A COMPOSER'S APPROACH TO EYE-EAR CROSS-MODALITY: SOUNDS, ILLUSIONS AND EMBODIMENT FROM OPERA TO INTERACTIVE INSTALLATION.

(PORTFOLIO OF COMPOSITIONS)

By

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ABSTRACT

This practice-led PhD explores perception-related principles for composing. My research in Composition aims to establish artistic relations between listening and seeing, which I pursued by shaping and altering audiovisual expectations in varied settings and musical structures. Throughout the portfolio, I have refined my focus to increase the audiences' and performers' listening awareness through visual cues management or visual deprivation, finding how visual stimuli – or removal thereof – can enhance the auditory perception. Research questions revolve around articulating these points through multifarious musical outputs and media. In some pieces, cross-modal perception was a core interest that originated my compositional concepts and determined my approach to developing material. In others, eye-ear sensory illusions were practically incorporated into musical narratives by reducing or removing visual stimuli, such as with dark or visually empty performance spaces. Methods have involved mind mapping, field recordings, composing (in music notation software and DAW), artistic/scholarly collaborations and performance, which enriched the creative process. That has led to expanding the borders of contemporary music genres with cross-disciplinary approaches and public engagement. My background as a conductor also supported compositional perspectives on gesture-sound interconnectedness. All my compositions discussed in this commentary were commissioned and performed in international contexts throughout my PhD, which increased their significance and outreach.

KEYWORDS: perception; sensory illusions; darkness; theatre; memory; auditory cues; interactivity; soundscape.

In loving memory of Gabriele Olini.

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PORTFOLIO: LIST OF COMPOSITIONS

- *Their wings have eyes* (2021)

for large ensemble
Duration: 6’

- *Inner engines on a private trail* (2021)

fixed-media, binaural
Duration: 10’07’’

- *Fondale mobile* (2022)

for orchestra
Duration: 10’

- *Those who have the right to yell – won't* (2021)

for ensemble and tape
Duration: 12’

- *Crumpled Questions* (2022)

for ensemble
Duration: ca. 4’

- *Radice Posizione Distanza* (2023)

mixed-media opera
Duration: 30’

- *Resight* (2023-24)

for string quartet and tape
Duration: 10’

- *Eclipse* (2022-24)

interactive immersive sound installation, multichannel
Duration: open and variable, subject to the visitor’s engagement, ideally 20’

- *Influences* (2023)

fixed-media, 4-channel
Duration: 6’ 16’’

PORTFOLIO APPENDIX

- *Eclipse* – Spatialisation Trajectories (2024)

For composed in the patch
Images from the UI (courtesy of Milad Mardakheh)

- *Studies on Eclipse* (2022)

fixed-media, stereo
Duration: 11’

- *Un fiume in pena* (2023)

for ensemble
Duration: 9’

MEDIA FOLDER STRUCTURE

Sara Caneva PhD Portfolio

- **1_Their_wings_have_eyes**
  - Their_wings_have_eyes__full-score.pdf
  - Their_wings_have_eyes__recording.wav
- **2_Inner_engines_on_a_private_trail**
  - Inner_engines_on_a_private_trail__binaural.wav
- **3_Fondale_mobile**
  - Fondale_mobile__full-score.pdf
  - Fondale_mobile__recording.wav
- **4_Those_who_have_the_right_to_yell_won't**
  - Those_who_have_the_right_to_yell_won't__full-score.pdf
  - Those_who_have_the_right_to_yell_won't__video-recording.mov
- **5_Crumpled_Questions**
  - Crumpled_Questions__full-score.pdf
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  - Radice_Posizione_Distanza__full-score.pdf
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- **8_Eclipse**
  - 1-Eclipse__curated-experiences
    - 1_Sara_walks_Eclipse_binauralCameraAngle.mp4
    - 2_Milad_walks_Eclipse_binaural-CameraAngle.mp4
  - 2-Eclipse__supporting-materials
    - Eclipse_8ch_media
      - Eclipse_Introduction.wav
      - Eclipse_scene_01.wav
      - Eclipse_scene_02.wav
      - Eclipse_scene_03.wav
      - Eclipse_scene_04.wav
      - Eclipse_Transition_pt1.wav
      - Eclipse_Transition_pt2.wav
- **9_Influences**
  - Influences__4ch.wav

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- trj_4.png
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- trj_7.png
- trj_8.png
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Trajectories_Scene2

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- trj_9.png

Studies_on_Eclipse
- Studies_on_Eclipse__stereo.wav

Un_fiume_in_pena
- Un_fiume_in_pena__full-score.pdf
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1. INTRODUCTION

1.1 Preface

The alterity of sensory perception has always been at the core of my artistic and human interests. A composite series of personal and professional contingencies – involving hearing and seeing – forged my curiosity toward this topic: from attending, as a hearing child, a primary school specialised in teaching deaf students, to residing in a care home for retired musicians during my graduate studies in Milano.[1] I believe that sharing space and time with people of different ages and abilities at crucial stages of my education emphasised the impact of subjective sensory sensitivity, behaviours and communication styles on my perception of everyday endeavours and an artist's life. Hence, I tend to interpret creative inputs at the intersections of these matters. On the other hand, pursuing a combined career in orchestral conducting and composition and undertaking the transformative challenges of the podium reinforced my awareness of the gesture-sound and eye-ear interconnectedness. Years of self-reflection in the conducting realm echoed in my compositional style. However, what ultimately captivated me, was noticing, during community soundwalks I led at the Bogliasco Study Center in 2019,[2] how unaccustomed general audiences were to acknowledging sounds without the source

[1] https://www.casaverdi.it/en/visiting-casa-verdi/visiting-casa-verdi/ (Accessed: December 2024). Casa Verdi, founded in 1901 by Giuseppe Verdi, was built with the intent to host and support retired musicians and artists, providing care for those in need and instrumental facilities for those who were musically active. I lived there from 2013 to 2015, when the Foundation used to reserve a small number of rented rooms for music students.

[2] And, before that, in Rome from 2016 to 2018. *Ear Ride I* (2019) at Bogliasco was a combination of an installation and a garden soundwalk. https://www.bfny.org/en/news-and-events/foundation-event-details/272 (Accessed: December 2024).

being visually identified. I started contemplating unmet expectations about the nature of sounds, deriving from missing visual information, as a powerful tool for composition. Obvious techniques such as masking the attack of a sound, for example, or provoking intentional audiovisual divergences, setting performances in dark environments, and similar procedures could be scaled up to principles for planning and structuring new music, potentially leading to sensory revelations or illusions for audiences and performers. I felt the need to address the visual dominance of the present society and suggest an alternative approach through experimental compositions.

