that vibrates in step or phase, with an externally applied oscillatory force. Resonance was first investigated in acoustical systems such as musical instruments and the human voice.⁴¹

reverberation: Reflections of the sound on surfaces in the surrounding space are added to the direct signal. The longer these reflections conserve their energy, the greater the reverberation time. In everyday language, reverberation is often referred to as the “cathedral” effect, or by extension, as echo.⁴⁴

sonic: (from Latin sonus = sound) related to audible sound / Sonic Architecture is a discipline concerned with the (re)construction of architectural spaces from the listening perspective, and vice versa.⁴⁵

sonic commons: “The Sonic Commons can be defined as any space where many people share an acoustic environment and can hear the results of each other’s activities, both intentional and unintentional. For instance, at any small-scale outdoor sporting game, the players, the fans, the nearby road with its unaware drivers and the passing jet are all part of the Sonic Commons. The Sonic Commons is a com-

plex multi-user environment leaving an accidental sound- scape as a by-product.”⁴⁶

sonic materialism / “a feminine sonic materialism”: „I understand sonic materialism to be feminine materialism. Both the feminine and sound do not speak in the dominant tongue, whose representational schema falsifies their material reality. They are both failed by the prevailing theoretical models and have to forge a different sensibility to promote the inclusion of the invisible and make themselves count. The feminine, just like Cox observes in relation to sound art, has been ‘undertheorized’, under-appreciated in the knowledge stakes. Its voice has not been heard or it has been marginalized as ‘goofy’, poetic, or sentimental.”⁴⁷

sound art: Sound Art describes a creative practice where sound is used as the medium. In the past, movements such as Dada and Fluxus experimented with sound, it can be seen within conceptual, minimal and site-specific art.⁴⁸

sound object: Pierre Schaeffer, the inventor of this term (l’objet sonore), describes it as an acoustical “object for human perception and not a mathematical or electro-acoustical object for synthesis.” The sound object is then defined by the human ear as the smallest self-contained particle of a SOUNDSCAPE, and is analyzable by the characteristics of its envelope.

Though the sound object may be referential (i.e., a bell, a drum, etc.), it is to be considered primarily as a phenomenological sound formation, independently of its referential qualities as a sound event.⁵²

soundscape/s: The sonic environment. Technically, any portion of the sonic environment regarded as a field for study. The term may refer to actual environments, or to abstract constructions such as musical compositions and tape montages, particularly when considered as an environment.⁵³

syntonization: the act or result of **syntonizing:** to put (two or more radio instruments or systems) in resonance.⁵⁴

“Philosophy’s history is not only visual it is also masculine. And this asymmetry finds expression in the self-certainty of the philosophical subject, his location and relationship with a material reality in which he finds himself mirrored and therefore represented in sameness and similarity. Masculine distance is relative to his correspondence with a representational truth. It is distance in the certainty of coincidence, which creates a dominant language. Thus it is a ‘conquered distance’, whose reach is relative to the masculine vision at the centre. Like a retractable and extendable lead, it is a controlled expanse that snaps back at the owner’s command, who never loses hold of its actuality and power in the first place. A masculine new materialism continues this dominant vision into its disappearance creating a hyperrealism of its historical truth. As Braidotti remarks, a hyperrealism does not wipe out class relations, racism or sexism, it

unison: the playing or singing of notes at the same pitch by different instruments or voices. / the writing, playing, or singing of parts in a musical passage at the same pitch or in octaves⁵⁵

Universal Acoustics: a term defined by Michel Serres: “If there are vibrations in every domain, in sort of universal acoustics, then music and information, both in a sense universal, ought to be able to construct an epistemology founded on hearing at least as easily as that which since Plato we founded on vision. Such a universal acoustics would allow us finally to hear the singing of the world and its enchantment.”⁵⁶

*intensifies them, increasing disparities and inequalities, through what I would argue is their hyper-invisibility: the invisibility of normative relations and values that represent unseen the unquestioned reality of an absolute view.”*⁵⁷

*“In a more detailed analysis, it would be necessary to distinguish between the terms “environment,” “milieu,” and “soundscape” (paysage), as proposed by Pascal Amphoux in “L’identité sonore des villes européennes, guide méthodologique.” This distinction respects three points of view – the given, the interactive, and the aesthetic – that can be applied to any constructed space.”*⁵⁸

*“When it comes to sound and it is no accident that sound gives us the paradigmatic term, resonance - this is most properly an appeal: it makes itself heard, which means that in showing itself it also shows distance, the distance from which it originates. Sound is spatial, it spreads through the air (or another medium) of which it is the vibration. Whereas the visible moves through space and in certain regards cancels it out, the sonic marries with distance and assimilates it.”*⁵⁹

*“Because sound conjugates with space, it crosses space, and the duration of this crossing is a part of the sound, an intrinsic property. Sound does not develop in time: it spatio-temporalizes itself according to its specific characteristics (frequency, timbre, etc.). Resonance-that is to say, the very existence of sounds - is nothing other than the appropriation or modelling of a space-time by a particular vibration. In propagating itself, that is to say in spreading out and enduring- a unique operation-it does something other than present some occasion or other for sensation: it configures a presence in the world (and a presence to me of the world.”*⁶⁰

Notes:

¹ Merriam-Webster dictionary, Merriam-Webster.com

² Ibid.

³ B. Truax, *Handbook for Acoustic Ecology*, UK, Cambridge Street Publishing, 1999.

⁴ Oxford dictionary, <https://www.oxfordlearnersdictionaries.com>

⁵ "In the talk, 'Phonocene: Bird-singing in a multispecies world' Despret proposes to shift our awareness to the pleasure that birds take (and give) in singing, to the boundaries of their territories as meeting places, and to the songs they learn with their neighbours. Towards imagining other stories about their shared dialects, these stories take into account all the good reasons they have for being deeply attached to, through, and by their territories and in turn, might help us to imagine what it could mean to inhabit shared territories in a multispecies world.", excerpt from the introduction to the lecture: Despret, Vinciane. "Phonocene": *Bird-singing in a Multispecies World.*", RIBOCA2 and suddenly it all blossoms: Public Programmes Online Series of Talks and Conversations, 2020., <https://www.rigabiennial.com/en/riboca-2/programme/event-language>

⁶ Merriam-Webster dictionary

⁷ Ibid.

⁸ Ibid.

⁹ Ibid.

¹⁰ definition from Merriam-Webster dictionary; a quotation from: L. Spitzer, *Classical and Christian Ideas of World Harmony: Prolegomena to an Interpretation of the Word "Stimmung": Part I*, Cambridge University Press, Vol.2, 1994., p. 418

¹¹ Merriam-Webster dictionary

¹² Oxford dictionary

¹³ Encyclopedia Britannica, <https://www.britannica.com>

¹⁴ Merriam-Webster dictionary

¹⁵ Ibid.

¹⁶ Ibid.

¹⁷ Ibid.

¹⁸ J.F., Augoyard, H. Torgue, *Sonic Experience: A Guide to Everyday Sounds*, tr. Andra McCartney and David Paquette, Montreal & Kingston, McGill-Queen's University Press, 2005., p. 153

¹⁹ Ibid.

²⁰ Oxford dictionary

²¹ J.F., Augoyard, H. Torgue, *Sonic Experience: A Guide to Everyday Sounds*, 2005., p.101

²² Ibid., p.203

²³ S. Voegelin, *The Political Possibility of Sound: Fragments of Listening*, London, Bloomsbury Academic, 2018., p.21

²⁴ C. Watkin, *Michel Serres: Figures of Thought*, Edinburgh, University Press, 2020. p.331

²⁵ Merriam-Webster dictionary

²⁶ Ibid.

²⁷ Encyclopedia Britannica

²⁸ J.F., Augoyard, H. Torgue, *Sonic Experience: A Guide to Everyday Sounds*, 2005., p.175

²⁹ S. Voegelin, *The Political Possibility of Sound: Fragments of Listening*, 2018., p.157

³⁰ Ibid.

³¹ Encyclopedia Britannica

³² Merriam-Webster dictionary

³³ Ibid.

³⁴ Ibid.

³⁵ Oxford dictionary

³⁶ Merriam-Webster dictionary

³⁷ Encyclopedia Britannica

³⁸ In her recent art installation, Vinciane Despret calls for a *Phonocene* - a term she borrows from Donna Haraway: "The fact of inscribing our time under the sign of the Phonocene is not to forget that when the earth rumbles and squeaks, it is because it also sings. It also means not forgetting that these songs are disappearing, but that they will disappear even more if we do not pay attention to them. It evokes the inventive forms of cohabitation and orchestration developed by animals, giving an account of the formidable power of "sung territories". As well as Haraway puts it: "The imposed silence, has allowed us to hear the sounds, and this is the first step towards trying to generate a more plural "us" that is meaningful to a personal journey."

³⁹ Merriam-Webster dictionary

⁴⁰ Ibid.

⁴¹ Ibid.

⁴² S. Voegelin, *The Political Possibility of Sound: Fragments of Listening*, 2018., p.157

⁴³ Ibid., p.162

⁴⁴ J.F., Augoyard, H. Torgue, *Sonic Experience: A Guide to Everyday Sounds*, 2005., p.196

⁴⁵ Merriam-Webster dictionary

⁴⁶ B. Odland, S. Auinger, *O+A, Reflections on the Sonic Commons*, LEONARDO MUSIC JOURNAL, Vol. 19, pp. 63–68, 2009.

⁴⁷ S. Voegelin, *The Political Possibility of Sound: Fragments of Listening*, 2018., p.162

⁴⁸ Encyclopedia Britannica

⁴⁹ S. Voegelin, *The Political Possibility of Sound: Fragments of Listening*, 2018., p.25

⁵⁰ Ibid., p.30

⁵¹ Ibid.

⁵² B. Truax, *Handbook for Acoustic Ecology*, UK, Cambridge Street Publishing, 1999.

⁵³ Cambridge dictionary, <https://dictionary.cambridge.org>

⁵⁴ Merriam-Webster dictionary

⁵⁵ Ibid.

⁵⁶ M. Serres, *Musik*, Berlin, Merve Verlag, 2015. p. 27

⁵⁷ S. Voegelin, *The Political Possibility of Sound: Fragments of Listening*, 2018., p.158

⁵⁸ J.F., Augoyard, H. Torgue, *Sonic Experience: A Guide to Everyday Sounds*, 2005., p.155

⁵⁹ J.L. Nancy, *Resonance of Sense* included in *Spectres II: Resonances*, Europe, Shelter Press, 2020, p. 14

⁶⁰ Ibid., p.15

PART II

Echo in Space

Spatial Sound Phenomena

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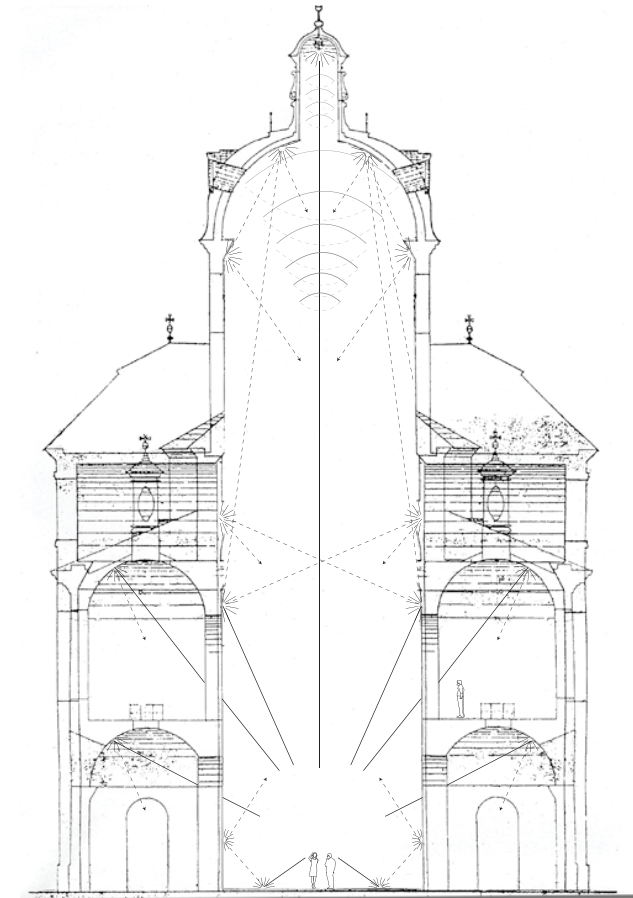


fig. 77: Diagram interpreting dispersion of an echo in space

Echo as a

reverberation
repetition
vibration
mirroring
reflection
copia
mimic
imitation
interruption
repercussion
reproduction
dispersion
deconstruction

[echology, reflection, repetition, interruption]

