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Article

Spaces within spaces: Composing aural architectures within site-specific sound

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Abstract

All around Santiago, Chile, there are water towers known to citizens as *Copas de Agua*. These towers are recognised as modern industrial heritage and integral landmarks within the city's urban landscape, contributing significantly to its cultural identity. This article presents strategies for exploring aural architecture by creating a new space defined by sound in motion within an existing architectural structure with unique morphological and acoustic characteristics through the medium of sound installation art. The project *Polyphono*, a multichannel sound installation located within the *Copa de Agua* of Quinta Bella, Chile, establishes a dialogue between three different spaces: the invisible space of the sound installation, the existing space of the water tower and the symbolic space of experience. In this process, an interior space of sound emerges within the physical space of acoustic reactions, which is experienced by the audience as aural architecture. This dynamic situation involves animating the monumentality of the water tower, transforming it through the performative action of the sound installation, thereby intensifying the historical significance of the site in physical, sensory, political and social terms. The outcomes are framed as a transitional space, from site-specific sound to aural architecture, creating an affective space for aesthetic experience.

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1. Introduction

The term *aural architecture* was introduced by Blesser and Salter (2009) to designate the act of listening to multiple sound sources in interaction with the environment, as well as the symbolic meanings that listeners attribute to such interactions. Human beings possess an innate capacity to apprehend their surroundings and to perceive space through auditory perception, identifying spatial dimensions, geometries and materiality. In this regard, spaces are not experienced exclusively through vision; auditory experience constitutes a fundamental sensory dimension that actively informs and mediates our everyday engagement with architecture and the environment. From this position, aural architecture destabilises the notion of geometric space by foregrounding the aesthetic experience of sound. Such experience resists explanation in purely spatial terms, manifesting instead as a temporal matrix of relational intensities in which sensibilities, affects and corporality converge. In resonance with Deleuze and Guattari's (2005) concept of the Body without Organs, aural architecture interrogates and subverts the hierarchical logics that sustain both capitalist thought and traditional architectural paradigms. Engages in a process of *deterritorialisation* (Deleuze and Guattari 2005), releasing architecture from its 'organs' and emancipating it from the physical, programmatic and functional constraints that conventionally delimit its scope. This dissociation of fixed structures dismantles material and utilitarian boundaries, fostering creative and subjective flows. Consequently, it inaugurates a deconstructive operation within the discipline, displacing the hegemony of the physical over the sensorial, the objective over the subjective and the useful over the non-utilitarian, thereby opening pathways towards alternative modes of existence and speculative practices in the production of space as sensorial experience.

The term *aural architecture* is employed in this article to designate its object of study. The adjective *aural*, derived from the Latin *auris* (ear), refers to the auditory and is aligned with the notion of *aurality*, understood as the spatial properties apprehended through listening (Elinbaum 2025). Aurality not only shapes our perceptual experience but also establishes a profound connection with the environment. The Colombian musicologist Ana María Ochoa (2014) conceives aurality as a cultural and social experience intrinsically linked to sonic experimentation, underscoring both its situated character and its relation to memory. Likewise, the Argentine architect Pablo Elinbaum (2025) approaches aurality by examining how processes of urban transformation reconfigure our sonic experience and how active listening may open possibilities for reinterpreting these environments. The aural thus refers to an experience of space grounded in the experiential and the perceptual and may therefore be conceived as an interpretive tool for engaging with the environment – one that yields subjective forms of knowledge about architectural and urban spaces.

By mobilising aurality as a critical instrument, Mexican musicologist Natalia Bieletto-Bueno (2020) synthesises interdisciplinary approaches to sound, drawing from musicology, architecture, anthropology and sociology, to interrogate the sonic matrix of Latin American urban environments. Her work

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emphasises how public urban spaces are not merely sites of acoustic presence but are actively auditorily inhabited, situating listening practices within an interplay between measurable soundscapes and subjective experience. This framework is further expanded through the ethnographic analysis of Buenos Aires' noise maps by Argentine anthropologist Facundo Petit (2024), who incorporates social and cultural aspects, foregrounding the relational power dynamics embedded in urban sound practices, underscoring the political character assumed by noise, sound and listening to the city (Bieletto-Bueno 2017). These sonic practices are recognised as political vectors, scaling into the public sphere as manifestations of power (Dominguez 2015). Political campaigns, social protests, cultural parades and street carnivals exemplify sonic events through which communities negotiate, resist and reconfigure systems of violence and inequality that operate as mechanisms of sonic agency (LaBelle 2018, 2021), articulating aural regimes of power.

Aural architecture – understood as the auditory dimension of architecture – constitutes a field of latent potential, connecting individual experience with collective force, identity and the memory embedded in the spaces we inhabit, guiding us towards an alternative understanding of the built reality. Here, architecture and the urban are thus presented as experiential phenomena, deconstructing the material rhetoric surrounding architectural discourse and opening towards an immaterial conception of spatiality. This article proposes the use of the term *aural* as a conceptual category that directs inquiry towards auditory perception. While sound is conceived as a medium for spatial construction, the emphasis lies on its corporeal reception – that is, on the act of 'listening to architecture'. Within this framework, the notion of aurality situates research at the intersection of space and listening, acknowledging that aural architecture transcends physical and material parameters to constitute a sensory, temporal and symbolic environment.

The article examines the auditory experience that emerges from the interplay between the acoustic space – shaped by the architectural morphology of a water tower – and the invisible space generated through the spatialised sound of the immersive multichannel installation *Polyphono*, which is activated through a performance. The sound installation is situated within the existing architectural structure of the *Copa de Agua* in Quinta Bella, Recoleta, Santiago de Chile. *Polyphono* functions as a case study for exploring how multichannel and acousmatic configurations of sound can compose transitional spaces – *spaces within spaces* – that are experienced as aural architecture, reactivating the acoustic heritage and memory embedded in Santiago's historic water towers. In this context, the vertical acoustic properties of the tower are captured and translated into experimental strategies that foster alternative and subjective narrative experiences.