Following these motivations, with my PhD in Composition, I wanted to zoom in on the intrinsic relationships between music, visual cues and visual deprivation with contemporary idioms and media. My observation moved towards making music that would alter and elude listening attitudes deriving from visual cues – or lack thereof – creating experiences of not seeing. The process revolved around three key questions:

- What expressive, perceptual, and technical aspects of composition are affected in performing without seeing (and, vice versa, what is needed from experimental composition to support performance in darkness);
- How to realise such musical experiences across different media and site specifications;
- How to link spatial perception, vision deprivation, soundscape and multisensory approaches to musical composition towards audience engagement.

These points have been explored in various degrees throughout my portfolio, each piece answering research questions from a different angle. In this commentary, I will discuss a selection of nine compositions chosen from a broader corpus composed between 2021 and 2024. My works range across different combinations of musical media, including instrumental and mixed-media chamber pieces, an opera, and acousmatic works including an interactive and immersive sound installation. Such expressive diversity aims to demonstrate a varied response to composing with sensory illusions. Furthermore, this choice reflects my multifarious artistic experience and personality. Two supplementary compositions and a folder of images[3] are attached in the appendix; I consider those preliminary or further studies produced to test techniques and structures in a separate, smaller-scale compositional environment.

1.2 Methods

The international discourse on methodology for practice-led artistic research is vast and nuanced. Depending on how scholars, academic environments, and composers define questions and knowledge, there may be very different standpoints around composition as research. Croft (2015) claims that composition cannot be considered research, as composers could create any music adhering to their objectives, with no barriers questioning the realisation of an output.[4] Conversely, Pace (2016) affirms that performance and composition have always been research. When considering artistic

[3] Images of drawn spatialisation trajectories for each audio channel of the interactive sound installation (see Chapter 5 and the list of attached works for details).

[4] "If the answer to your 'research question' is always (trivially) 'yes', then there's no research going on." (Croft, 2015, p. 7).

outputs as “original investigations seeking new knowledge through practice and its outcomes” (Skains, 2018, p. 86), models of creative cognition and reflective analysis can apply; in fact, Practice as Research has grown in representation over the years. I think of research as part of composition, and composition as part of (any) research.[5] I believe that a composer’s formulation of research questions and results truly depend on the experiment of composing and remain unknown until a piece of music has been completed, presented, and revised.

Music-making was a critical part of my systems and objectives along the lines of portrayal, rendering and praxis in artistic domains (Savin-Baden & Wimpenny, 2014). In my practice, those can translate respectively into planning/design, composition, and performance:

- Planning/design

Planning and design have often been the most prolonged and deeper steps. I relied significantly on productivity tools like mind mapping and diaries, jotting notes as text, voice messages, or five-line musical notation to inspect, understand, observe and question my rationale for each piece. In this phase, literature and extra-musical searches convey, as well as potential collaborations with other researchers, artists, and commissioning institutions.

[5] Similar approaches are supported by Manghani (2021) and Nelson (2013).

- Composition

My typical approach is based on considering the performance ecosystem as part of the composition, although this can vary with each project, applying composing and orchestrating techniques in instrumental and electroacoustic frameworks. I worked with various tools, including recordings, notation software, and DAW. As for planning/design, I developed and readjusted my writing in response to feedback from musicians, workshops, residencies, electroacoustic studio sessions and BEAST research days, collaborations with performers and other artists.

- Performance

All the pieces in this submission were performed in public concerts or presentations. My participation in some of my pieces' performances as a conductor enriched my approach to composing with a practical perspective.

While these three stages of research activity would usually happen sequentially for each piece, ending with a performance, there is often the chance to rethink a composition based on knowledge acquired during the production process. I particularly value the impact of overlapped phases on the overall process, where artistic collaborations are a crucial component (**Table 1**).

My research took a tailored shape around each single project development. Compositions that excluded eye contact posed instrumentalists' synchronisation and notation issues, hence required specific methods to encompass rhythm in the audible fixed-media track or similar solutions. The opera creation demanded historical and literary research to make knowledgeable decisions around composing the libretto.

Compared to all other works, the interactive sound installation unfolded on a longer timeline and along more intricate queries, such as how to manage indefinite durations and discoverability. While I conceived the subject, composed the music, paced and spatialised auditory cues for *Eclipse,* the overall output and idea were born as a collaborative effort with Dr Milad Mardakheh[6] in the capacity of research consultant, programmer and co-curator. Mardakheh implemented cutting-edge innovations in machine learning and wearable Ultra-Wide Band (UWB)[7] technology applied to audio technology, realising efficient and user-friendly interactive tools in this sound installation. My composing was inherently feedback-driven and reliant on continuous on-site testing and reshaping narratives in response to the technological developments, as well as teamwork discussions and planning of such enhancements. In this commentary, I will not examine technological details but will refer to those technology-informed pieces of evidence essential to discussing my artistic practice.

[6] https://mardakhehmusic.com/ (Accessed: December 2024).

[7] A radio technology applied in real-time position tracking.