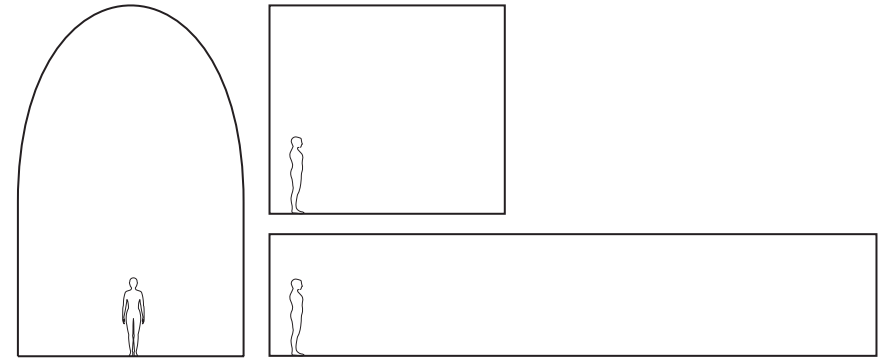


fig. 78: Different spatial environments affect human perception of sound phenomena

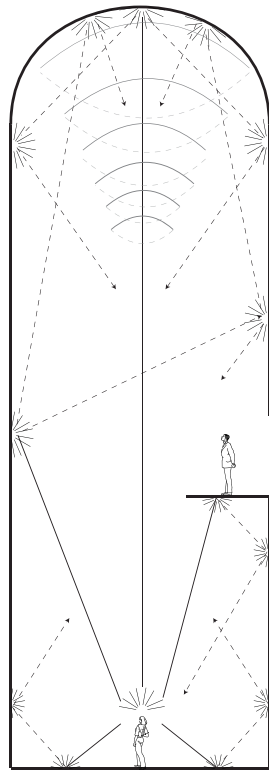


fig. 79: Diagram of vertical dispersion of an echo; schematic sectional view

“*Servant spaces*” (“*dienende Räume*”) were defined by Louis Kahn (1901-1974) in his book “*The Power of Architecture*” as such spaces that serve the utilized - principally utility rooms or subordinate areas such as sanitary, technical and installation areas, staircases, storages, along with others. They are assigned to the primary or so-called “*served spaces*”. “*Served spaces*” (“*bediente Räume*”), on the other hand, are those spaces in the building that are actively used. The served rooms have to fulfil more complex criteria, such as lighting, ventilation, size and the room sequence, than the serving rooms. When comparing those two groups, one may clearly notice a distinct hierarchy. Staircases are architectural structures designed to connect two or more building floors and they do not possess social and political ideologies or affiliations. Although staircases themselves are not political, they can play a role in shaping social interactions and building communities within buildings. Considering the medium of sound as a collaborative, participative and democratic medium, for this Project, servant spaces - as accessible and potentially “*democratic*” type of spaces will aim to provide an opportunity to expand the limits of what one strictly defines as *servicing* or *being serviced*. Staircases and corridors in this case become resonant, immersive sonic environments. They are soundscapes of the transit spaces, of the threshold one needs to pass to get from one place to the other. Additionally, staircases often possess interesting acoustic properties due to their shape, dimension and materiality. In staircases, where the sound vertically arises and since they represent the spaces of movement, they consequently become instruments of their irregular and unforeseen public sonic expression. Similarly to church interiors, if a musical score were placed in the context of vertical sound distribution, higher tones and frequencies would soar to the higher floors. In contrast, lower tones would stay below, in this way being manifested as a composition of multi-layered audible frequencies, responding to the appropriate sonic settings.



80



81

fig. 80 & 81: spiral staircases



82



83

fig. 82 & 83: rectangular staircases

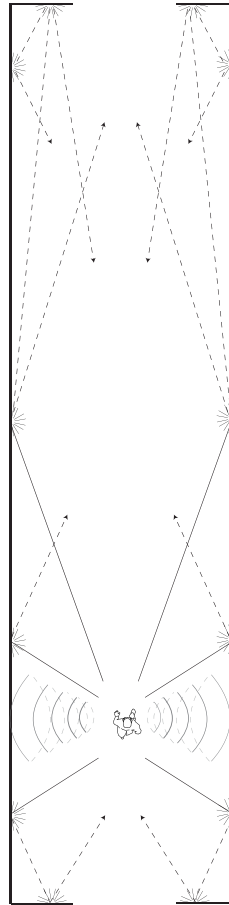


fig. 84: Diagram of horizontal dispersion of an echo; schematic floor plan view

Like staircases, corridors do not have a “democratic side” as they are simply passageways within a building designed to connect living rooms and spaces. However, in the same way as staircases, corridors can also have a social side and contribute to creating a sense of community within a building. One way that corridors can promote social interaction is through their design, e.g. wider corridors with seating areas or alcoves and niches can provide spaces for people to pause and chat. In comparison again, narrower corridors may and do encourage people to move quickly without stopping. In addition to the previous, corridors can be used as an exhibition space for art or information displays, which can support creating a sense of shared interest or purpose among building occupants. In some cases, corridors may also be used as meeting places or gathering spaces for informal events. For instance, a building may have a central corridor that serves as a hub for social activity, with adjacent rooms and spaces opening onto it, to host events like potluck dinners or game nights. Although corridors may not have a particular political affiliation or ideology, they can still play an essential role in shaping social interactions and in forming a sense of community within a building. Furthermore, due to its outlook a corridor represents various aspects: **an accessible and egalitarian space** - a place for gathering approachable and available to everyone, **a transitional space** - a place of movement from one location to another one, **a connecting space** - architecturally, it connects different rooms, as well as socially it stimulates social interaction. After all, it accomplishes its active and engaging role of *servicing*, not *being-served*.

From the acoustic side, the echo reverberates horizontally in corridors. It is prolonged linearly, like in a tunnel, and the time delay is present. Once the sound of a voice from one side reaches the walls on the other side of the corridor, a certain amount of time has passed, i.e. it will take longer for the echo to reflect back to the listener. It also acts as an audible shadow or an echoey silhouette of a by-passer. It follows and reflects the sound of steps in the room, creating an aural ambience and an illusionary feeling of sonically extended space.

HORIZONTAL REVERBERATION

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85



86

fig. 85 & 86: different corridors

corridors



fig. 87: The Arcade Courtyard with War Injured, Main Building of the University of Vienna, 1914/15

*“Both the proportions and the message of an existing space can be changed with lines of sound. To a long, neutral, exhausting corridor for a large number of people (in airports for example) circling lines of sound are added transverse to the axis of the corridor at certain intervals: **the corridor acquires an ornamentation, a new rhythm, is humanised and rescaled for the individual.**” — BERNHARD LEITNER*

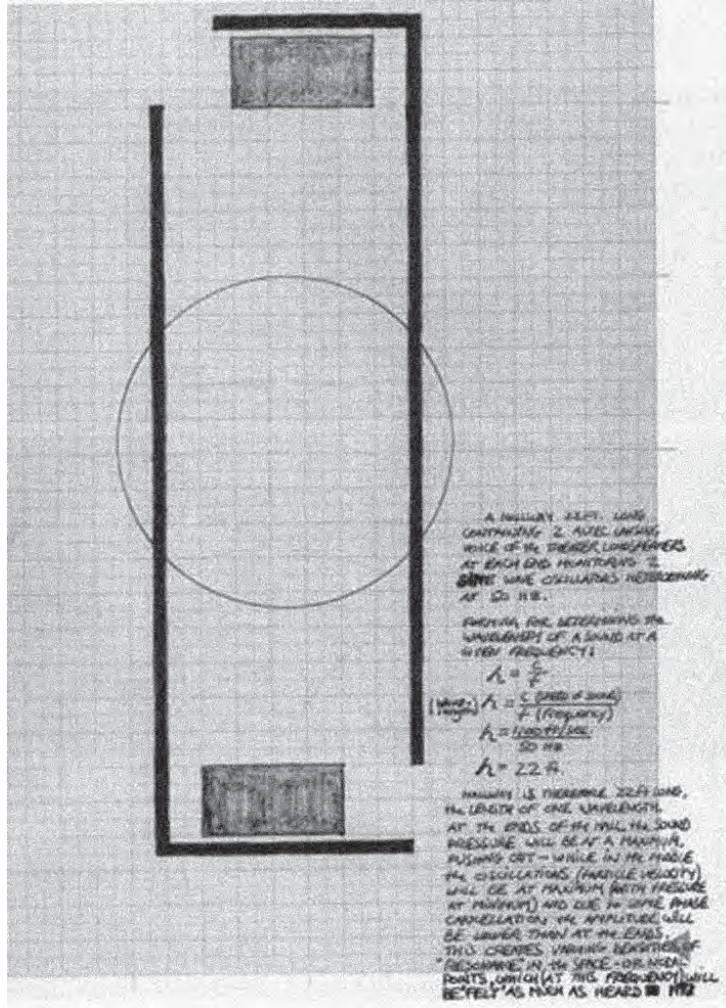
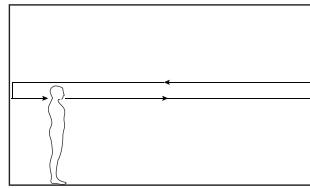


fig. 88: Bill Viola, *Hallway Nodes*, 1972

Similarly to Bernhard Leitner's work, Bill Viola, in his sound installation, *Hallway Nodes* (1972), touches on the issues of an immediate sound effect on the human body. He conceived sound spatially by placing two speakers transmitting sound waves at the opposite ends of a long corridor: the sound waves intersect at a particular point, creating a sound node that is not visible but can be sensed physically as pressure intensities. If one moves around the room, he/she can sense the changing intensity of the sound waves, and this sensation will be naturally most intense in the node of the intersection of two or more wave motions. In this work, Bill Viola uses the acoustic properties of an existing space (a corridor) as a resonator and amplifier of the sound.

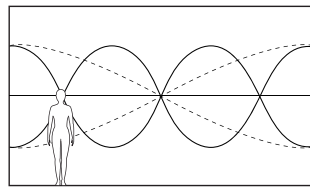
aural perception of space: human-space relation



89

PARALLEL SURFACES CREATE FLUTTER ECHOES

If two walls in a large room are more than 7-8m apart, the sound waves moving back and forth create flutter echoes, i.e., echoes that follow each other quickly but can be perceived as individual sound events due to the increased distance with more than 50ms time difference. This severely impairs speech intelligibility and musical performances in particular. A slight rotation of the reflecting surfaces by about 3-5° is sufficient to counteract this effect.

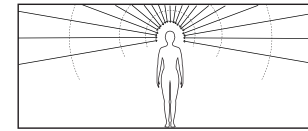


90

INTEGER SPATIAL PROPORTIONS CREATE STANDING WAVES

In smaller rooms, standing waves of particular frequencies always occur between two parallel, reflecting walls. The wavelengths of the frequencies involved are always half or a multiple of the distance between the two surfaces. These specific frequencies' sound waves overlap and are disturbingly amplified and unevenly distributed in the room. If another room dimension is an integral multiple of another dimension, these natural frequencies occur particularly strongly. A deviation of the ratios by more than 10% should be aimed here to avoid this effect. This is especially important for small rooms that are planned for musical use. As the room dimensions increase, this effect shifts to lower frequency ranges, which are less significant for the human ear.

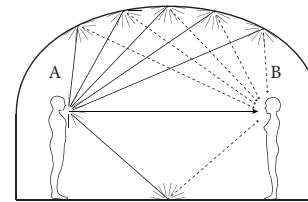
fig 89: Parallel surfaces generate flutter echoes
fig 90: Integer spatial proportions create standing waves



91

LOW CEILINGS INCREASE DISORIENTATION

Because the human auditory apparatus, due to evolutionary development, is designed to locate sound events in a horizontal plane, humans can orientate themselves much better in a room due to reflections from walls. If a low ceiling in a room acts as a strong reflector, the sound waves reflected from the ceiling arrive in our hearing before those reflected from the walls, which weakens our auditory orientation ability.