Two critical research questions arise to guide this inquiry: How can multichannel sound installations establish a dialogue between newly composed sonic spaces and pre-existing acoustic environments? In what ways does sensory engagement with spatialised sound generate aural architectures through performative, site-specific experiences? By framing the research in terms of the intersection between space, listening and embodiment, this study positions aural architecture as a modality capable of transcending the materiality of architecture to produce sensory, temporal and socially resonant spatial experiences. Through this interrelation, aural architecture emerges as both a compositional and perceptual practice, articulating layered spatial experiences and guiding new modes of engagement with architectural and urban environments.

2. Spaces of sound

Aural architecture emerges from a transdisciplinary field with diverse roots, among which the most influential are the concepts of soundscape and sound space – terms that first appeared within the field of music. Following the advent of atonality, musical practice underwent a radical transformation that led to new ways of conceiving sound. The decomposition of music into what Varèse termed 'organised sound' marked a pivotal moment in the integration of space as a compositional parameter, redirecting the historical trajectory of musical development towards transdisciplinary exploration. In this context, the term *sound space* initially emerged to describe spatial configurations of sound sources, often mediated through speaker systems. This process not only consolidated the idea of a possible interaction between space and sound but also transformed listening into an essentially spatial experience. Research and theoretical approaches to sound space have since expanded to encompass an increasingly diverse range of terminologies, including *acoustic space* (Guerin, Schafer 1991, 1977, 1973; Truax 2006), *spatial music* (Henry Brant in Harley 1997; Schaeffer 1952), *spatialised music* (Harley 1993), *Musik im Raum* (Stockhausen 1958), *spectral space* (Smalley 1997), *la musique environnementale* (Minard 1991), *acousmatic space* (Duchenne 1991; Bayle 2008) and *musical space* (Bayer 1981), among others.

The role of music in these explorations evolved towards experimental configurations that expanded the spectrum of possibilities in multichannel sound spatialisation. Building on this, composers such as François Bayle (1989), Pierre Schaeffer (1952) and Iannis Xenakis (2008) proposed an interrelation between music and architecture. The *Acousmonium*, conceived by Bayle in 1974, constitutes a multichannel device for constructing spatial sound environments, introducing the concept of *i-son* (sound image) (1989), understood as the perceptual form of spatialised sound articulated through the subjectivity of listening. Schaeffer, in turn, referred to this relationship between music and architecture as *spatial music* (1952: 194), conceiving it specifically as the space generated by an n-dimensional sound configuration in terms of static spatialisation (fixed diffusion) and cinematic spatialisation (moving sound projections). Xenakis (1958) subsequently adopted and reformulated this idea, transposing Euclidean space into a sound space, where 'sound points define space in the same manner as geometric points in stereometrics . . . ' (Xenakis 1958: 133). Based on this model, Xenakis developed compositional strategies aimed at enhancing aural perception, proposing that sound can define and articulate geometric space to create immersive environments. These reflections provided the theoretical foundation for his architectural work, materialised in the Philips Pavilion and later in his sound installations, the *Polytopes* (Xenakis 2008).

This relationship between architectural support and sound is further developed by Bernhard Leitner (1978), who emphasises that the three-dimensionality of sound space is achieved through moving sound. In his artistic research, Leitner (1978) developed a variety of sound installations to experiment with the motion of sound within space, highlighting two central aspects: (1) the physical configuration of sound spaces, based on the properties of sound – intensity, frequency, timbre and movement – as constructive materials; (2) the perception of space linked to temporality, where sound generates spatial sensations. Some of the morphological categories experimented with and defined by Leitner include the *soundcube*, *spatial grid* and *soundgate* (1978), among others.

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These spatial typologies enable the placement of moving sound within an architectural language that provides a formal description of the spatial sensations produced through listening. In this way, Leitner's sound installations open a critical inquiry into how we perceive and inhabit space and architecture, revealing alternative modes of engagement through sound. This perspective is echoed by Colombian sound artist Carolina Ortiz Cerón (2018), who approaches sound installations as sonic territories that generate new experiential spaces. Through active listening, her work prompts reflection on how we perceive and inhabit everyday environments, positioning the aural as both a conceptual and metaphorical tool that enables speculation on the construction of realities and possible futures. Sound installations can be understood as sonic worlds or environments that offer an alternative perspective on reality (Voegelin 2013). In her theory of 'possible sound worlds', Voegelin (2013) introduces the notion of a 'semantic inhabiting', which entails active and creative engagement, connecting with a 'phenomenological inhabiting' – that is, the world as it is experienced by the subject. The subject is immersed in the virtual world constructed by listening, which is actualised through their aural experience in a reciprocal and temporal relationship that renders the world meaningful for that individual. This is an ongoing process in which the listener, shaped by the intersubjectivity of perception, simultaneously produces what they are perceiving. In this sense, both the subject and the artwork are co-generated and are equally ephemeral.

According to Pauline Oliveros (2005), we are consciously aware of what we hear, and the practice of *deep listening* seeks to intensify and expand this sonic awareness, encompassing as many dimensions of attention and perception as possible for the listener. Therefore, aurality constitutes a critical practice of consciousness that subverts traditional modes of auditory perception, strengthening listening and shifting attention from the merely audible towards the potential, the absent, the imagined and the utopian (Moya 2025). Aurality functions as a form of resistance, a practice that reconfigures the relationship between sound, the body and the imagination, rendering *audible* the creative productions of the body and making *visible* the imaginary spaces of the mind. It is not merely a matter of expanding sonic sensitivity, but of interrogating the political, social, epistemological and aesthetic conditions that define what ought to be listened to, thereby fostering the construction of subverted realities. By activating the imagined through virtuality, aurality destabilises established orders of the sensible and emerges as a tool for the production of alternative realities and insurgent spatialities.