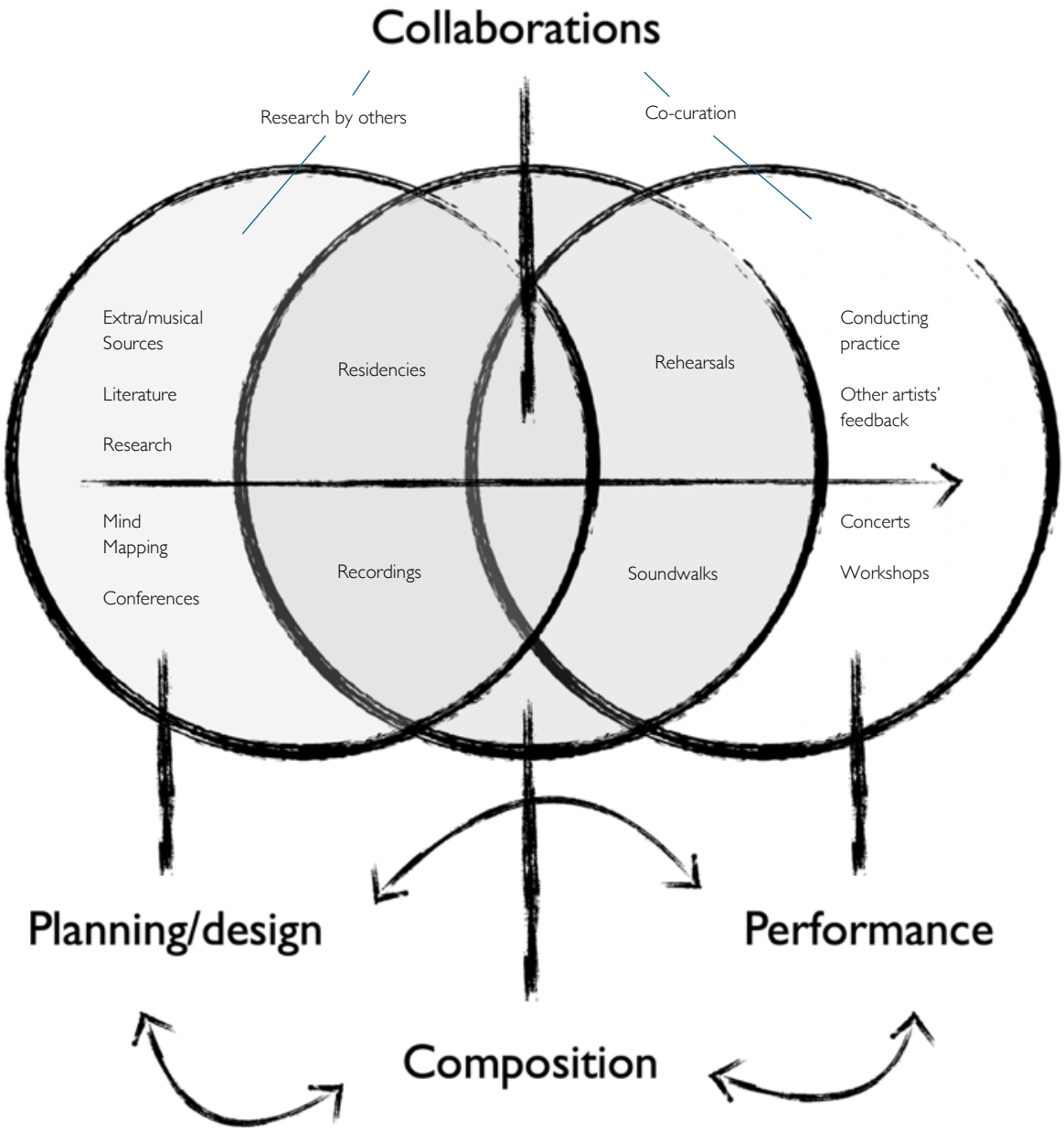


Table 1 – visualisation of my research methods

1.3 Background context

The beginning of my PhD coincided with the 2021 waves of COVID-19 pandemic; at the time I had recently completed a virtual artistic residency at the Finnish Saari – Kone Foundation, where I had started preparing for my research. In spite of worldwide shocks brought from isolation, which severely affected musical practices, Fram et al. (2021) observed that musicians were exceptionally resilient and proactively took initiatives of "activist musicking" online. Some affirmed the crisis of spatial materiality at the time (Taylor et al., 2020) asked for new intimate spaces for experiencing music. Listening to music is proven to change the perception of time and space (Schäfer et al., 2013); during COVID restrictions I strongly felt that purpose of musical outreach connected to feelings of sharing sensorial dimensions. In fact, I felt that togetherness in isolation was a sensory illusion, where hearing had virtually unlimited anchoring powers. Dyson (2009) connects the experience of hearing to that of being touched by sounds that act on physical and emotional levels. That stood up for me even more when compared with the condition of seeing each other during lockdowns, that was only possible through screens.

Remote collaborations by adaptation to hybrid platforms were also aligned with my practice during the Saari residency, as it is demonstrable. I invited fellow resident artists from different disciplines to share fragments of their pandemic experiences in the form of audio recordings or voice messages. That participatory initiative formed a unique sense of community and allowed me to gather a collection of scattered samples that became the starting fabric for my portfolio of musical works. It will emerge from this commentary that certain sounds recur, which I deeply investigated in their creative potential: birds,

civil protection sirens, engine sounds, water, and underwater motions have all been featured prominently. Each audio carried emotional memories and sensory experiences of their takers – me included – and I have tried to preserve and enlarge this content in my compositions.

In the following paragraphs, I will explain my influences as a composer, reviewing relevant aspects of music theatre in darkness, orchestral conducting, and soundwalks.

1.3.1 Music theatre in darkness

Etymologically, we might call 'theatre' everywhere a performance or event is watched and heard. Theatre, music, and vision were cohesive since their origin: according to the ancient Greek definition, the theatre – 'theatron' – is a 'place for viewing', from the verb 'theaomai' meaning 'to watch' (Sifakis, 2001). John Cage, in an interview (Cage et al., 1965, p. 50), produces a rather inclusive definition of 'theatre':

> I would simply say that theatre is something which engages both the eye and the ear. [...] The reason I want to make my definition of theatre that simple is so one could view everyday life itself as theatre. [...] the horn player, for example, from time to time empties the spit out of his horn. And this frequently engages my attention more than the melodies, harmonies, etc.

This answer also demonstrates how ordinary orchestral actions, such as routine instruments' maintenance, can be visually captivating and modify the experience of a concert, potentially overpowering one's listening attention. Based on that, every concert that involves vision can contain theatre. Conversely, acousmatic music is, by its etymology, tied to the absence of vision (Emmerson & Smalley, 2001; Kane, 2014) – from

the Greek word ‘akousmatikoi’, meaning ‘those who listen’. The way I use the term ‘acousmatic’ in this commentary is not especially associated with spectromorphology (Smalley, 1997, 2007), nor am I studying the theoretical contextualisation of the acousmatic experience as reduced listening (Chion, 2019; Schaeffer, 1966) or following on the sound materiality discourse. As unprocessed natural sounds occupy a substantial part of my recent compositional practice, I rather refer to the accentuated sensory aspect of not seeing when defining my compositions acousmatic. In fact, my thesis approaches the experience of listening from a holistic perspective, with a focus on interactions between aural and visual sensory modalities[8] and their role in compositional processes.

Kendrick’s *Theatre aurality* (2017) named a difference between ‘spectatorship’ and ‘audience’, for which listening appears to be more subjective and viewing more objective.[9] All these aspects I wanted to unravel through my practice-led research: sound, space and (non) vision, to realise multiple subjective perceptions, or illusions. From my perspective, modulating the use of light in theatre can act as a modifier of sensory expectations, listening and form. In a composition so conceived, audiovisual expectations can be carefully managed to articulate theatrical purposes.