92

CONCAVE SURFACES LEAD TO SOUND CONCENTRATION

Circular surfaces concentrate light and sound events according to the concave mirror laws in their center or focal points, increasing the sound pressure in these areas. This can lead to a disturbing amplification of background noise at these focal points and is especially critical in lecture rooms. Convex surfaces, on the other hand, have a distributing effect and are often explicitly used in room acoustics.

fig 91: Low ceilings increase disorientation
fig 92: Concave surfaces lead to sound concentration

perceiving sound in space

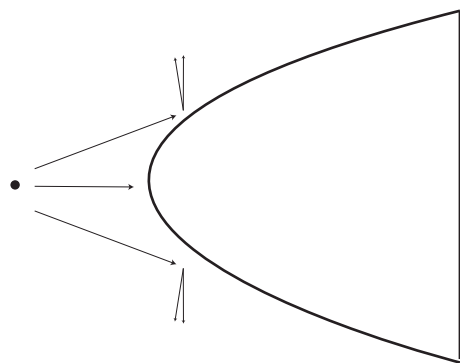


fig. 93: convex reflection creates dispersion of sound

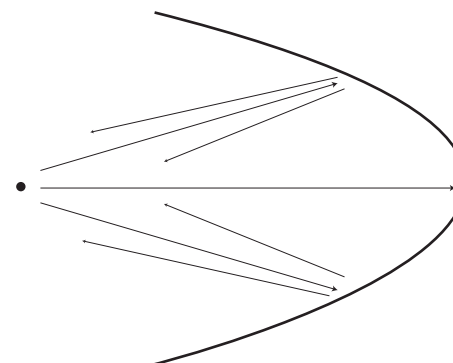
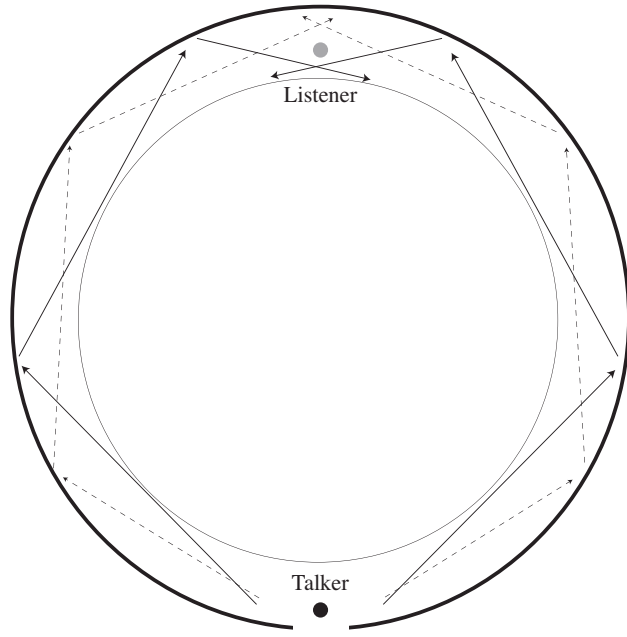


fig. 94: concav reflection creates echoes

perceiving sound in space



Dashed lines show how sound waves bounce from one end of a circular space to another without meeting any resistance, making them sound as though they've been emitted from a much closer distance. The full lines show sound waves directed at an angle that doesn't generate the effect. A speaker/talker standing against the gallery wall can whisper and be heard by someone standing against the wall on the opposite side of the room. This occurs because the walls of the room are perfectly cylindrical, so sound waves directed at the proper angle can bounce from one side to another without losing much volume.

fig. 95: sound transmission between the talker and the listener in a circular space

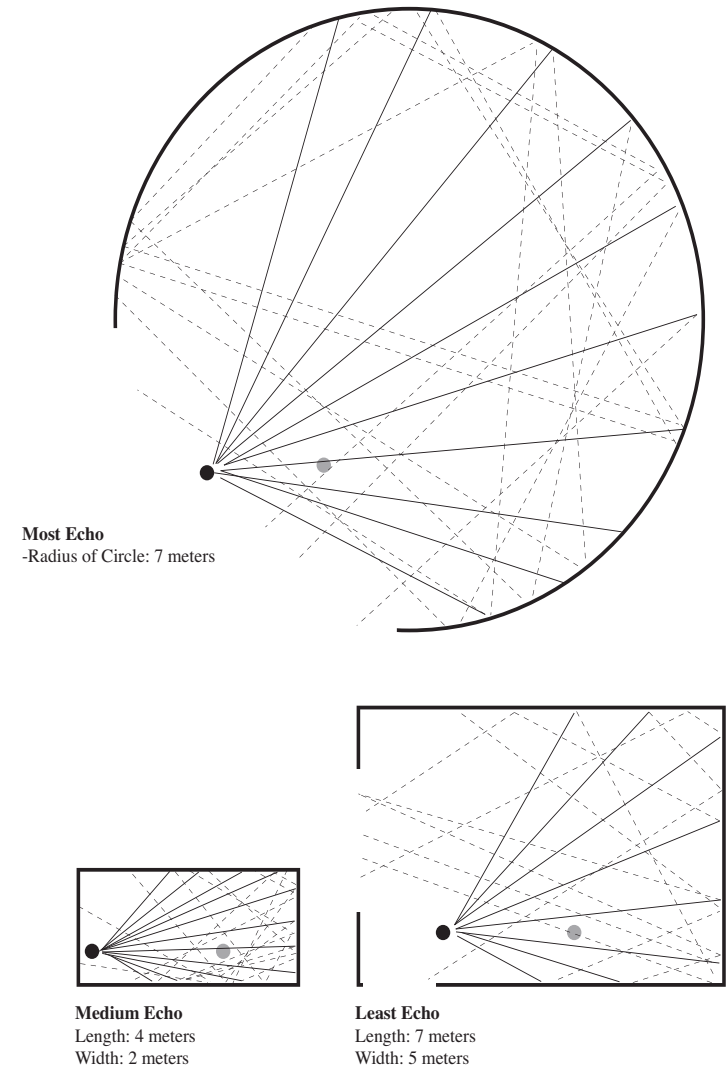


fig. 96: manifestation of an echo in 3 different spatial settings

perceiving sound in space

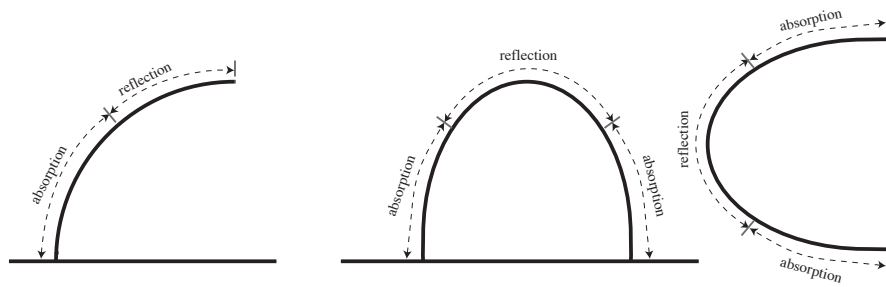


fig. 97: performance shell: diagram of reflection / absorption

subversive character of sound

Sound in time and space.
In its FORMLESS FORM,
adaptable to changes.
It doesn't become something else.
Only in its REFLECTED SHAPE,
it MODIFIES itself.

[being-honeyed, intangible, invisible,
transforming, sonic volumes, echology]

*a poem made by author

*“We have been so concerned with language
that we have forgotten how sound flows
through space and occupies it.”*

- ALVIN LUCIER

Alvin Lucier is sitting in a room



fig. 98



Sound Installation

V

Sound has a certain depth and always goes with time - it is temporal. It is omnidirectional, so one can distinguish different sounds even if they are produced simultaneously, because the ear can differentiate more spectrum than the eye does. In quantum physics, sound behaviour is defined as a circulation, specifically a circle that operates vertically to infinity. The four elaborated models of Echologies take into consideration those characteristics specific to sound and attempt to expand the traditional architectural role of the visual and the physical by viewing them as a device of self-reflection, participation and repetition, namely, the four main aspects of the echo in a time-space relation: Mirroring, Interruption, Cyclical Repetition and Sonic Volumes. There is no distinc-

tive hierarchy among those Echology registers, on the contrary, they possess complementary characteristics. While frequently engaging in spatial interactions, they do not exhaust one another. Instead, they grasp, deepen, project, reproduce, scale up, interrupt and sometimes even intertwine each other, hence stimulating novel outcomes. Therefore, they temporarily either disturb the listener or stimulate confrontation of time and space. Echo as a spatial sound phenomenon, sonic contingency, reflecting towards the observer, provoking if put in an unexpected, unforeseen environment demands a reaction and attentiveness. In light of the argument of this Thesis and considering all of the previously mentioned aspects of Echologies, the following sound installation applies these theoretical gestures in a physical form in public architectural spaces. The case studies or places where the sound installation is implemented are staircases and corridors, which tend to possess interesting echoey acoustics. These architectural spaces are “servant”, public, connecting and accessible spaces. As a starting point, the original audio recording of a capella duet singing in

the staircases was brought to another sonic environment and again re-recorded while at the same time being influenced by that particular acoustic setting. This copy of a recording is, again, by following the same procedure, brought into a new acoustic context and again re-recorded. There is only a single constant rule: when recording a sound, the sound is continuously switched between vertical and horizontal staging, beginning with a vertical reverberation (in the staircase), moving to a horizontal one (along the corridor), and then returning to a vertical one, and so on. In this way, the echo of a room where the recording is being performed is altered and modified every time by its sonic surrounding and is a result of its unique acoustics. Alvin Lucier, Susan Philipsz and Bernhard Leitner’s work was the main inspiration for this strategy due to how they approached sound as a spatial medium. Relating to the three significant figures who were all dealing with the sound in a sculptural way, there is a further clarification necessary: Leitner, because he observed the phenomena of spatial acoustics through the human body and movements, which, by implementing a human body in,

becomes an extension of the body and of the space itself. Through this, Leitner expands the limits of the invisible but audible “new geometry” or - the Sonic Volumes. Leitner investigates the following questions: How do acoustical changes influence space perception? How do vertical and horizontal space transformations influence the sonic experience? Secondly, Philipsz who explores the psychological and sculptural potential of sound. Some of the questions that are invoked in her work are: How can sound define space? How can it create a space within the space? Philipsz is also interested in the ambient sound, or as she calls it, “soundscapes of transit spaces”. She takes out segments from the compositions and rearranges them in space, playing with the distinct acoustics of the space. As the last reference, Lucier, who uses the medium of sound by emphasizing the acoustical aspects of the architecture. In his work “I am sitting in a room” a perpetual, repeating process of re-recording the sound, which is produced and heard in the end, becomes and is a new re-formulated sound. The sound is modulated and affected through the specific acoustic properties of

the room, and through the repetition of those, it will affect every following recording. In a way, it stands as a “sponge” of its sonic milieu, absorbing important and filtering out unimportant resonant frequencies of the area, never knowing what will result as an outcome. For Louis Kahn “served” spaces (“bediente Räume”) are those spaces in a building that are actively used, whereas “servant” spaces (“dienende Räume”) are those spaces that serve the utilized ones. When comparing those two categories, one may notice a distinct hierarchy. Although staircases and corridors themselves are not political, they can play a role in shaping social interactions and creating communities within buildings. Considering the medium of sound as a collaborative, participative and democratic medium, for this Thesis servant spaces, as accessible and potentially “democratic” types of spaces, will aim to provide an opportunity of expanding the limits of what one defines strictly as serving or being served. Staircases and corridors often possess interesting acoustic properties due to their shape, dimension and materiality, and in this case, they become resonant, immersive sonic

environments. They become echoing soundscapes of the transit spaces, of the threshold one has to pass in order to move somewhere. The sound is not prolonged in an identical way in the vertical and horizontal space. Both spaces, however, reverberate the echoes and thus are fascinatingly observed as instruments and resonators of the spatial sound phenomena. So, if a capella singing occurs in the servant space, such as the staircase is, it is a sort of interruption, a provocative gesture located in the trespassing space. It certainly stimulates the engagement of its accidental passenger who happens to participate in this manifestation. A voice reflected multiple times in the room, an echo of an echo no longer belongs to its originator. It is altered and modified by its milieu. What can one get from the disembodied echo of an echo? Who does this entity belong to, and what is the potential narrative and paradigm behind it? The sound is a medium, and the space becomes a tool in this interplay of spatio-temporal assemblage. The sound is ultimately a medium that claims the space, even though it remains invisible, unseen, and intangible.