Aural architecture conceives sound and listening as tools for knowledge and world-making, proposing a reinterpretation of the built reality towards a speculative dimension emerging from intuition and imagination. Collaborative research on aural spaces in architecture by acoustic engineer Felipe Otondo and architect Emil Osorio (2021) demonstrates how architectural spaces 'speak' through the auditory perception of participants, based on the analysis of subjective experience during a performance presented in a reverberant hall within a brewery in Valdivia, Chile. From this experience, they investigated the interplay between aural spaces and architecture, employing an asymmetrical eight-channel loudspeaker set-up within this unconventional environment. They argue that the space was not treated as a neutral container, but rather as an active and flexible framework that fosters diverse listening experiences. The acousmatic space explores the integration of architectural space into the performance through the concept of transposition, whereby spatial attributes from the sonic domain – such as intimacy and exteriority – are projected and reflected within the architectural context.

Otondo and Osorio (2021) investigated the subjective realm of sound affections through individual interviews to explore the aural space of the experience. Some responses indicated that the eight-channel sound system enhanced the timbral and dynamic dimensions of the music, creating a layered, multisensory environment in which space, sound and performance were tightly interwoven. Sound spatialisation in Otondo and Osorio's performance is fundamental for generating these types of auditory experiences and sensory reactions. Here, the sound space of the multichannel sound installation functions as a structural principle, while aural architecture operates as a tool for designing the space of auditory experience (Gazana 2022). The perceptual dimension operates both as a precursor and a constitutive force, whereby the listener's embodied engagement with sound actively enacts and negotiates the construction of meaning of the artwork. This has been evidenced by research conducted at the AcusmaLab of the University of Chile, which demonstrates that auditory experience revolves around spatiality as a formal parameter shaping musical composition, interpretation and perception. Thus, this spatial dimension is not merely physical but also sensory and cognitive.

One of the primary objectives of AcusmaLab is to investigate cognitive responses to sound spatialisation within musical configurations while constructing meaning grounded in the individual listener's experience. The composer and AcusmaLab director, Federico Schumacher, together with philosopher Claudio Fuentes (2017a, 2017b), assert that spatiality is primarily interpreted affectively rather than syntactically, with multichannel formats being perceived as both natural and engaging. They argue that acousmatic music highlights these affective dynamics by shaping sound through its unique modes of production and spatialised representation. Brazilian media artist Basbaum (2003) attributes these affects to the power of immersive environments to reorganise our senses through technology, transforming our relationship with time and space and immersing us in an experience that privileges sensation over narrative. For Basbaum (2002), technology has catalysed a resurgence and expansion of synaesthetic experience, integrating multiple senses across non-linear temporal and spatial frameworks, generating immersive environments in which perception constitutes the core of artistic and cultural experience.

Aural architecture operates as the conceptual and experiential field where the listener's mental space – shaped by metaphorical and imagistic schemas – actively interprets acousmatic sound materials within a spatialised acoustic environment situated in a broader architectural and contextual framework. Within this field, spatial perception in acousmatic listening exceeds the mere distribution of loudspeakers, integrating an internal cognitive domain with an external situational reality. The interaction of these dimensions produces a multilayered experience of space and meaning, constitutive of the perceptual territory that informs aural architecture.

3. Composing aural architectures

Explorations around aural architecture are deeply rooted in the relational nature of sound, exploring the dynamic interplay between the internal and external space, the objective and the subjective, the sonic, the spatial and the listener. To further investigate the spatial dimension of sound, a specific multichannel sound installation will function both as a case study and as a

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Figure 1. Water tower Quinta Bella (F. Mardones 2022).

research method, generating an aesthetic experience that may contribute to understanding the transitional spaces of aural architecture. In this framework, the sound space operates as the medium, while aural architecture constitutes the object of study. The concept of using artworks as a method derives from a cognitive process referred to as 'aesthetic conduct' (Arteaga 2017: 24). In his paper on *Embodied and Situated Aesthetics*, Arteaga argues that aesthetic conduct is primarily facilitated by our sensorimotor and emotional abilities, fostering an exchange between our individuality and our environment. This process is receptive in nature, allowing for the spontaneous emergence of new responses to sensory stimuli. However, Arteaga asserts that aesthetic conduct does not directly generate knowledge or skills for specific tasks. His ideas are grounded in the work of Chilean biologists Maturana and Varela (1980) on how living systems cognise objective reality, shifting the focus from external reality to the internal structure that enables organisms to effectively interact with their surroundings. Perception can be conceived as a dynamic process shaped by the embodied dialectic of multiple relations arising from the continuous interaction between our internal states and the external environment.

We can say that every internal interaction changes us because it modifies our internal state, changing our posture or perspective (as a functional state) from which we enter into a new interaction. As a result, new relations are necessarily created in each interaction and, embodied in new states of activity, we interact with them in a process that repeats itself as a historical and unlimited transformation (Maturana and Varela 1980: 39).

The artistic practice, in this context, aims to mobilise cognitive processes for the emergence of aesthetic knowledge through artworks that utilise sound spatialisation. These artistic outcomes engage the sensory body to address invisible spatialities. Grounded in Varese's (1936) notion of spatial music, in which sound is projected into space, the artworks seek to develop strategies that enhance sensory experience through precise sound source localisation. This will be illustrated through the case study of *Polyphono*, a multichannel sound installation and performance created within the *Copa de Agua* of Quinta Bella. This work provided an aesthetic experience recognised as aural architecture, articulated through an acousmatic space that transcended its physical location, generating both a dynamic sound space and an affective aural space within the reverberant environment of the water tower.