[8] In the context of my compositional research, I use terminology from various disciplines, including music cognition. In this commentary, the term 'modality' refers to specific types of sensory inputs and the distinct channel through which they are processed in the brain (i.e. vision or audition). 'Cross-modality' is to be intended as the reciprocal interactions between different sensory modalities (i.e. the interaction of vision and audition).

[9] See § 2.2.

The composer Georg Friedrich Haas has researched darkness across his production of many years, with performances placing both audience and players in darkness or gradually reaching darkness. His composition *in vain* (2000)[10] asks for the concert venue to turn progressively faintly lit, then completely dark. *"In iij. Noct." : 3. Streichquartett* (2001) is set in complete darkness. In *"In iij. Noct."* no stands, parts, or emergency lights are permitted; the adopted musical material, in the form of textual instructions, is suitable for generating long durations while allowing effective memorisation and auditory coordination between the players. In this piece, Haas disposes of 'invitation sounds' that any players can decide to start; these auditory cues can initiate the following section, once everyone else in the quartet has accepted the invitation. A comparable darkness formula is enlarged and reiterated in Haas' opera *Koma* (2015-2016/2018). The staging may appear conventional at first, with a conductor in the orchestra pit, the notation displaying marginal indeterminacy.[11] As the conductor becomes invisible in darkness, episodes in darkness rely on auditory cues and singers/instrumentalists' interplay. After several incursions into complete darkness, the listener becomes accustomed to the rotation of the two states. This compositional alternation intersects layers of consciousness, maturing an expectancy of darkness embedded in the opera's plot.

Further practice-led research on listening in altered perceptual conditions was delivered by Vladimir Gorlinsky, founder of the art collective *Dreamtory* (2016), dedicated to

[10] The piece is 70 minutes long, and the last 20 minutes are performed in darkness. https://issuu.com/londonsinfonietta/docs/haas_programme_for_issuu/6 (Accessed: December 2024).

[11] Especially when compared with *"In iij. Noct."*

overnight musical performance and sleep, in a game of actions and improvisations.[12] The listener's status, whether, for example, awake, sleeping, or physically impaired, also affects auditory processing and awareness of acoustic distances (Kaplanis & Velzen, 2012). My first experimental contribution in this sense was my piece *Night is Night, no matter how long* (2019) for six performers of purpose-built biodegradable instruments. For thirty minutes, the ensemble is positioned all around a blindfolded audience (**Fig. 1**), performing without reading and in complete darkness. In that composition, I created an equivocation between the soundscape of a forest and a structured music performance. I realised an "in-headphone auditory conductor" (Caneva, 2022b) that guides and recalls primary cues for the performers, through my pre-recorded voice. The auditory conductor is for the sole use of the ensemble and not audible to the audience. That also set up separate states of consciousness for the audience and the ensemble (Caneva, 2022a).

[12] https://electrotheatre.com/people/vladimir-gorlinskiy (Accessed: December 2024).



Figure 1 – blindfolded audience for *Night is night, no matter how long*

1.3.2 Conducting persona

Another form of theatre, considerably present in my background, is that of an orchestral conductor's presence on stage. Being a conductor myself, audio-visual awareness and motorial management of visual cues was not only a creative interest but also a matter of training and personal development. Furthermore, there are lines of thinking in orchestral conducting, such as Ilya Musin techniques, which particularly emphasise theatrical aspects, visual clarity, and the amount of expressive information conveyed through categorised gestures (Musin, 2014). Conductors of Musin's lineage may conceive their practice similarly to that of actors, and it is not unusual to apply Stanislavsky's method (Stanislavsky et al., 1993) to score preparation. Musin's school is a specific case where visual appearance connects with emotional memories into mimic representations of musical characters.[13] The study of these techniques has undoubtedly left a significant footprint in my way of receiving performances and thinking of the music I compose, focusing on sensory memories, their embodiment and visualisation.[14]

Historically, the conducting essence has not always been visual (Galkin, 1988);[15] however, since the XIX century, conductors typically communicate through gestures, as a visual guide to the orchestra (Kumar & Morrison, 2016). Conductors, by convention, show the music ahead of the beat, communicating intentions that are immediately

[13] I encountered the conducting technique of Ilya Musin when studying with Ennio Nicotra in 2011-2013 at the University of Milano Bicocca. In learning orchestral pieces, especially from the Romantic era, I reproduced some of Stanislavsky's exercises to recall emotional memory analogous to the piece's character, consisting of writing details journals to personify a musical narrative in gestures. Other exercises addressed space awareness in performance.

[14] Like in my opera, string quartet and sound installation in this portfolio.

[15] Ibid. pp. 437-446.

recognisable to the orchestral group. A reasonable anticipation of visual signs (Colley et al., 2018) informs the musicians ahead of the beat about tempos, cues, expressions, and stylistic coherence to elicit a synchronous collective response. The conductor's gestures should provoke a reaction from the players, which, in turn, influence the following conductor's cues. That ultimately educes a chain of visual stimuli and musical responses in a synchronous feedback loop that unfolds during a performance. The lag between gestural indications and in-sound reactions is necessary to human sensory processing and occurs in any conducted group. There is empirical, musical and scientific evidence that "both the quantity and quality of lag values are significantly different between ensemble types, experience levels" (Meals, 2020). It can be stated that visual cues have here a double technical (quantitative, for synchronisation) and expressive significance (qualitative). My interpretation of visual stimuli in any field of application in my music making corresponds to these practicalities. That made me reflect on anticipating auditory cues in compositions where a conductor is not concerned.[16]

I primarily expect to see meaning and purposefulness around all relevant musical matters from my own conducting persona, with a direct gesture-sound correlation. Sometimes, the presence of a conductor may even be counterproductive in composition projects dealing with darkness or visual stimuli removal. Individual composers' conceptions of what conducting means to their style can produce very distinct cases of

[16] e.g. the in-ear audio-guide conductor of *Night is night no matter how long* (2019).