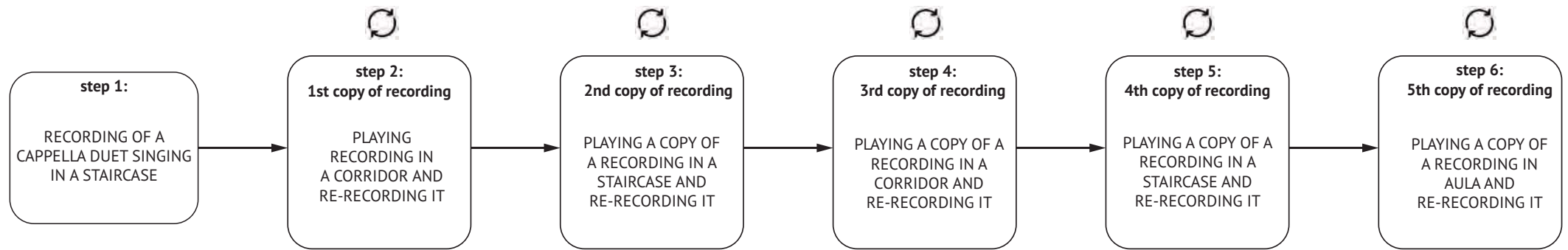


fig. 99: Duet singing a capella in the staircase

Title: Miraculous love's wounding
 Composer: Thomas Morley
 Description: Choral pieces, madrigal
 Instrument: Duet a capella
 Language: English
 First published: 1595 in Canzonets to Two Voices, no. 5

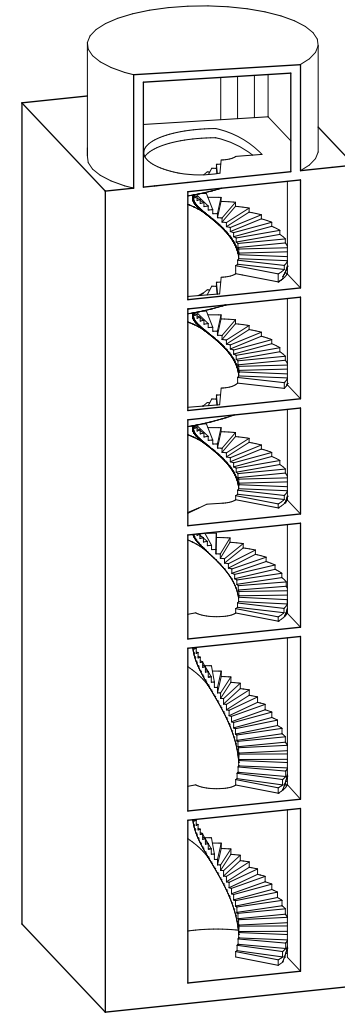
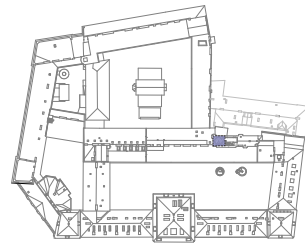
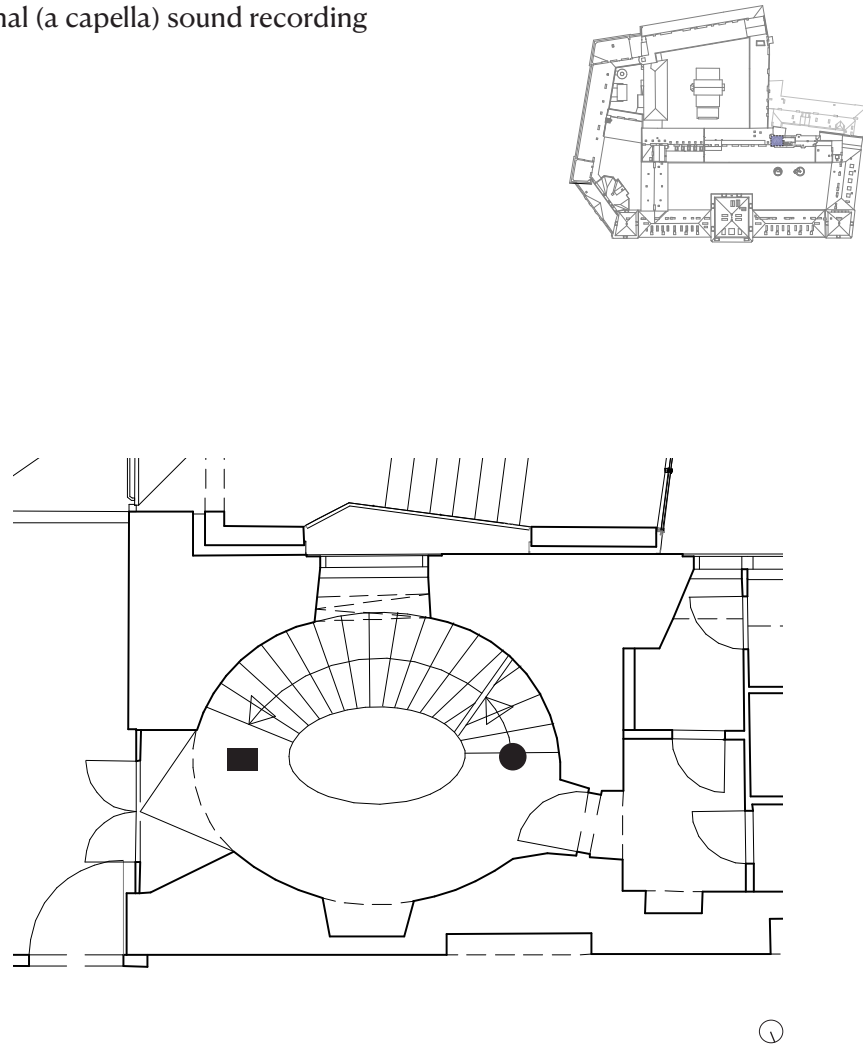
*Miraculous love's wounding.
 E'en those darts, my sweet Phillis,
 So fiercely shot against my heart, rebounding,
 Are turn'd to roses, violets and lilies,
 With odour sweet abounding.
 Miraculous love's wounding.*

fig. 100: Diagram explaining sound installation process



VERTICAL REVERBERATION

step 1: original (a capella) sound recording



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- sound source / singers
- sound recorder

fig. 101: floor plan of the **staircases**, TU Vienna, Karlsplatz 13, (scale 1:200), 4. Floor

SCAN ME



scan this QR code to
hear the recording

fig. 102: axonometry of the **staircases** (scale 1:300)

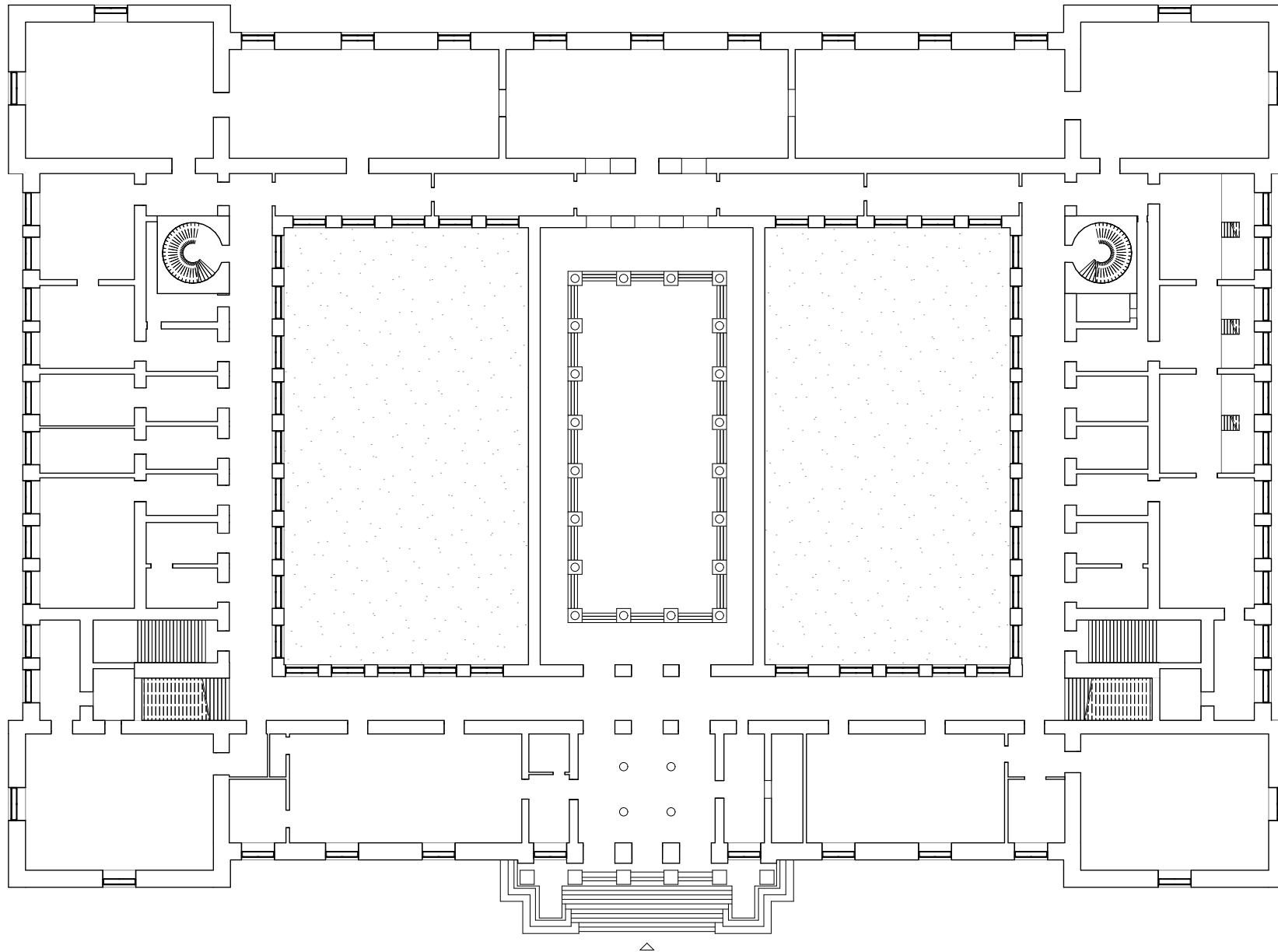


103



104

Floor plan of the Sound Installation area



0 1 3



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fig. 105: floor plan of the Academy of Fine Arts, Schillerplatz 3, Vienna (scale 1:500); Ground floor

HORIZONTAL REVERBERATION

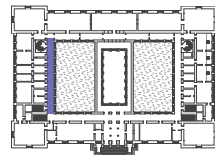
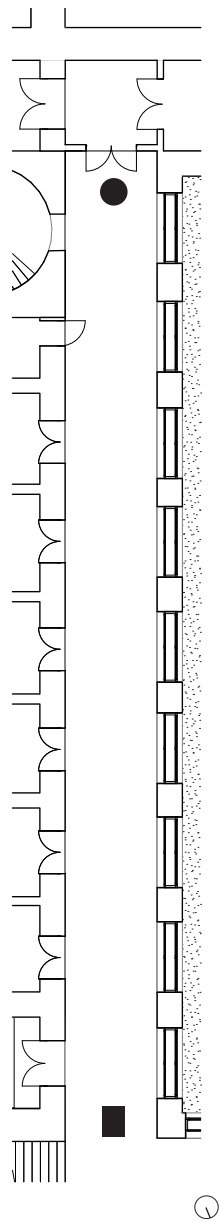
step 2: 1st copy of recording

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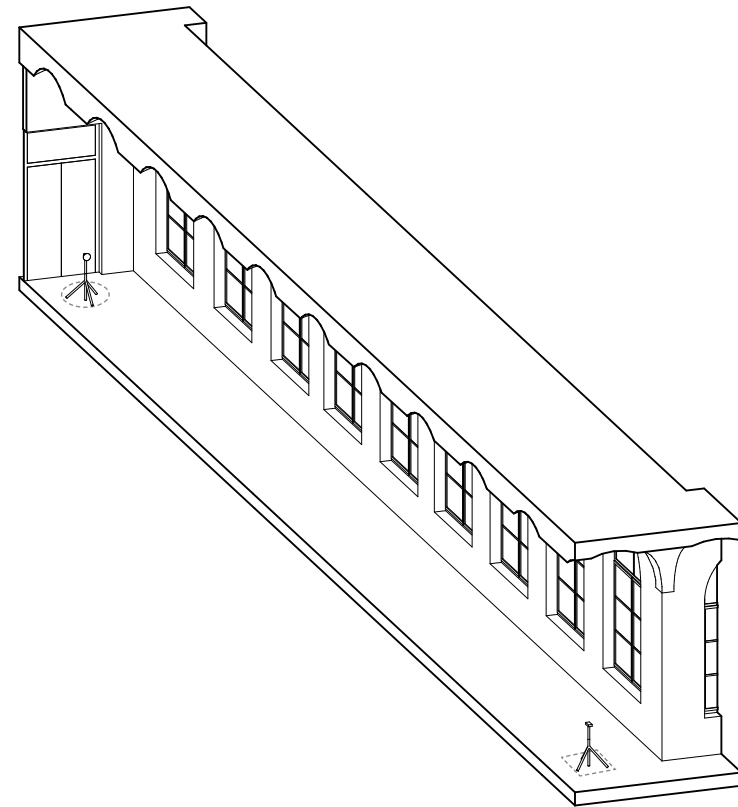
- sound source / speaker
- sound recorder

fig. 106: floor plan of a **short corridor** (scale 1:300), 1. Floor



- sound source / speaker
- sound recorder

fig. 107: axonometry of a **short corridor** (scale 1:200)



SCAN ME



scan this QR code to hear the recording

fig. 108 & 109: Images from a short corridor

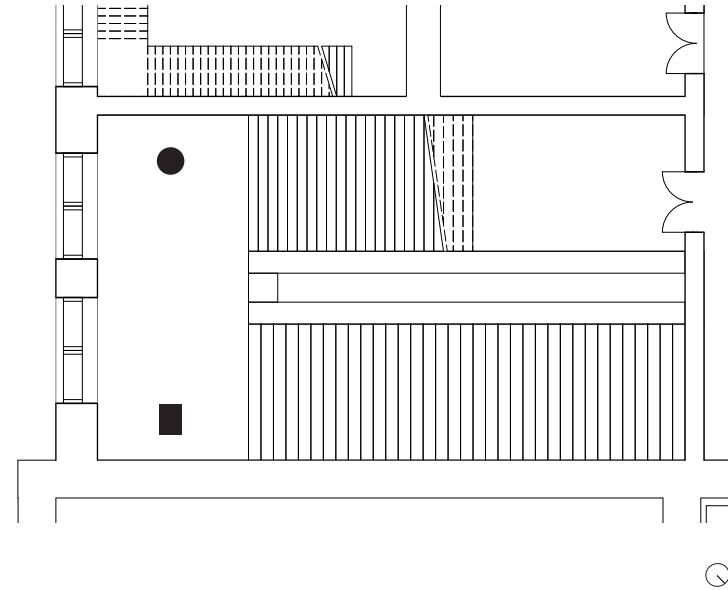
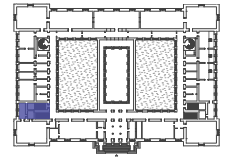