3.1. Copa de Agua *Quinta Bella, Recoleta, Santiago de Chile*

The Metropolitan Region of Chile is home to a total of 56 water towers, each characterised by its own distinct typology. The majority of these towers belong to the water company Aguas Andinas. As part of the research process, meetings were held with representatives from the company to secure permission for the study; however, a favourable response was never received. Nonetheless, these meetings resulted in the acquisition of a valuable document outlining the status of each of the 56 water towers, detailing whether they were in use, abandoned or transferred to other owners. Over the course of two years, a survey was conducted on all the abandoned water towers as well as those owned by other entities. The findings revealed various new uses for these structures, with most having been repurposed for informal occupation, advertising support or as storage facilities. One notable example is the water tower in Quinta Bella, which was transferred from Aguas Andinas to the Municipality of Recoleta. The municipality not only supported the research and upcoming interventions but also granted permission to host the first Architecture and Listening Festival: *Espacios Resonantes*. It was within this framework that the multichannel sound installation *Polyphono* was developed.

The water tower at Quinta Bella (Figure 1), approximately 100 years old, is located to the north of Santiago. Originally constructed for water distribution within the commune, the tower is no longer in use. The property is currently part of the second phase of a social housing project being developed by the *Inmobiliaria Popular* under the communist Local Government of Recoleta, which is still in the design phase. The structure of the water tower consists of a base with a vertical void that supports an elevated reservoir at its top.

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Figure 2. Left: Exterior of water tower. Right-top: Ground level of water tower. Right-bottom: Interior of water tower (F. Mardones 2022).

It is a concrete structure with a decagonal base 1.5 metres in edge, measuring 5 metres wide, surrounded by ten pillars that rise together to a height of 20 metres, supporting the elevated reservoir. A transparent structure surrounds the perimeter, contributing both sculptural and aesthetic value, rendering the tower a prominent visual landmark throughout much of the commune (Figure 2). Its presence serves not only as an orientation point but also contributes to the neighbourhood's identity. These water towers serve as tangible reminders of Chile's industrial history, connecting them to a pivotal period of the country's modernisation. As many of these water towers fall into obsolescence, they symbolise the gradual decay of industrial infrastructures, becoming abandoned monuments. Therefore, recognising the value of these industrial infrastructures as modern architectural heritage is a crucial aspect of the project.

3.2. The voices of space: Polyphono

Polyphono is a multichannel sound installation that engages in a dynamic dialogue with space through sound. The term ***Polyphono*** is derived from two Greek words: *poly*, meaning many, and *phono*, meaning sound, evoking a system with multiple audible extremities. This project draws on principles of echolocation and acousmatics to establish a communicative relationship with space. Its objective is to facilitate a sound-spatial dialogue by capturing the sonic responses of the space, enabling an auditory exploration of the principles that shape spatial experiences. Such interplay is articulated through a site-specific sound performance that activates the installation.

The system functions as an instrument played by the space itself, generating compositions modulated by spatial morphologies. This results in the creation of a new form of architecture, shaped through the sonic interaction with the existing space and sensed by the body. ***Polyphono*** consists of a ten-channel loudspeaker system, each speaker addressing a specific part of the space. As a site-specific installation, the exact configuration of the speakers depends on the characteristics of the location where the system is placed. The speakers can either remain static or move; when in motion, they are suspended by pulleys, allowing both vertical and horizontal movement. To further visualise the communication with space, the system is paired with a laser shaft created by media artist Mauricio Lacrampette, which reacts to the spectral interactions coming from the sound space (Figure 3).

In its first version, *Polyphono* was installed in the water tower of Quinta Bella, Recoleta, as part of the *Espacios Resonantes Festival* (Figure 4). This festival serves as a collective platform for discussions and creations centred on 'architecture and listening', bringing together architects, researchers, sound artists and composers who explore the intersections between sound, art, architecture and listening.

Polyphono was installed at the base of the water tower Quinta Bella at ground level. The installation comprised ten loudspeakers arranged vertically within the structure. The speakers formed a spiral pattern, starting at floor level with a BOSE L1 Pro8 loudspeaker and subwoofer and ascending upwards with cone-like speakers ranging from 5 to 8 inches. Three speakers were installed hanging from the water pipes at 2 and 3 metres high, while the remaining six were suspended at a height of 11 metres from