"idiomatic conductor" (Caneva, 2022b).[17] When the piece's arguments need to exclude the conductor's visual presence, I would nevertheless think of a substitution, a form of "composed conductor" to embed in my scoring, as it will become apparent in my portfolio. Podium experience also hugely refined my musical imagery,[18] by improving my score reading, listening and performing skills in new music; my conducting practice often informs my notation systems[19] and compositional choices.[20]

1.3.3 Sensory awareness and soundwalks

When I first approached musical investigations of visual cues and sensory illusions, I had soundwalks in mind. I already mentioned leading soundwalks, installations and soundscape mapping, which remain valuable tools I substantially use in my research and to acquire fresh compositional materials. In my perception, and drawing from Cage's words, soundwalks and music theatre could share several characteristics, provided that the entire world is assimilated to a multidimensional stage, with scenery, changing lights, singing and sounding entities. Vice versa, a staged transposition of soundwalks is possible through soundscape composition (Adams et al., 2008; Truax, 2008; Westerkamp, 2002). In the environment, more musical events happen simultaneously

[17] i.e. how integrated is the conductor within compositional thinking. The analysed cases of Cage's *Concert for Piano and Orchestra* (1957-58), Schnebel's *Nostalgie* (1962) for Solo Conductor, Battistelli's *Experimentum mundi* (1981) and my work *Night is night, no matter how long* (2019) differ greatly in the role assigned to the conductor, namely in terms of (1) relations between gesture and characteristics of the score, and (2) whether the composer or someone else is conducting (Caneva, 2022b).

[18] The "mental experience of music" (Jakubowski, 2020) can occur intentionally or unintentionally. It may involve imaginative processes or the mental replay of tunes, and it varies depending on several factors that researchers are studying, such as an individual musical expertise.

[19] See *Resight* (2023-24).

[20] See the opera *Radice Posizione Distanza* (2023).

than any spectator could ever experience at once, and in countless places: it is the walker who builds a sequence of musical events by moving their point of listening, visiting different places at certain times. However, the walker's decision of where and when to go next is not only motivated by sound, given the ocular-centrism reflected in how urban landscapes are built and experienced (El Moussaoui, 2021). What happens if I build the conditions for soundwalking trajectories to be driven by auditory cues only, such as by making the space perceivable but visually empty?

Relations between sound, space, perception, the performance space and its audiovisual recording are thoroughly delineated by Smalley (2007), pointing out that spectromorphologies are carriers of spatial information. For these points I could find a precise application in the interactive installation I will present in Chapter 5, although they remained a supporting thread throughout this portfolio.

Given my previous work on extended techniques and the new lutherie (Verrando, 2014) for sensory illusions purposes,[21] soundscape orchestration through acoustic instruments seemed suitable to express my current compositional research. Using instruments and voices to reproduce soundscapes could potentially incentivise listening awareness in a

[21] e.g. by adding found objects to instrumental ensembles. See my composition *Become a fan* (2016) for mixed quintet, table fan and handy fan. Video recording: https://www.youtube.com/watch?v=BpCws5JG22g (Accessed: December 2024). In this piece, I revealed the presence of the table fan only in the final bar: a compositional technique that encourages the listeners to reconsider their perception retrospectively. I further developed this concept in my work *Those who have the right to yell – won't* (2021). See § 3.1.

similar manner to Schafer's proposed listening and sound-making exercises (Schafer, 1992). I started researching in these directions.

1.4 Thesis structure

This thesis is organised into six chapters, including the Introduction and Conclusions. The middle chapters propose a self-reflective narration of my creative process and techniques for composing each work. The analysis unfolds to demonstrate my compositional perspective and is contextualised within broader topics in the areas of acoustic ecology (Chapter 2), music psychology (Chapters 2, 3, 4 and 5), architecture and perceptual studies (Chapters 4 and 5). Artistic outputs are presented in a nearly chronological progression, with slight discrepancies from the timeline due to prioritising thematic affinities.

2. SOUNDSCAPE ORCHESTRATION AND MUSICAL IMAGERY

The first two works I am about to present, were composed in parallel to each other. They address similar artistic objectives: (1) orchestrating artificial and natural soundscapes morphing into one another, and (2) doing this with either purely acoustic or electronic media. I focused my research on ambiguous soundscapes that could instil perceptual doubts on their production, origin and actuality, as those could likely exist in natural settings as much as in digitally manipulated audio.

I based these compositions on two sounds: birds and boat engines. I referred to a specific raw recording[22] taken during harbour manoeuvres from a motorboat, extracts of which I used in the binaural piece *Inner Engines on a Private Trail* (2021). I worked on the same sound source in *Their wings have eyes* (2021) for large instrumental ensemble. *Fondale mobile* (2022) for small orchestra, previously existed as a large symphonic overture (2019). Based on my experience of conducting the piece, I worked on a transcription[23] that expanded and restructured timbral features, emphasising textural shifts.

Whether my music incorporates visual elements or not, I imagine and treat sounds like 'actors' and their envelopes like a script. Hence, spectral qualities are always relevant to my investigation and inventiveness.

[22] That was informally recorded on a friend's motorboat approaching the dock.

[23] The 2019 version was commissioned by the Teatro La Fenice di Venezia, conducted by Jonathan Webb. The 2022 version was premiered with the Orchestra di Padova e del Veneto, which I conducted. Concert programme: https://www.opvorchestra.it/rassegne/veneto-contemporanea-2-travestimenti/ (Accessed: December 2024).

2.1 Instrumental soundscaping

– *Their wings have eyes*

Instrumentation: piccolo, Bb clarinet, bassoon, horn, trombone (with plunger mute), percussion (lo-hi timbales, water tam-tam + water-filled tub, snare drum), harp, violin (+ mute), viola (+ mute), cello (+mute), double bass.

Duration: 6 minutes.

For several years preceding my PhD, I was intrigued by Ezio Sinigaglia's novel *Eclissi* (2016). In the final chapter, the author describes the protagonist listening to an exponential decrease in volume of birds singing, as birds sensed the eclipse was coming.[24] In my composition's title, *Their wings have eyes* (2021), I quoted a line from the character of the Scandinavian boatman Kurtli in Sinigaglia's novel, asserting: "Birds have wings, and their wings have eyes. They can see things we can't see."[25]

The eclipse's point of observation depicted in the book is on a small engine boat in the sea, not far from the coast. My piece's formal arch articulates such description in sounds and represents three elements in the soundscape:

(1) Disappearing birds

Woodwind and brass textures progressively grow thinner, and this happens in stages, with drastic disappearances from loud to nothing (e.g. mm. 1-11; 43-47; 61-63). My approach to writing for winds in this piece was influenced by Carola Bauckholt's

[24] Sinigaglia (2016), p. 98.

[25] Ibid. p. 94; original in English.