108



109

VERTICAL REVERBERATION
step 3: 2nd copy of recording

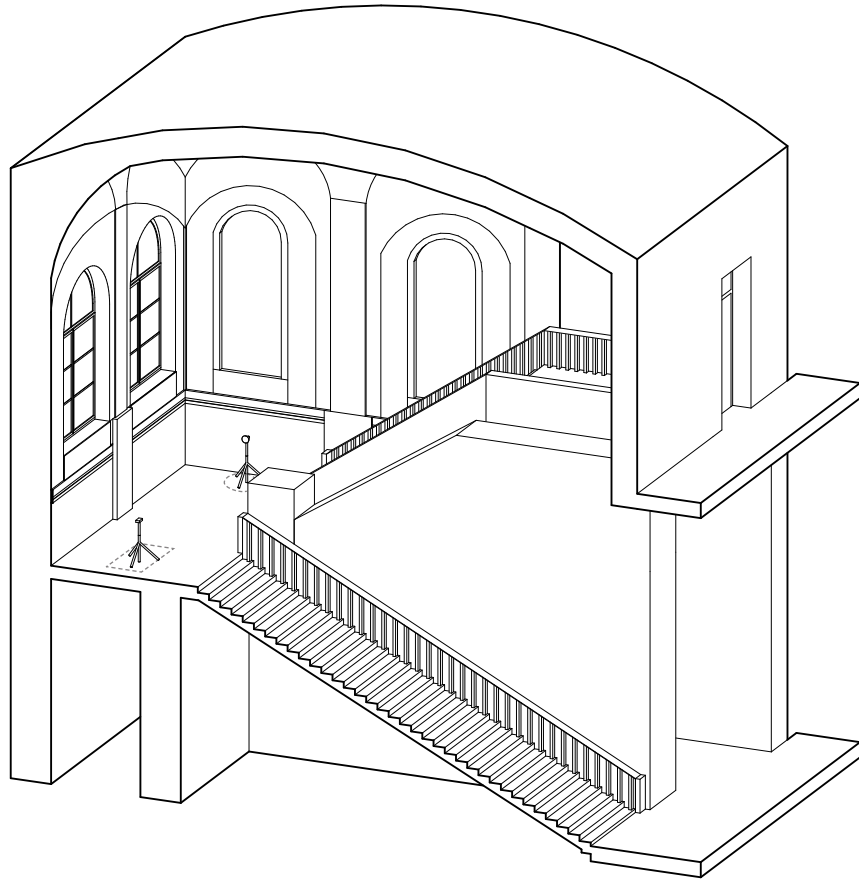


- sound source / speaker
- sound recorder

fig. 110: floor plan of a **rectangular staircase** (scale 1:200), 2. Floor

- sound source / speaker
- sound recorder

fig. 111: axonometry of **rectangular staircase** (scale 1:200)



SCAN ME



scan this QR code to
hear the recording

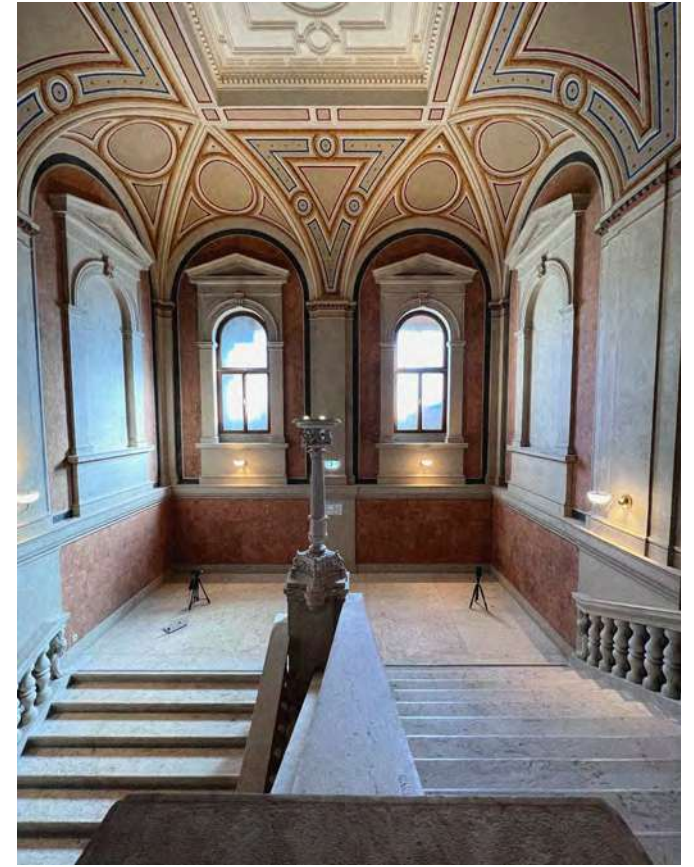


fig. 112: Image from a rectangular staircase



fig. 113: Image from a rectangular staircase

HORIZONTAL REVERBERATION
 step 4: 3rd copy of recording

- sound source / speaker
- sound recorder

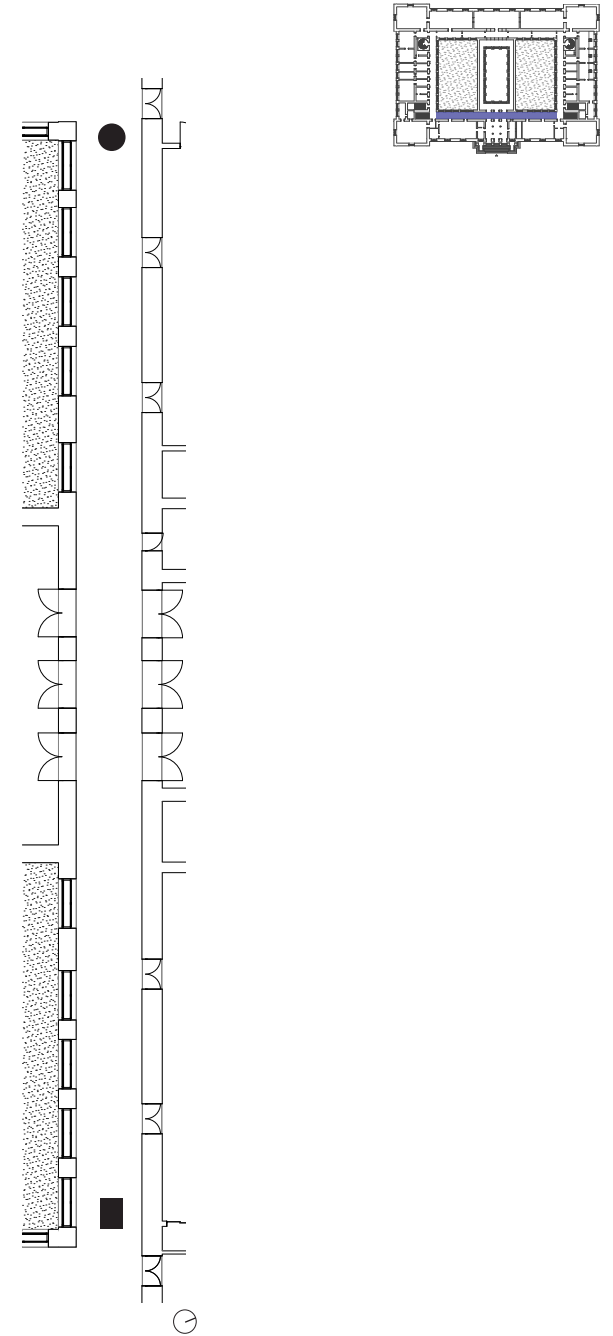
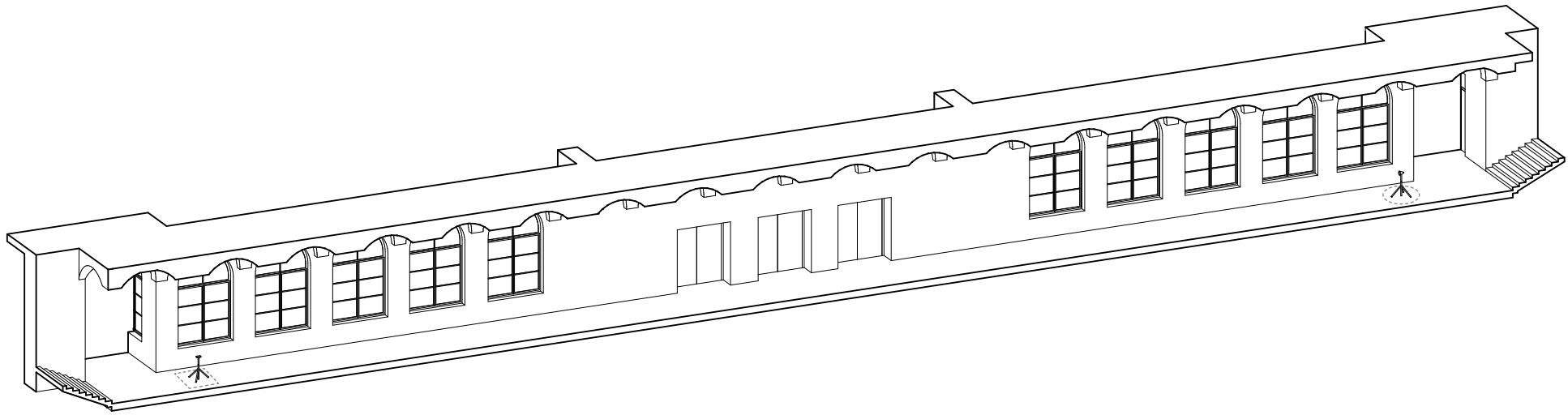


fig. 114: floor plan of a **long corridor** (scale 1:300), 1. Floor



- sound source / speaker
- sound recorder

SCAN ME



scan this QR code to
hear the recording

fig. 115: axonometry of a **long corridor** (scale 1:300)



fig. 116: Image from a long corridor



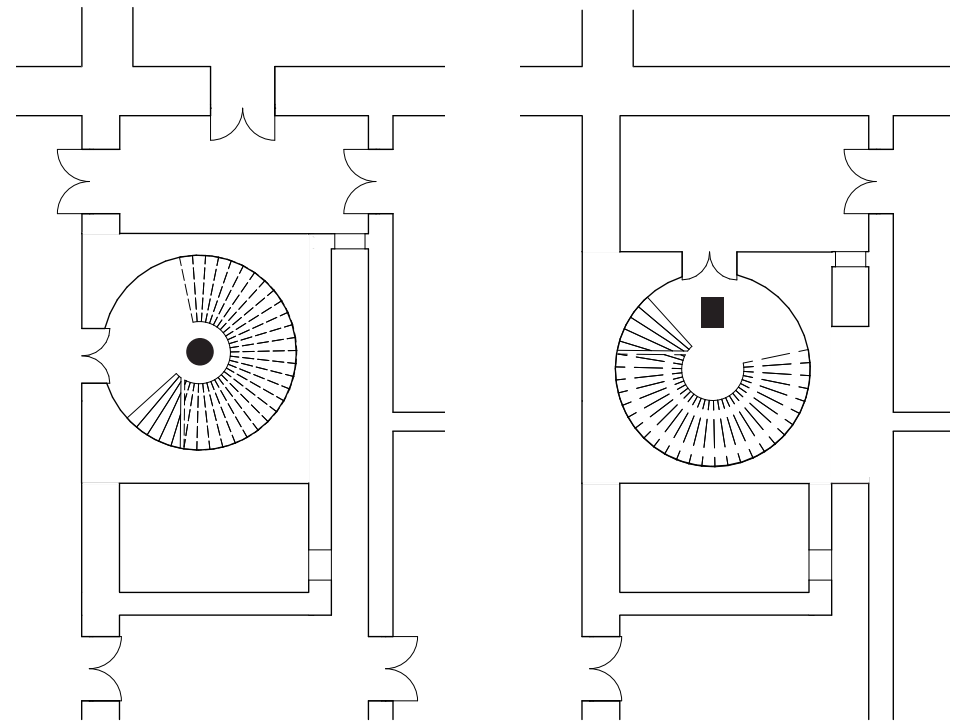
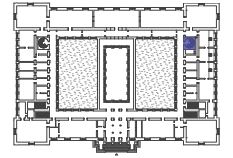
117