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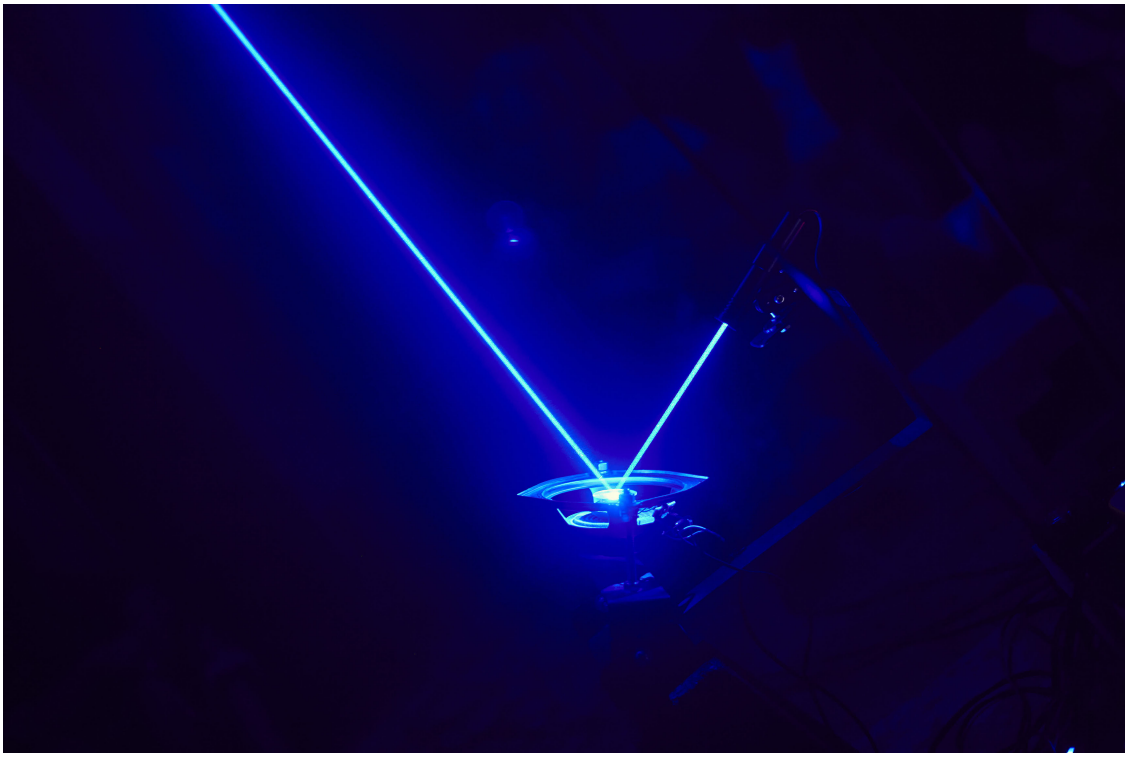


Figure 3. Laser shaft (F. Mardones 2022).



Figure 4. Speakers hanging from pulleys (F. Mardones 2022).

pulleys, each at a specific height, constructing the verticality with an ascending spiral (Figure 5). The objective of this configuration is to conquer the vertical field of the tower, enabling *Polyphono* to engage in a dialogue with the space through the intrinsic characteristics of the infrastructure, highlighting its original function as an elevated cistern. The acoustic characteristics of the tower's interior are defined by metallic echoes shaped by its pronounced verticality. Accordingly, the vertical arrangement of

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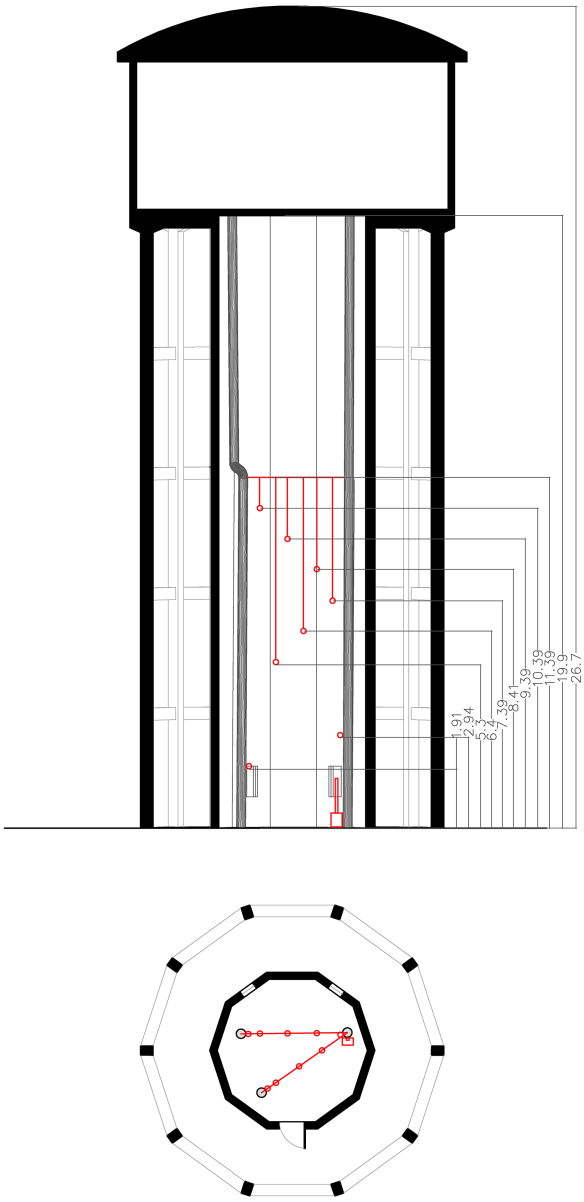


Figure 5. Plans of *Polyphono*'s sound installation (S. Balbontín 2022).

the ten loudspeakers was conceived to encompass the entirety of the space, accentuating the structure's height in order to elicit a dialogue with the tower's acoustic voices.

The sound composition was created using sounds of a Korg MS-20 synthesiser and pure frequency oscillators. These sounds were recorded beforehand and served as raw material for creating a multichannel composition in Ableton Live 11, which was then played in its entirety through the installed system (Figure 6).

Due to spatial constraints, the audience was positioned along the inner perimeter of the tower on yoga mats, leaving the centre open for the performer. No prior information was provided to the audience, allowing them to approach the work without preconceived expectations. The sound composition consisted of three distinct sections: percussive sounds, noise and pure frequencies. Simple sounds were chosen to allow the space itself to take a central role, revealing how the acoustic characteristics of the environment modulate the materiality of sound. The performance's three-part structure follows a narrative of spatial discovery.

Figure 6. QR code: Short video of *Polyphono* at *Espacios Resonantes Festival*.