Zugvögel (2011-12) for reed quintet that imitates sounds of migratory birds with respect to rhythm, timbre, pitch and playing techniques.[26]

(2) Boat engine manoeuvring

Rhythms and sonorities reconstructed the boat engine sound features and paced the formal structure. To prepare for orchestrating this layer, I performed sonographic analysis[27] of the raw recording[28] (**Fig. 2**). That highlighted essential components of the boat engine sound and its developments in time. As a composite sound, its timbre and rhythm were interdependent. First, I investigated percussion possibilities that would replicate a muffled staccato texture, similar to the rumbling engine, with a versatile dynamic control in the medium-quiet range. That led to experimenting with frame drums and beaters of different sizes and materials. Low and high timbales with half-closed metal brushes seemed the closest match. Musical developments also follow the audio sample's profile. I developed

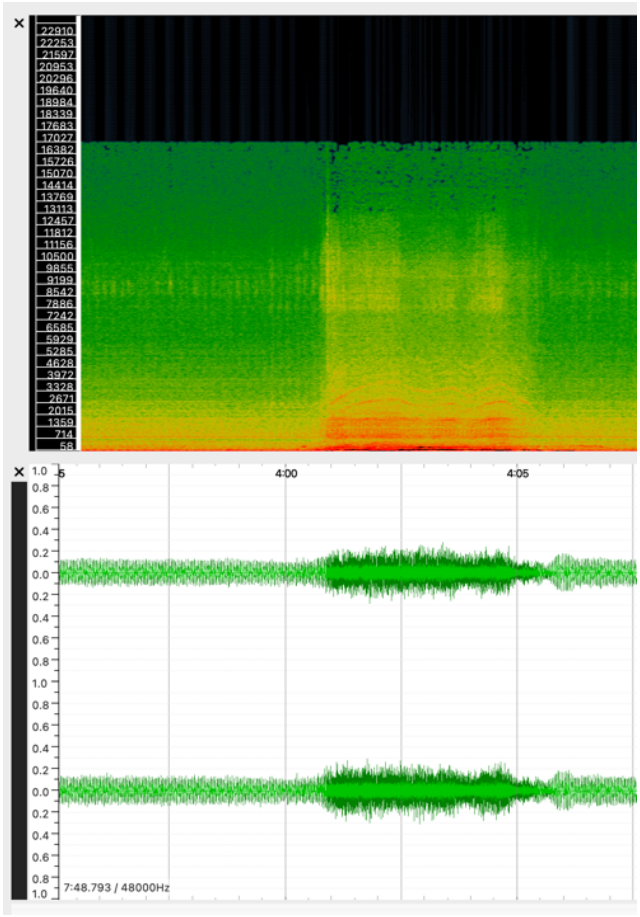


Figure 2 – engine sound: spectrogram and waveform

[26] In *Zugvögel*'s performance notes preceding the score, Bauckholt specifies that her notation is just a suggestion, and players should find what technique works best to imitate the sounds in the recordings attached for each of the thirteen migratory birds featured in the piece.

[27] I used the open-source software Sonic Visualiser – https://www.sonicvisualiser.org/ (Accessed December 2024).

[28] See p. 19.

the material by alternating two main pulses and modelled metric modulations on speed fluctuations in the recording of the engine sound during harbour manoeuvres. That was to resemble variations in the engine speed, which also affected the timbre. In these timbres, I combined fast sextuplets in the two timbales with contrasting rhythms in the strings, playing glissandi and pizzicati (e.g. mm. 29-31; 40-42; 48-52, et sim.). Continuous rhythmical figurations in the timbales also drive slower sections, corresponding to further changes in string playing techniques, with the scratchy and repeated vertical bowing tremolos and overpressure techniques.

(3) Fade-out: the eclipse quietness

The second part of the piece (mm. 70-99) explores a quieter, calmer and surreal soundscape, evoking nocturnal and watery atmospheres. That corresponds to a shift in percussion instruments from timbales to tam-tam in water (**Fig. 3**).

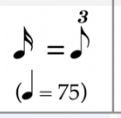
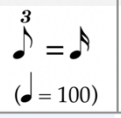
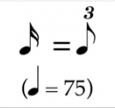
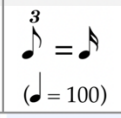
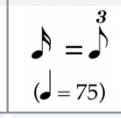
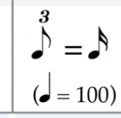


Figure 3 – water tam setup

Every metric modulation unifies contrasting and overlapping textures (**Table 2**). The transition to the final quieter sonority is obtained by continuing the timbales rhythmical patterns (i.e. the engine switching off) into subtler tongue rams and air sounds in the woodwinds.

Across all sections and textures, I used the harp with a resonance role, colouring and bridging over different percussive episodes (mm. 47-49; 64-68).

What I found especially poetic and relevant in it and its literary inspiration was the cessation of sound (the birds, the engine) in correspondence with the incumbent darkness (the eclipse) at unexpected times. Both animals and humans in the novel felt the instinct to silence themselves in presence of an upcoming sensory stimulus of vision removal – as described in *Eclissi*. This composition symbolises a sensory experience of the unknown brought about by extraordinary natural phenomena dealing with invisibility, such as a total solar eclipse. While the practical performance settings did not involve darkness or explicit illusions, the formal structure derived from an eye-ear sensory observation and constituted the basis for future breakthroughs. In fact, this matter has developed much more extensively over the course of my PhD, particularly in *Eclipse* sound installation.

Metric modulation		1	2	3	4	5	6
							
Measures	1-28	29-31	32-39	40-42	43-47	48-52	53-58
Disappearing birds	all winds + violin	-	all winds no violin	-	all winds no cl.	-	piccolo solo + vla, vc seagull gliss.
Boat engine	timbales + plucked vla, vc + db	brass air sounds + timbales + bow scratch trem.	timbales + vla, vc pizz + db	brass air sounds + timbales + bow scratch trem. + hp. finger tapping	timbales + plucked vln, vla, vc + db	piccolo + brass air sounds + timbales + bow scratch trem.	timbales + plucked vln, vla, vc + db
Eclipse quietness						-	

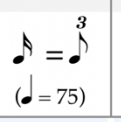
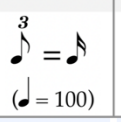
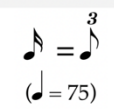
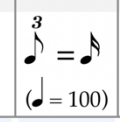
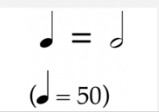
Metric modulation	7	8	9	10	11	
						
Measures	59-60	61-63	63-68	69	70-85	86-99
Disappearing birds	-	-	-	-	cl. bsn. hn. tbn.	
Boat engine	brass air sounds + timbales + cl. solo	timbales + plucked vln, vla, vc + db	engine switching off snare dr. + woodwinds air stacc. + hp. finger tapping	timbales + all strings plucked	bsn. helicopter stacc. + bow scratch trem.	-
Eclipse quietness					tam-tam in water + hp. bisbigl. + strings harmonics	

Table 2 – *Their wings have eyes*, analytical view

2.2 Headphone listening for a wandering mind

– Inner engines on a private trail

Setup:
binaural audio.