118

fig. 117 & 118: sound installation equipment

VERTICAL REVERBERATION
 step 5: 4th copy of recording



MEZZANINE FLOOR

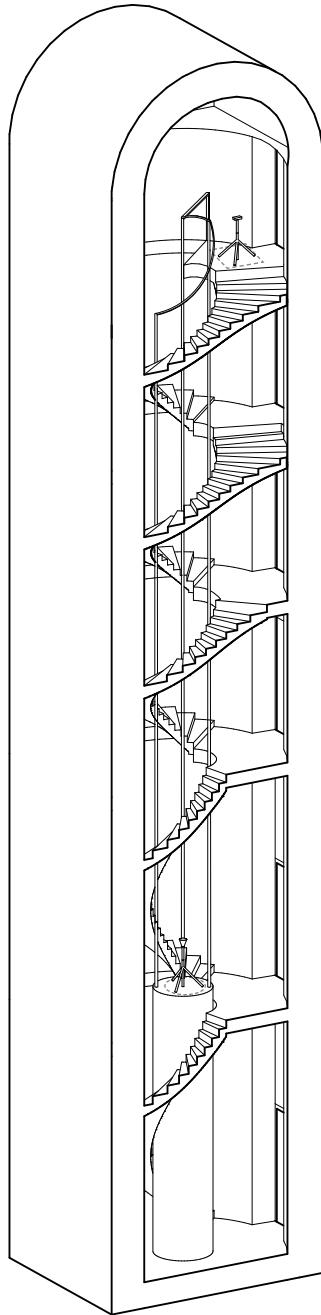
ATTIC FLOOR

- sound source / speaker
- sound recorder

fig. 119: floor plan of a **circular staircase** (scale 1:200)

○ sound source / speaker
□ sound recorder

120: axonometry of **circular staircase** (scale 1:200)



SCAN ME



scan this QR code to
hear the recording



fig. 121: Image from a rectangular staircase

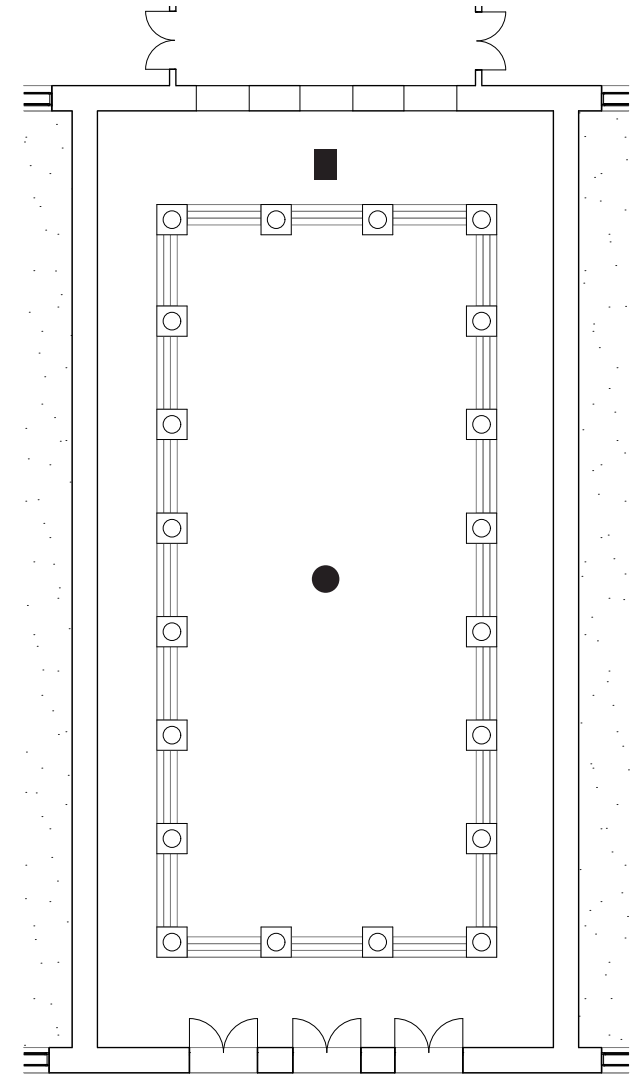
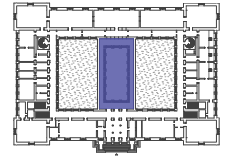


fig. 122: Sound installation equipment; image from a bottom of a staircase where was the sound source positioned



fig. 123: Image from the top of a staircase, where was the sound recording positioned

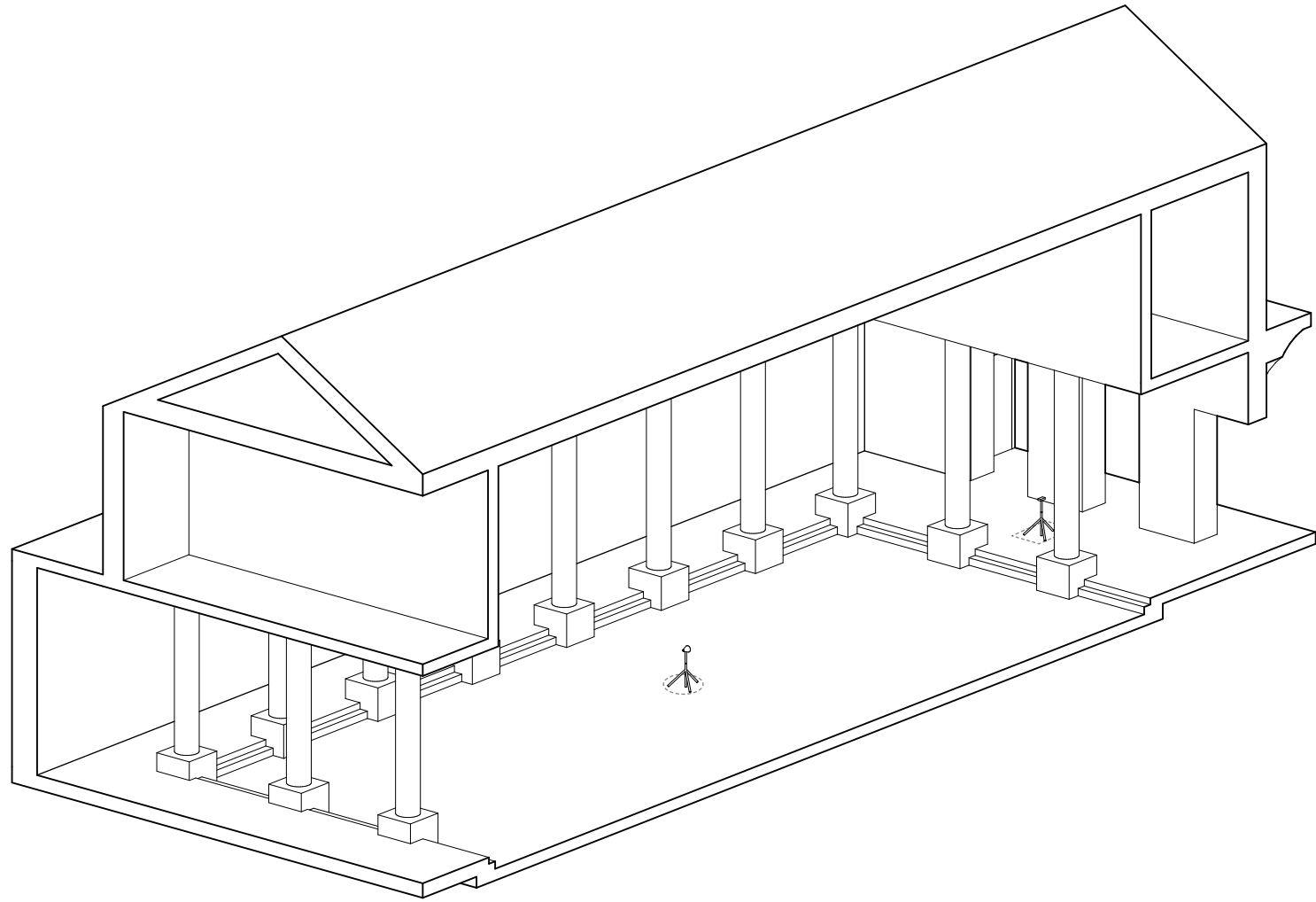
HORIZONTAL REVERBERATION step 6: 5th copy of recording



- sound source / speaker
- sound recorder

fig. 124: floor plan of **aula** (scale 1:300)

fig. 125: axonometry of aula (scale 1:200)



- sound source / speaker
- sound recorder

SCAN ME



scan this QR code to
hear the recording



fig. 126: Image from aula

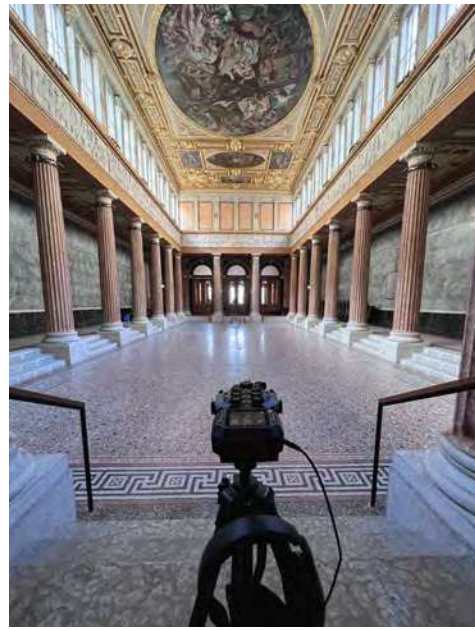


fig. 127: Sound installation equipment in aula



fig. 128: Sound installation equipment in aula

Eternal Echo

S *t* *i* *l* *l* *,*
but *its* *own* *way* *or* *moving*
in *its* *own* *way* *or* *style.*

D *i* *s* *e* *m* *b* *o* *d* *i* *e* *d* *,*
but *one's* *persistent,*
in *one's* *mind.*

[echo, reflection, memory, echology]

APPENDIX

Acknowledgements

First and foremost, I would like to thank my friends and family, my brother and sister, and especially my parents, who were the biggest support from the beginning, and who made my studies possible.

I would like to thank Prof.in Mag.a art. Christine Hohenbüchler for trusting me and navigating me towards the outcome of this thesis, which challenged me in many ways and gave me novel insights into the field of architecture.

I would also like to thank Prof.in Dr.in phil Vera Bühlmann for her trust and patience from the beginning when I still didn't know where exactly am I heading with the thesis. Your observations taught me that architecture offers various dimensions and should be treated so, as a holistic field. Also thank you to the whole ATTP Department (Architekturtheorie Institut), where most of my texts were discussed and elaborated.

Thank you to the four interviewees, who took their time and answered all my questions in very detail and gave me a lot of new perspectives towards the notion of sound.

Thank you to Jordi Vivaldi for letting me be a part of the seminar course where we had a lot of interesting philosophical discussions, which gave a rise to the whole theoretical part of this thesis.

Many thanks to Alexandra and Daniel whose beautiful voices loudly echoed through corridors and staircases, without whom it would not be possible to realize the sound installation.

A big thank you to Ivan and Paul who gave me suggestions and recommendations for the practical part of the sound installation.

I would like to thank all of the participants for taking their time to answer the questionnaire and thus helping me to filter out the main thoughts and collect interesting references.

A special thank you to my adviser and life companion Lana Novak, who criticized me when needed and push me forward every time I doubt myself.

Thank you to Mirna Marinčić who did the proofreading for this book.

Lastly, thank you to all the people who helped me in a certain way and with whom I crossed my path in this phase of my life.

Danksagung

In erster Linie möchte ich mich bei meinen Freunden und meiner Familie, meinen Geschwistern und vor allem bei meinen Eltern bedanken, die von Anfang an die größte Unterstützung waren und mein Studium erst möglich gemacht haben.

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Danke an die vier InterviewpartnerInnen, die sich die Zeit genommen haben, alle meine Fragen sehr ausführlich zu beantworten und mir viele neue Perspektiven auf den Begriff des Klangs eröffnet haben.

Vielen Dank an Jordi Vivaldi, der mir die Teilnahme am Seminar ermöglichte, in dem wir viele interessante philosophische Diskussionen führten, aus denen der gesamte theoretische Teil dieser Arbeit hervorging.

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Und schließlich danke ich all den Menschen, die mir in gewisser Weise geholfen haben und mit denen ich in dieser Phase meines Lebens zusammengekommen bin.

Note: This Questionnaire was a part of my research where the aim was to collect references, hear opinions and eliminate the unimportant information in order to have more concise argument of the thesis. Disclaimer below was a part of the original document.