The first percussive section occurs in complete darkness, compelling the listener to apprehend the space solely through listening. The percussive beats are dry so that the space can shape and articulate them. The second section engages the audience in recognising the sonic-spatial dialogue through the vertical movement of the loudspeakers. Noise, encompassing the full spectrum of frequencies, enables the space to modify its pitch through sonic reflections, so sound is modulated according to its vertical position. In the third section, pure frequencies were aligned with the resonant frequencies of the space, selecting both high and low tones within this spectrum. Horizontal movement of the speakers introduces high frequencies first, allowing the audience to perceive their inherent directionality through lateral motion. Subsequent low frequencies generate a sense of omnipresence, overlaying and interacting with the pure frequency layers, which begin to resonate with each other and with the architectural space. Through this compositional narrative, the performance gradually constructs a sequence of sonic spaces that unfold progressively and collectively, so that the listener can apprehend, through these three spatial manifestations, the auditory experience of *Polyphono's* aural architecture.

In the first section, emphasis was placed on spatialisation, with the speakers remaining stationary while the sound moved acousmatically through the space. The vertical area was kept in complete darkness, focusing the audience's attention solely on the auditory experience. During this phase, the deprivation of other sensory inputs heightened the sensation of sound, creating an immersive spatial experience driven by the movement of sound. Despite the audience being situated along the periphery, the spatial distribution of the sound sources, combined with the vertical reverberation of the space, created the illusion of being enveloped by sound. In this initial section, the composition was characterised by a single dry sound, resembling a snare drum. When spatialised and interacting with the reverberation of the tower, the sound produced varying tonalities, modulating as it traversed the space. The sound gradually accelerated, with its beats per minute (bpm) increasing, intensifying the movement and generating new temporal spatialities dependent on the sound's physical position within the space.

The second part focused on the vertical interaction of sound with space. During this phase, the speakers are lowered using a system of pulleys, while the laser is activated, providing a visual cue that directs attention to the downward movement of the speakers (Figure 7). Six different types of white noise are used, each containing a full spectrum of frequencies. This type of sound facilitates changes in the pitch as the speakers descend, gradually increasing towards higher frequencies. The proximity of the speakers to the ground serves as a high-pass filter, influencing the reflected frequencies. The

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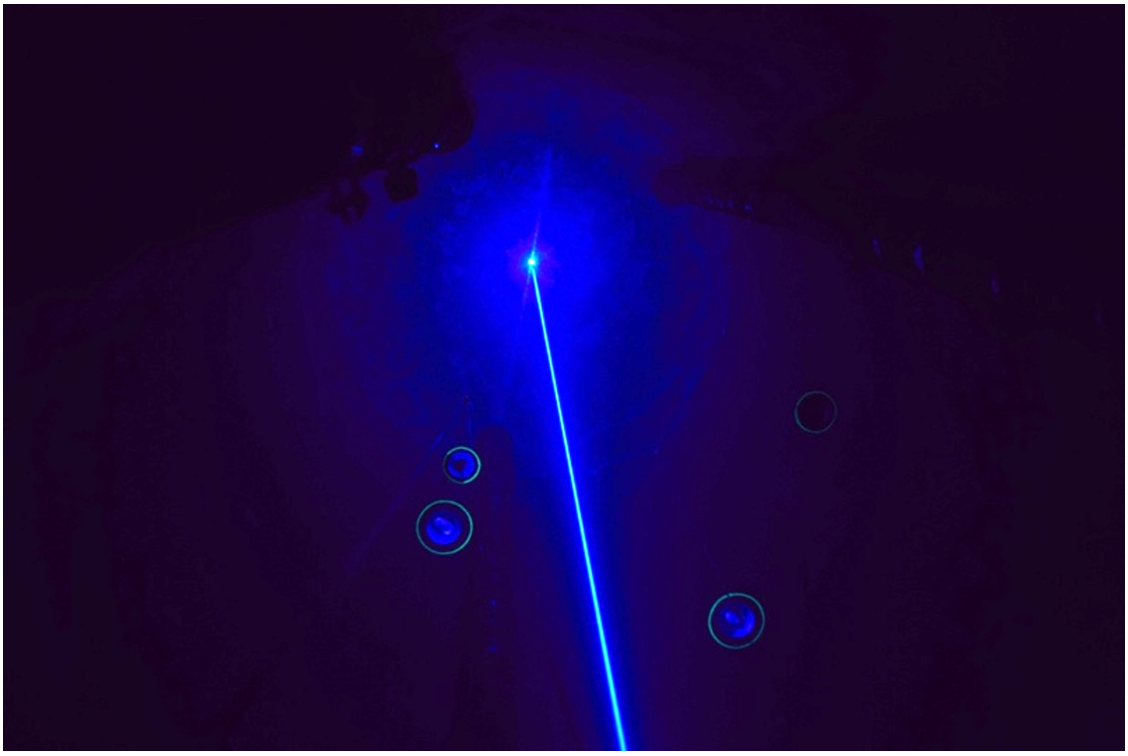


Figure 7. Laser shaft is on for the vertical movement of the speakers (F. Mardones 2022).

continuous noise is modulated based on its vertical positioning relative to the ground, resulting in undulating patterns created by the speakers' upward and downward movements.

The third section explores the horizontal relationship between sound and space. Described as a 'speaker dance', the sound sources are moved by the performer throughout the space, altering the auditory experience through the motion of the speakers. During this phase, the laser light begins to visualise the frequencies, projecting them onto the ceiling 20 metres above, thereby visualising the conforming sound space in graphic terms (Figure 8).