Duration: 10’07’’

During lockdown, I engaged in field recordings and audio mindfulness sessions to investigate what creative implications could expand from these activities. It seems to me that what Kendrick (2017)[29] describes as an “absence of aurality” is connected to the obsession for watching in our society, which I was aiming to contrast within my musical practice. Recent studies and empirical evidence in neuroscience examined states of consciousness during music listening and performance (Palhares et al., 2024), defining numerous gradations and cognitive categories affected by musical experiences. Specifically, I was interested in interpreting intersections of creative thought and fluctuating awareness. I wanted to write a headphone-theatre piece that could link perceptual and technical aspects of composing and listening, allowing space for real-time mind wandering and returns to the present moment. *Inner engines on a private trail* was conceived for in-headphone listening, as its BEAST FEaST 2021[30] premiere was

[29] “The notion of sight as a dominant sense is fundamental to the idea that the self is separate from the world. This autonomy has produced a subject that can have an impartial impact on the world because they are not *in* it; this is a direct consequence of the enduring notion that the eye distances us from anything that is not *of* us and thus we are removed—physically and philosophically—from it. Aurality, on the other hand, brings all those qualities of auricular engagement—of feeling, movement, immersion and multiplicity—to the forefront of our relation with the world. These qualities of aurality are aligned with the idea of being in the world, and not just because the ear is always open to it.” (Kendrick, 2017, p. 9).

[30] Concert programme: https://beast.cal.bham.ac.uk/beast-feast-2021/saturday-24-april/ (Accessed: December 2024).

streamed online. Due to COVID restrictions, the University of Birmingham and Electroacoustic Studios were inaccessible at the time I composed this fixed-media work. I took the chance to familiarise myself with multichannel composition headphone workflow and Ambisonics. Given the headphones' portability and the remote nature of the concert, I embraced discrepancies in frequency response and device models as a factor that could significantly alter the experience of this piece. Thus, I integrated such contextual limitations into my research topic and the composition, with real/unreal soundscape ambiguity and related auditory hallucinations shaping musical elaborations. On-ear listening also made the listening space private, inserting the piece's purposes into private listening ecosystems.

Foundational sound materials were derived from three main threads: (1) the already analysed boat engine, (2) walking steps on crunching leaves and hard wood, and (3) a rolling bass drum played with a friction mallet. Spectral analysis and resynthesis were my privileged compositional techniques: all sounds were presented in their unmodified version and as resynthesis, both sequentially and simultaneously. The structure's unfolding has a generally slow pace and soundscapes merge into one another progressively, "with a beginner's mind and curiosity".[31] Dynamics develop within a mid-

[31] *Inner engines on a private trail* retraces the experience of a mindfulness session. Constant practice may suggest metaphors of the inner steps we have to walk inside ourselves. During meditation, all kinds of emotions are welcome, as long as the pressure of expectations is released. Every time we acknowledge that our mind is wandering far off, we can bring it back to focus on the present moment, paying attention to our individual "breathing spot". That helps to build mental strength. Similarly, in my piece, long episodes occur as attempts to embrace any feeling that may come about, even from strenuous events. Listening awareness is also a part of meditation, in a broad sense. Accordingly, sounds are introduced as unpredictable beings, appreciated with a beginner's mind and curiosity. That also reflects on the ambiguity of realistic versus imaginary or virtual sound behaviours, which unfolds in the headphones' private space. (Source: programme notes).

quiet range, with only one climactic point (07’32’’-08’32’’) when digital and concrete soundscapes spin around the listener’s head.

Spatial audio was another area of compositional elaboration. I used the IEM Plug-in Suite[32] in Reaper to spatialise audio in third-order Ambisonics. As most source media were taken with handy stereo recorders by Saari residents or myself during soundwalks and excursions, I applied the IEM StereoEncoder plug-in to relevant tracks (**Fig. 4**).

Guided imagery has been studied as a meditation technique that proved to ease anxiety in various contexts (Zemla et al., 2023). These basic mindfulness techniques informed my compositional design (**Table 3**), especially concerning the pace of soundscape transformations and textural changes. The sound of footsteps crushing dry leaves (e.g. 01’52’’; 2’18’’-2’35’’) acts as an anchoring breathing spot in the piece: a recurrent element that brings the listener’s attention back to focus after the listener’s mind has wandered for a moment, as it would happen in meditation. Footstep sounds also represent a separation formula that delineates sections and climactic points.

In terms of spatialisation, I intentionally created an unrealistic sound image for certain cues, such as the steps being almost always localised on or above the listener’s head. That procedure can be also seen as a sonic metaphor of transiting thoughts, hence the unusually localised steps in the ambisonic sphere.

[32] https://plugins.iem.at/ (Accessed: December 2024).

Sensory illusions may arise from within the composition – through resynthesis, the use of distance, and spatialisation means – and from the outer environment – when the listener would use open-back headphones.