Questions:

1. Which type of sensations do you notice the most in the space: visual, auditory, haptic, etc.? Do you think that these sensations affect our perception of architectural spaces?
2. How do you perceive sound? What is your relation to it?
3. What type of sound affects you? (harmonic, disharmonic...) Do you associate it with something/someone else?
4. Do you think that the material quality of the space affects the sound and our perception of it? How?
5. In your personal experience, can you think of any spaces/places that were influential (acoustically speaking) to you, in a good/bad way? Why? How would you describe them? (Try to think of it in detail: materials, height, proportions, etc.)
6. How would you define echo in space? Is it necessarily bad and unwanted? (hint: churches, or daily life example-bathrooms, sound is very present there due to its particular acoustics...)
7. Is there any art piece (it could be a building, but as well as sculpture, installation, image, literature, musical piece, or your own experiences and associations) that you would relate to the notion of sonic architecture?
8. A “tangibility” of sound - very often we are not aware of the sonic sensations (or in technical language ‘acoustics’) in the space until it bothers us, do you think that certain sounds have texture, volume, and as well influence on our psyche, emotions, in general atmosphere in the space?
9. Could you provide me with some architectural references that you find interesting related to sonic architecture? (It can be sacral, non-religious architecture, as well as cafes, shops, public spaces, your own room/flat/house, etc.)
10. Bonus: If you have some extra recommendations, suggestions, experiences, stories, articles, books...

*sonic - (from Latin *sonus*=sound) related to audible sound | (Sonic Architecture is a discipline concerned with the (re)construction of architectural spaces from the listening perspective)

*Disclaimer: The following questions will be used for the individual purpose of a Master’s Thesis from Iva Grlić Radman at TU Vienna. There are no right or wrong answers, the questions act as a catalyst for my own research for the thesis. Your individual responses will not be given to any third party whatsoever. According to a preference, collected answers might be shown as anonymous or by the name of the author (optional choice of the participant). Not all of the questions need to be answered (choice of the participant). In addition, you will not be added to any mailing lists as a result of taking this survey. Proceeding to the survey implies that you understand and agree to the provisions in this disclaimer. Thank you in advance!

Ajdin

1. Yes – Colors, Smell and Light are the strongest sensations that affect the mood of a space to me.
2. I am very sensitive to sound. Therefore, especially the sound of haptics, that I perceive is crucial to me. I also hear high tones of HVAC installations easier than other people. This influences also how comfortable I feel in a space.
3. Especially noisy air ventilation sounds or sizzling electricity sounds remind me of the poorly constructed houses in my parents’ hometown in Bosnia. I do not have a positive association with it. It reminds me of funerals, times of poverty and depression.
4. Of course, I do. There are materials that absorb such sounds and translate them into exothermic heat. Also, just the sound and feel of stepping over a nice hardwood floor, that gilds the other disturbing noises might help a lot.
5. I always appreciate a nice sacred room, especially newly built mosques in Bosnia, where the echo is so overwhelming, that in the mist of all surrounding sounds, an intimate conversation with a person seems even more private. Usually, the spaces are very easily constructed: brick walls, creating a floor plan-silhouette of an octagon or hexagon. On top of it a dome/cupola out of concrete, that stretches the total space height to a maximum of approximately 10m. The walls are plastered and painted in white, while there usually is just the apsis that is covered in timber. People are only allowed to go barefoot through the carpeted space. The room height also always features a gallery, where women are situated. Therefore, higher notes of the women voices resonate in the top, while the lower male tones spread across the floor.
6. Echo in space is something very magical. I see it pragmatically: The more important it is, to speak to an audience, or have proper conversations in terms of content (e.g. working space, a lot of phone calls, a living room, ...) the less echo is magical, but more annoying.
7. I think Yayoi Kusama’s “Infinity Mirrors Space” is a great example of an illustrated sonic experience. All the little collective pieces resemble a sort of noise, that can be perceived as disturbing but also as calming. Also, singer/songwriter Banks made a music video for her song “drowning”, where she featured a similar space, which is only an advocate for how this art installation is strongly related to sound/music. (<https://www.youtube.com/watch?v=HzGHgQBPyV0>)
8. As I wrote earlier, some sounds remind me of an experience, that ultimately trigger an emotional response. But sometimes a certain echo or noisiness can just appear as annoying.
9. -I like the C21 Atelierhaus by Werner Neuwirth, where the higher Maisonette Space parts create an echo, while the “normal height” spaces have a more intimate feels to it, and almost seem like a cozy niche, while being an actually normal space. The sound quality of it is radically different. -Also, the “Kaštel” in Pula features a contemporarily extended, historical castle in the middle of the city of Pula, Croatia, representing a maritime museum with a courtyard. The noise of the surrounding city is here that much isolated, by the building that surrounds the courtyard, that even nice, more silent and intricate concerts can happen.
10. -I would listen to music. Bosnian Sevdah Music – a very re-enacted sonic experience
Božo Vrečo: <https://open.spotify.com/artist/0vDCP16DIIsQ4mfULnAW3o?si=ot7G3QSm-ROOsDdsM4Lr6-A>
Amira Medunjanin:
https://open.spotify.com/artist/3wkbSRLiVRpHpS8WJ3N19?si=Vx7VCbqnQNY_HNhot_wpkQ

-I like the short documentary of Arte about Quentin Tarantino's Film Music: https://www.youtube.com/watch?v=pNHb4WaD_hk

-I think to have a stronger experience of sound and/or sonic architecture, another sensation element needs to be weakened – e.g. seeing.
I read this article in the architectural review, describing, why dance clubs are dark, starting with the avant-garde and club culture since the 1960s, calling it “dark matters”
<https://www.architectural-review.com/essays/dark-matters-the-avant-garde-and-club-culture-since-the-1960s>

Loulou

1. I would overall say all of them. But probably the most impactful for me are haptics and smell. I always believed those sensors awake the strongest memories in me, and oftentimes they give me hints about my perception of a space in an associative way. But overall I would say visuals and acoustics impact my perception a lot as well, but more from an imaginary point of view, as if by brain builds up frames and captures fragments of those experiences. Shortly said, I think that sensorial perceptions play different roles in my perception of space, some are more linked to past experiences, some of them amplify my experience in a space.

2. Sound is probably my most intimate and personal sensorial experience. Within all of its elements, sound carves a deep space within me. And it probably is the amplifier of different stages of my psyche. To give an example, I was once in a church in the mountains during an Easter mass, and the choir together with the organ awakened mixed emotions for the first time. From a feeling of anguish, to one of relief and calm and so on....

3. I would say all of them. But of course each one of them evokes mixed emotions. Harmonic ones are usually related to positive feelings, whereas disharmonic to anxious and tense ones. But still both play an important role equally in the perception of space or of our inner psyche.

4. YES! I totally agree on this. Material quality plays an extremely important role in acoustics. Because of my thesis, which doesn't have to do with such a topic, I though stumbled across one interview conducted to Neri Oxman, a multidisciplinary architect and professor at MIT, where she mentioned that they had to design the seating of for a possible use in concert halls. It was an interesting sight since we are used to limit our vision to the height of the halls, the texture of walls and so on, when it comes to performative spaces. I never really thought how even the furniture actually can improve by either sound absorbing or enhance the quality of the acoustic. But it makes sense when it comes to echoing and voids.
<https://neri.media.mit.edu/projects/details/gemini.html>

5. I cannot think of something personal to me, but i can give you a notable example of my birthplace Bologna. In the city centre, close to the main square Piazza Maggiore, you can find a spot under the arches where when we were younger used to play because of an acoustic effect. If you basically located yourself at a corner of the vault, you could hear very clearly the other person whispering something to you at the very opposite side of your corner. To make it more clear to you, ill link it here:

“We are in Piazza Maggiore in Bologna, where the Palazzo del Podestà, the imposing building that joins with the Palazzo di Re Enzo, overlooks. This is one of the most visited squares in the city, the nerve center, the living room and meeting place of the Bolognese. And it is here that something magical happens: the columns of the porticoes speak. The vault with the speaking columns has a unique feature: the cross vault, of Romanesque architecture is supported in the four corners by four columns, surmounted by statues representing St. Petronius, St. Dominic, St. Francis and St. Proculus, the patron saints of the city. This type of structure creates a kind of “wireless telephone.” In fact, by standing in one corner you can hear the whispered voice of the person who is speaking in the opposite corner. This technique, had an important functionality during the plague epidemic,

in this way it was possible for the infected to receive religious confession without risking infecting the priests.
<https://www.viaggiinews.com/2022/03/08/voltone-podesta-bologna/>

6. I am not a sound expert. But in my “poor” musical education, I do believe that it plays an extremely important role when it comes to sound. Like you mentioned, in churches it works as a choir's enabler or extender of the sound, creating that typical ethereal vibe which characterizes the pure and candid atmosphere. Same can happen in other spaces, but it of course can also have a bad influence, like when I went to a podium discussion that took place in an ancient hall of a building, where the interlocutor's voice was barely understandable which later compromised the whole success of the talk. Shortly said, echo for me is a sort of sound enhancer, like a filter.

7. I have been lately working on doing some mixtapes, and interestingly I stumbled across the term synesthesia. Synesthesia is a strange, rather rare condition in which “sensory overlap” occurs, that is, stimulation of one of the 5 senses induces, quite involuntarily, a secondary perception in another sense. Sort of like seeing a taste or hearing a color. I was inspired by such condition and tried to understand what a person is able to experience when listening, or when seeing something. I took it as a source of inspiration to create some of my mixtapes. I am both a music and film enthusiast, and this method allowed me to create a synergy between combining songs, having in mind a picture. I don't know if this makes sense.

But giving you an example, wow. I could name many, but I'll maybe give you the most impactful one which is Hans Zimmer compositions. I admire his capability of composing music with such an image in his mind, as if he is using all of his senses to do so. While listening to him, my mind starts a visual journey that rarely happens to me while listening to music. The specific ones are to be found in the Interstellar OST.
Another example can also be Kiasmos, whose ability to translate music into fragments of images is extremely wonderful.

8. And again, yes. I can think of how many years ago, while making playlists I tried to combine sounds to textures. Like velvet, metallic, polished relating them to synths, bass and so on...

9. See 5.

10. <https://liquidarchitecture.org.au/>

<https://yctm.e-flux.com/sonic-boom>
<https://www.e-flux.com/announcements/451539/you-can-t-trust-music/>
<https://oudekerk.nl/en/programma/residency-nicolas-jaar-and-children-of-the-light/>

Anonymous

1. Der Geruch. Die Geräusche der Absätze am Boden. Wie fühlt sich der Boden an, auf dem ich gehe. Ist er glatt, grob oder uneben? Ich sehe schlecht. Der Blick steht deshalb womöglich weniger stark im Vordergrund.

2. Ich mag Sound / Geräusche / Noise. Die Abwesenheit von Sound, Ruhe, macht mir Schwierigkeiten. Ich bin in der Stadt aufgewachsen an einem belebten Ort. Die ersten drei Lebensjahre mit einer Baustelle gegenüber. Manchmal nehme ich Baustellenlärm nicht sofort wahr, außer wenn zu ungewöhnlichen Zeiten der Asphalt mit einem Presslufthammer aufgebohrt wird. Gestern bin ich über Kies gelaufen. Ich sagte zu meiner Begleitung, dass ich das Geräusch von Kies mag, wenn ich mit Schuhen drüber laufe. Das sanfte Knirschen.

3. Ich hasse das Geräusch von Staubsaugern. Das hat weniger mit dem Geräusch an sich zu tun, als

mit der Person, mit der ich es assoziiere (jeden Tag hat sie gesaugt). Ich halte es nicht gut aus, wenn Menschen mit den Fingern knacken. Bei lautem Männergelächter könnte ich aus der Haut fahren, ich denke das affiziert mich am meisten. Ich liebe experimentelle und Neue Musik. Morton Feldman, Delia Derbyshire, Throbbing Gristle, etc. Ich hatte immer das Gefühl, dass mit Harmonien brechende Musik, mehr meinem in-der-Welt-sein entspricht, wie ich sie wahrnehme.

4. Ja, leere hohe Räume mit glatten Steinböden hallen (Kirchen, Stiegenhäuser, leere Wohnung), oder? Textilien, Möbel und Holz schlucken / dämpfen Schall, (eingerrichtete Wohnung), glaube ich?

5. Spontan fallen mir zwei Räume ein, die mir in akustischer Hinsicht nicht in guter Erinnerung geblieben sind: 1) Zum einen das Burgtheater von der Galerie und dem zweiten Mittelrang aus: ich habe den Eindruck von dort aus nicht alles verstehen zu können. 2) Zum anderen der Hörsaal 50 auf der Hauptuni. Er ist Amphitheaterartig angelegt. Sowohl als Hörerin sowie auch als Vortragende war es unangenehm. Einmal habe ich dort ein Seminar im Sommersemester besucht. Es war heiß und stickig (es gibt keine Fenster), wenn die Lüftung aktiviert wurde, mussten wir 5 – 10 Minuten unterbrechen, weil wir sonst nichts verstanden hätten. Wenn ich selbst da unten stand und unterrichtet habe, hatte ich den Eindruck, dass meine Worte oben nicht ankommen, als würden sie am Weg verschluckt. Das kann aber auch damit zusammenhängen, dass ich nicht gut sehe, ich vielleicht meine Sichtweite mit meiner Hörweite in einen Zusammenhang bringe. In positiver Erinnerung ist mir die Minoritenkirche in Krems beim Donaufestival geblieben, während eines Noise-Acts. Ich kann mich aber nicht mehr allzu gut erinnern.