In this section of the composition, pure frequencies are employed, with each speaker emitting a distinct tone that is gradually activated and spatially integrated. The resonant frequencies of the space informed the selection of these tones, encompassing both high and low registers. High frequencies are introduced at the beginning to allow their horizontal movement to manifest the inherent directionality characteristic of such tones, creating a dynamic interplay of sound rays. Low frequencies are introduced subsequently to form an omnipresent sonic mass that engages in continuous dialogue with the previously established layers. As these frequencies overlap, they interact to generate rhythmic patterns through beat effects, producing varying undulations depending on their spectral proximity. This interactive phenomenon is also projected onto the ceiling via the laser shaft, enabling listeners not only to hear the interaction of frequencies but also to perceive it visually. The horizontal movement of the speakers functions as a filter, altering the spatial position of the frequencies and producing subtle gradations in sound, thereby enriching the auditory experience. As the oscillating speakers traverse from the periphery to the centre, they modulate the sound in response to the architectural space's proximity and distance. This final section of the composition reveals a rhythmic duality arising from both the interplay of frequencies and the horizontal movement of the sound sources.

The traditional listening experience typically involves a fixed sound position. However, when sound is in motion, it evokes a different sensation, creating the illusion of a dynamic and morphing surrounding space. Such movement can evoke various spatial impressions in listeners, depending on their position relative to the sound source. The human ability to locate sound sources in space depends on factors such as the distance between the source and the listener, the listener's body position and the acoustic properties of the architectural space. In the case of Quinta Bella's water tower, the polyphonic installation reconfigured its acoustic space by arranging the speakers in an ascending spiral. This arrangement altered the natural interpretation of the space's acoustics by human perception. The sensory experience of spatialised sound can thus construct a unique spatial environment determined by the distribution of speakers, thereby modifying the 'room information' as described by Chowning (1971: 3).

The movement of sound sources significantly contributes to the sensory experience of the internal sound space that the sound installation builds. Hussler's (1931) concept of the *lived-world* is applied here as a spatial representation through the arrangement of sound sources in an ascending spiral and their vertical and horizontal movements. By constantly changing position, the sound source conveys information about the relative and continuously shifting distance, transforming space from a static to a temporal experience, where it is dynamically constructed and deconstructed. As Chowning (1971) notes, 'In the presence of a moving sound source, a listener receives velocity information from the rate of the angular shift in energy (angular velocity), the rate of the radial shift in energy, and frequency shift due to the Doppler effect (radial

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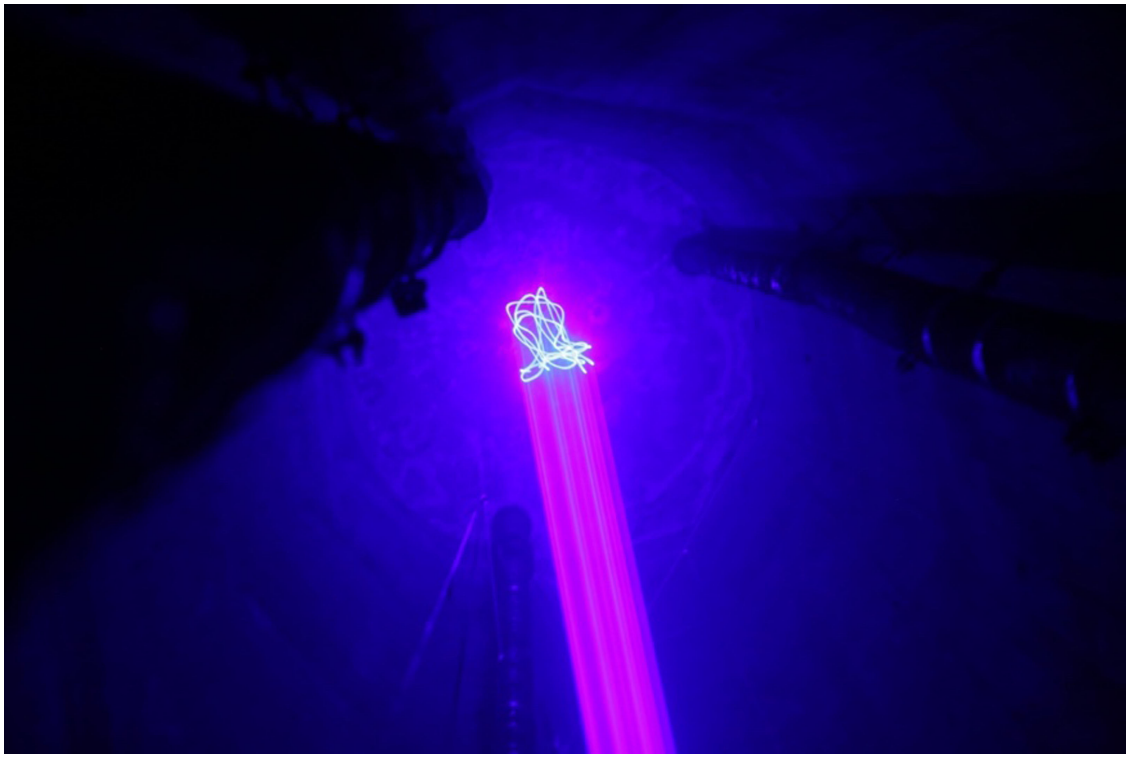


Figure 8. Visual sound (F. Mardones 2022).

velocity)' (3). When sound sources move horizontally, the perceived sound is modulated according to the spatial relationship between the listener and the moving source. This perceptual effect, described as the Doppler Effect, involves changes in frequency: if a sound source moves towards a listener, the sound waves compress, resulting in a higher frequency (higher pitch); conversely, if the source moves away from the listener, the sound waves stretch, leading to a lower frequency (lower pitch).