6. Ich stimme zu, dass ein Echo nicht notwendigerweise schlecht sein muss: das Singen am Morgen im Badezimmer oder auf der Toilette (als Kind habe ich das gemacht), oder Konzerte in Kirchen, z.B. Ruprechtskirche oder Minoritenkirche in Krems (siehe oben).

7. Ich weiß nicht, ob das passt: Neulich war ich im Filmmuseum und habe Carl Theodor Dreyers „Die Passion der Jungfrau von Orléans“ (1928) gesehen, ein Stummfilm, der im Filmmuseum ohne Musik gezeigt wurde. Es war ganz still. Wir hatten Angst, dass die Stille unerträglich wird. Das Spannende war, dass ich den Film dann als laut wahrgenommen habe. Die Bilder, mancherer Bilder, waren unglaublich laut. Insbesondere die Szene in der Jeanne d’Arc die Folterinstrumente vorgeführt werden, u.a. ein großes Rad. Das Rad wurde gedreht und es kam mir vor, als ob ich das Rattern des Rades hören würde.

8. Wie ich oben geschrieben habe, dauert es bei mir manchmal länger, bis ich Baustellenlärm höre. Vor ein paar Jahren gab es ein bis zwei Wochen, in denen ich mich fahrig und unruhig fühlte. Als ich dann Samstag Früh den Presslufthammer auf der Straße hörte, also zu einer ungewöhnlichen Zeit, folgerte ich daraus, dass meine Unruhe vermutlich mit dem Baustellenlärm in Zusammenhang stand.

Um die Frage zu beantworten: Ja, definitiv.

10. Steve Goodman: Sonic Warfare. Sound, Affect and the Ecology of Fear (2012)

Valentina

1. I definitely notice visual and haptics characteristics first, the auditory aspect gets relevant if there is an uncommon sound effect within the space, like an echo or if it is a sound installation

2. I feel very connected to sounds otherwise, I am very sensitive towards pleasant and unpleasant sounds alike. I am an avid music listener and I used to play music as well.

3. I appreciate harmonious sounds, and I especially like recurring sound patterns, which have something meditative about it (i think of disco music and then house). I associate them with round-

ness, and I imagine the vinyl spinning endlessly which I associate with the music’s identity itself. Unpleasant sounds are definitely disturbing, even tho there is a degree of individuality to it.

4. There is definitely a connection between materials and sound propagation.

5. I attended a concert at the Elbphilarmonie in Hamburg. As I was looking for a sharp and crisp sound experience I was not disappointed. The interior was planned to explicitly make live music sound good. The space was planned with cnc-ed panels made of a special material (do not remember which exactly)

6. Since I spoke about a good experience before, I would say a bad acoustic experience could be happening inside a very tiny space, almost claustrophobic. Low ceiling, narrow width. This is strictly related to the material on which the sound bounces off. If the material doesn’t absorb any sound waves

I will have a very unpleasant experience. But I think that even the opposite is very weird aka highly absorbing material (like a recording studio).

7. - Pierre Huyghe: UUmwelt exhibition

-I had to remember an excursion I took in Spain, where we visited a cave inside which some of its stalactites and stalagmites would produce different sounds to the touch, and they created a sort of natural xylophone

- Gongs (as architecture made to produce sound)

8. I absolutely think that certain sounds have texture, trigger emotions, and make an atmosphere. (Think of a restaurant that plays a piece of music so not in tune with its vibe, ugh). Sound can influence so much of your experience. I feel that sometimes sounds slap your face, and vibrate through your body. I love to feel the vibration of an amplifier when loud music plays, because it really feels like being able to touch the sounds.

9. / 10. -Sea Organ, Zadar, Croatia

-The village of Badgastein (I remember when I first arrived there the noise of the water was so intense I thought I would go crazy. After a few minutes though, I completely forgot about it and noticed how my brain tuned it out.

- Buddhist prayer wheels

Anonymous

1. First impression that I get about space always comes from visual sensation but I consider auditory and haptic sensations that follow to be equally crucial elements of space perception

2. I value sounds as an important element of my surrounding. Sounds, especially loud, uncontrolled or unnerving sounds can change our perception of space and our enjoyment of it.

3. I find disharmonic, loud or overly repetitive sounds to be extremely unnerving. They are distractive and can, in some people, trigger misophonia (being negatively emotionally affected by sound).

4. Material quality influences not only visual and haptic impression of space and its quality but also auditory experiences.

5. Acoustically very exposed open spaces like cliffs, mountaintops or decks make for a very unnerving/ unpleasant auditory experience. Spaces like well-designed music halls with even, diffused sound have a calming effect,

6. Echo can be both good and unwanted depending on context. For example, school aula with a lot of echo leaves a lot to be desired whereas in church it is an incredible design tool that makes for an affective space.

7. There are two works that loosely relate to the topic which might be of interest- Introductory scene in Tarkovsky's movie Stalker that shows in a 'floorplan perspective' a room with a table on which medical supplies are scattered and then glides over the bed in which, in that order, mother, child (probably sick) and father are shown while room is audibly and physically disturbed by a train passing in close proximity and then glides back (in reverse order) ending with mother, now fully awake from the sound. Sound in that scene is not only used as an accessory in plot introduction but is a valuable and intrinsic part of the space.

Second piece of work is a book Wuthering Heights which is not directly related to sounds, but revolves around characters whose psyche is affected and shaped by the landscape in which they live and grow up- "wuthering heights".

8. Sounds are deeply connected to the rest of our senses which is more strongly impactful on some than on others. In some cases, experiencing one sensation can be so closely connected to others that it becomes hard to discern them. People experiencing this have synesthesia (a perceptual phenomenon in which stimulation of one sensory or cognitive pathway leads to involuntary experiences in a second sensory or cognitive pathway.) Composers like Haydn and Liszt had it, former of which was known to yell things like "add more blue" while conducting orchestra.

9. Berlin philharmonic, Kunsthofpassage building Dresden (rain house), White noise white light Athens 2004

Carlotta

1. Visual and olfactory. Both affect my perception of architectural space in terms of light, materiality and orientation.

2. Sometimes sounds of the outside space can be a harmonic accompaniment to my every-day tasks, sometimes something I need to isolate myself from, with other type of sounds I can control better, such as music.

3. Harmonic, I associate them with memory or past events.

4. Yes. The way sound bounces on different types of materials

5. Bad way:

- underground passages which amplify the sounds of traffic

Good way:

- swimming inside sea caves, hearing the echoes of the waves

- art exhibitions and installations which play both with sound and visuals, interacting in an architectural space. (Examples: CYPRIEN GAILLARD in Palais de Tokyo, Anri Sala and Dominique Gonzalez-Foerster in Bourse de Commerce)

6. As mentioned above, it can also be a good experience, according to the amount of echo (defined by the space and the materials) and what is being echoed.

7. The façade of Mumok

Liča

1. It depends on the space. In general I would say I first notice visual and then auditory and haptic. Visual is the first impression, but auditory and haptic can then completely change the space.

2. There are two types in my opinion - noise and sound. I perceive them if they are bothering me or suiting me.

3. I don't like restaurants and cafes with bad acoustics. I actually avoid the places on purpose if I notice acoustic is bad.

4. Similar to my answer above - for instance Disco Volante. All echoey materials and not a single acoustic strategy. On the other side, sound of the sea is beautiful. :)

5. Echo can be magical, for example in churches or some caves. When you can experience the sensation of echo in a direct and sharp way. When there is too much noise being echoed, it can be quite tiring.

6. Morske orgulje (Sea Organ) in Zadar

7. I think yes, I remember living in Paniglgasse and there would be an incredibly loud sound from the street, the whole street would echo. It was one of the reasons I wanted to move out.

8. I remember reading an interview from a guy from Air (band) where he talked about similarity of music and architecture. He recorded an album based on architecture (if I remember correctly, it was a couple of years back). Theaters and auditoriums are spaces of sound, so first that comes to my mind is by Herzog de Meuron Philharmonie in Hamburg. Hmm there is also a water tower turned to sound chapel by Glenn Murcutt!

Josef

1. Mostly visual in shape of light - direct/indirect/reflections/bright/dark. This sensation defines my perception of architectural spaces. Without light no architecture. auditory secondary, but important for the feeling of a space. haptic probably the least, since I don't tend to touch many spaces directly.

2. It's not my strongest or most important sense in a way. but it's an important part of making a space feel comfortable. "cozy or lost" "warm or cold" depending on how strong the echo is or if there's none.

3. Mostly background noise is important in my everyday life. I do not like the silence. background noise in the form of a radio or tv when I'm not actively listening to/ watching something. rumbling of indistinct voices for example, quiet music in the next room. probably not too rhythmic, more natural, diffuse sounds please me

4. Sound reflecting materials with a strong echo make a space feel empty, cold and large. sound absorbing materials absorb the echo and make a space feel warm, comfortable and liveable.

5. Already as a child I was drawn to churches and their height and grandeur, marble and stone, light and shadows. as a strong contrast to the place I lived in, which was warm and cozy. churches make one feel small, for they are built for god(s) and not for the human scale. the church of churches: St. Peters in Rome take these characteristics to the maximum, where you feel like an ant, so much, that by looking up at the walls and ceilings I got dizzy, since the scale of it felt incomprehensible to my brain. the proportions and human scale are lost in this megalomaniac building, which makes for a

special experience, when not really a pleasant one.

8. The absence of sound - silence has the biggest impact on my psyche and emotions and makes me very uneasy.

9. St. peters in rome, Lesesaal Universitätsbibliothek Wien, U Bahn Station Schottenring Ausgang Rolltreppen, Stephansplatz,

Kya

1. All of the above, the sensory experience of architecture is not separate from the physical construction itself. In this way, I think senses (smell, sound, light) all actually come together to construct what we think of as architecture. This is also why I believe the intention of the architect is important but does not always across or hold when architecture is actually inhabited due to some imperceptible qualities after it is built and used. The physical space can become a kind of canvas that is projected onto.

2. My feeling about sound changes every now and then. Sometimes I prefer silence, sometimes noise, it can be complementary (or not) to my mood. I would say, growing up in a household of many children and many family friends coming around for dinner, etc, I feel very comfortable in spaces with background noise, especially talking in another room when I am falling asleep, or the sound of someone showering. Lately, after living in the forest, I have become more sensitive to the noises of the city. My father told me that as a child I told him that I liked falling asleep in the city because all the noises made me feel that the action would continue until I woke up.

3. Sound in all its extremes affects me. Chaotic noise or music makes me anxious, although my partner seems to find calm in it. It's something we always have disagreed on.

4. Yes, there is obviously research done into this about hard surfaces and noise reflection. Or empty spaces and echo.

5. Personally, there are spaces that have been much more influential in terms of scent.

6. I would not characterize it as "bad." I think echo defines a space that is hollow, expansive, spiritual, and probably not inhabited. In this way, I think it can strategically affect people in different ways.

7. Camille Norment, Rapture. <https://www.youtube.com/watch?v=x6Ym9cjz1jU>

8. Absolutely.

1. Burle Marx & Oscar Niemeyer's Ibirapuera park in Sao Paulo has a covered public promenade used mostly by skateboarders but acts as a connector between various buildings. The experience is unique because of the loing, snaking shape and continuous roof.

2. The School of Architecture and Urbanism at USP by João Batista Vilanova Artigas as a space to be occupied

3. SESC Pompeia by Lina Bo Bardi with its various walkways and interior space with water pools

10. Bernhard Leitner, Sound space: <https://www.archdaily.com/168979/bernhard-leitner-sound-spaces>

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- illustration on the front cover:** Abstracted illustration of a water circles dispersion

External links of the sound recordings:

- #original recording** : https://soundcloud.com/spatialsoundphenomena/miraculous-loves-wounding-original-recording?si=d949cf23216c4013a045ad3728ce947c&utm_source=clipboard&utm_medium=text&utm_campaign=social_sharing
- #1st copy - Short corridor** : https://soundcloud.com/spatialsoundphenomena/1st-copy-smaller-corridor?si=488c1e0a3b4c4b90af9aa76c6ce85a1e&utm_source=clipboard&utm_medium=text&utm_campaign=social_sharing
- #2nd copy - Rectangular staircase** : https://soundcloud.com/spatialsoundphenomena/2nd-copy-rectangular-staircase?si=a573105341d74cd2821693a06cbd0ce9&utm_source=clipboard&utm_medium=text&utm_campaign=social_sharing
- #3rd copy - Long corridor** : https://soundcloud.com/spatialsoundphenomena/3rd-copy-longer-corridor?si=4f35063998d24ff295d64a30c98a1d12&utm_source=clipboard&utm_medium=text&utm_campaign=social_sharing
- #4th copy - Circular staircase** : <https://on.soundcloud.com/2Bz5E>
- #5th copy - Aula** : <https://on.soundcloud.com/L3EH2>

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