The manifestation of sonic information is shaped by the spatial positioning of sound sources, which in turn modifies the intrinsic characteristics of the sound, including intensity, frequency and timbre. Within the perception of the sound space, three distinct dimensions intersect: sonic features, spatial sound and spatial movement. The interplay among these dimensions determines the appearance of sound, filtering sonic information and dynamically modifying the overall auditory experience.

Polyphono was able to elicit a multiplicity of experiences in the audience, described by some as an immaterial place. Some listeners described the spatialised sound becoming a liquid mass, a moving flow, which, as an intangible presence, evoked images of the earth in movement, structures in movement and sea in movement, among others. The space at the beginning of the performance was completely dark; however, the sound spatialisation system distributed through vertical levels indicated the verticality of the space through vibrations that ran up the space, expressing diverse temporalities. One person from the audience declared, 'At first I thought the height of the building was going to be lost in the darkness, but you could still visualise the verticality and height through the sound'. Some other spectators commented on feeling a state of confusion, which was described by them as an expanded state of consciousness similar to a meditative state. This state may allow the person to get lost inside their mind, finding new mental spaces. Also, the sound textures of the interior provided by the performance interact with the textures and voices of the exterior soundscape, integrating and merging them, one into the other.

Within the context of the *Espacios Resonantes* Festival, located in a vibrant, densely populated and familiar neighbourhood, the intensity of the surroundings functioned as an eleventh sonic source, actively participating in the performance. Simultaneously, the water tower acted as a giant microphone, capturing external sounds and amplifying them within the interior. The cultural expressions of the surrounding environment permeated the *Polyphono* sound installation, which integrated these local soundscape elements as signifiers of identity, thereby connecting the work to its social context.

4. Conclusion: Sound space as a creative tool for exploring aural architectures

Through the act of listening, we can dissolve into space; sound is a medium that develops a sense of connection and emotional resonance with space through embodiment. The artwork is a method of exploration while creating new spatial experiences through sound and experimenting with new ways of listening spatially. This approach leads to a process of discovery that enhances our ability to perceive space through auditory stimuli, allowing us to understand invisible surroundings through spatial sound. As we engage with sound, we become increasingly attuned to our senses, facilitating an exchange of information where sound informs us about space, while our listening experience informs us about our internal state within the sound space, fostering self-awareness.

Through acousmatics, the sound space establishes a connection to a phenomenon of transduced information, with sound evolving in space. This creates a temporal narrative, where messages of space are conveyed through sound. The intended effect on the audience was to engage them bodily with the internal space of the spatialised sound through active listening. In the multichannel

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installation *Polyphono*, the spatialisation of sound evolves throughout the composition, seeking to produce a sonic stimulus that situates the experience within the site-specific acoustics of the water tower. This fusion of internal sound space and external acoustics generates spaces within spaces – what may be understood as a third space – offering a hybrid sensory experience that is transduced into aural architecture.

The spatiality evoked by each of these sonic experiences can manifest as multiple sonic morphologies, shaped by spatial modulations in both real and mental scenarios. As such, three distinct spaces coexist simultaneously: the acoustic space of the water tower, the sound space of the multichannel installation and the mental space of the aesthetic experience. This experience within the artwork fosters sensory perception, allowing for a holistic understanding of the environment through bodily engagement.

The synaesthetic activation of space through auditory features enables new forms of embodiment within spatial narratives. Sound-generated spaces can amplify the sense of hearing, fostering a distinctive interaction between aural architecture and sensation. Within this process, listeners may become attuned to the inherent tactility of sound, drawing on bodily sensations to construct new, invisible spaces within the physical, monumental space of the water tower. The sound space, as a creative tool, can establish cross-modal correlations between sound and space, connecting them through our bodies to generate new spaces within spaces. The sensory experimentation inherent in artistic practice within performative contexts elevates both the interior and exterior dimensions of sound space to a metaphysical level, while exploring transcendental intensities capable of generating parallel realities.

The listener could oscillate between the various sensory levels evoked by sound, transcending physical understandings to phenomenal creative outcomes. The architecture's boundaries are not defined by physical walls, but rather by the invisible spaces created by sound. As the body senses sound, it creates an aural space, while simultaneously, the sound space inhabits the body. This symbiotic relationship between subject and object becomes the ontological basis for the emergence of the multiple spaces that coexist in this experiment. The phenomenology of space and its production through situated experiences introduces aural architecture as the sensory recognition of the sonic environment. Artistic expressions, as installation art and performance, create a dimension of reality by blending multiple sounding elements and sensory engagement within a situated experience of sound embodiment. The creative spatial outcomes produced here as spaces within spaces are artistic expressions themselves, involving both the performer and the listener in an ongoing phenomenological and creative process.

This process involved moving beyond mere thought to explore different mental realms through deep listening, experiencing an expanded state of consciousness (Oliveros 2005). By creating spatial sensations through sonic experiences, we can gain insights into the cognitive principles underlying how we construct our imaginary world. Drawing on autopoiesis and enactivism (Maturana and Varela 1980), this approach views aesthetics as a form of cognition manifested through action. These theories suggest that knowledge emerges from active engagement with the artwork and with space, prompting an exploration of how artistic expression structures perceptual-cognitive information from our surroundings.

When architecture is affected by sound, an auditory dimension of space emerges. The aesthetic practice of *Polyphono* presented in this article establishes new interactions with spatial sound and site-specific acoustics, creating a cognitive map accessible through embodied listening that unifies sound, space and body. By engaging in the creative construction of *sound spaces* within the aesthetic framework of an existing *acoustic space*, the practice can elicit cognitive interpretations of *aural spaces*, giving rise to dynamic, morphing aural architectures – living perceptual spaces shaped by the interplay of the artist's gestures, the propagation of sound and the listener's creative interpretation.

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