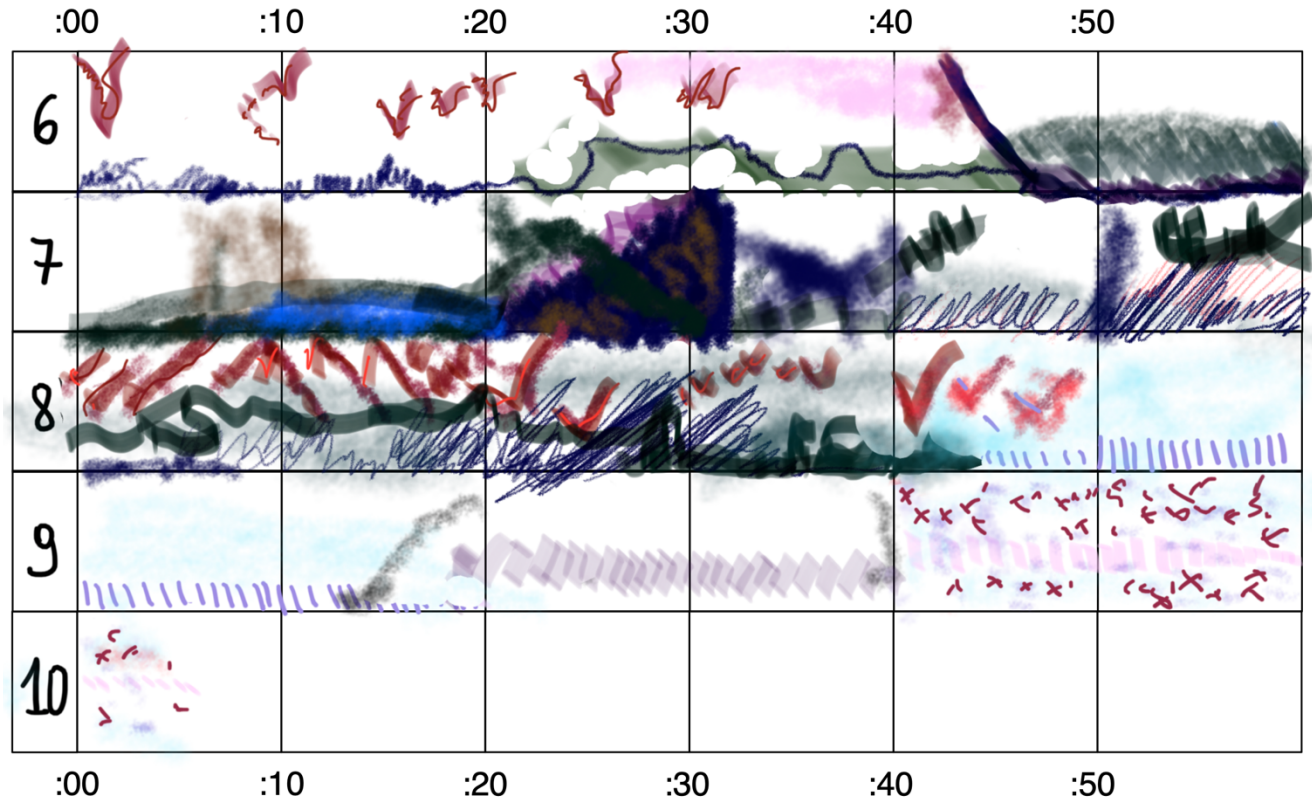


Table 3 – *Inner engines on a private trail*, graphic score (6' to end)

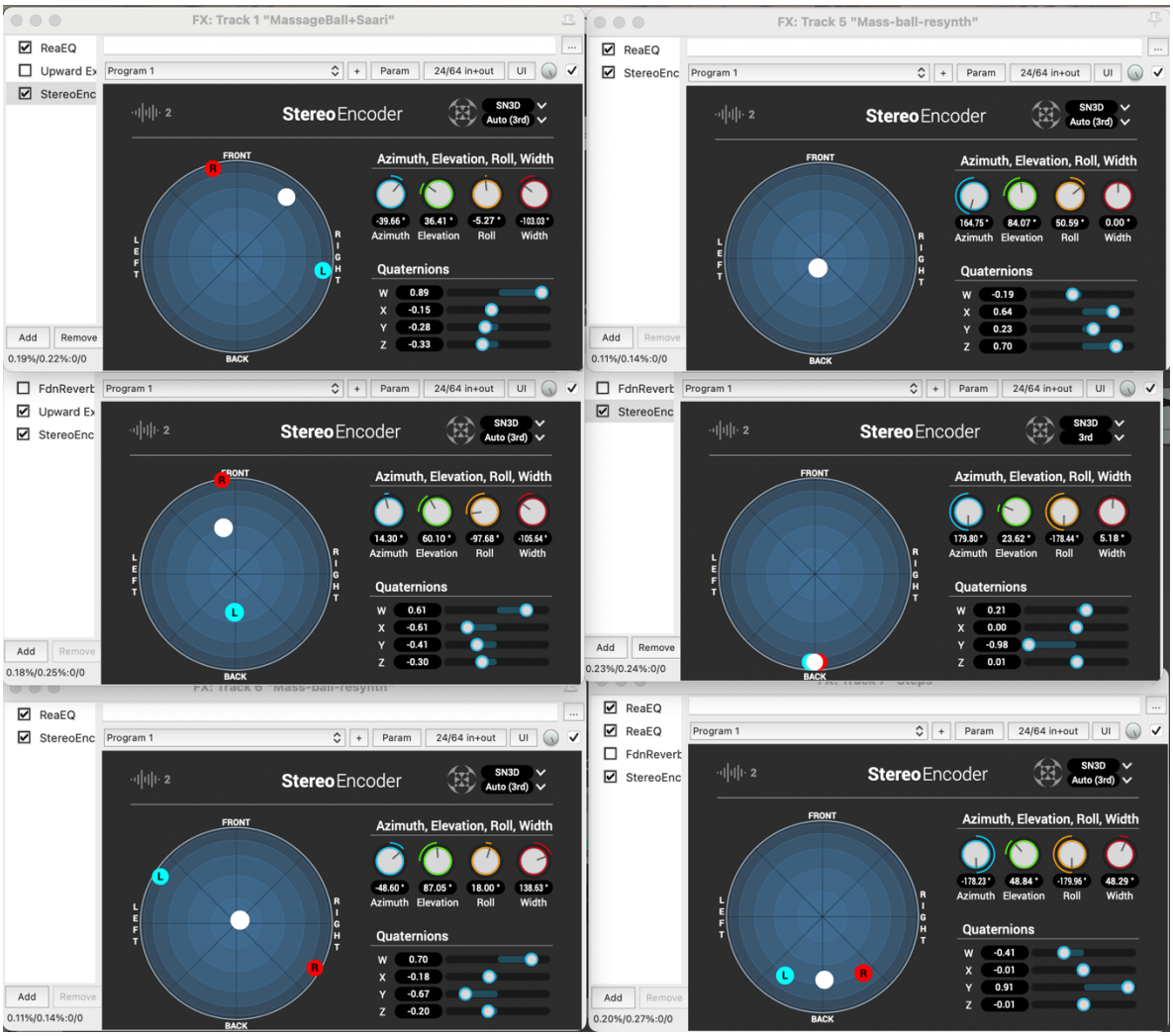


Figure 4 – *Inner engines on a private trail*, IEM StereoEncoder plug-in showing tracks 1-6 at 07’32’’ (climactic point)

2.3 A symphonic follow-up

– *Fondale mobile*

Instrumentation:
2 flutes (II also piccolo), 2 oboes (II also cor anglais), 2 Bb clarinets (II also bass clarinet), 2 bassoons (II also contrabassoon), 2 horns, 2 trumpets in C, 2 trombones, timpani (32", 29", 26"), percussion (tam-tam, bass drum, suspended cymbal, tubular bells, marimba), strings.

Duration: 10 minutes.

When compared to the other compositions in this chapter, *Fondale mobile* stands out as a symphonic follow-up on states of fluctuating awareness already mentioned. As the title suggests, *Fondale mobile* (in English, 'moving background') narrates the shapes of a fluctuating background in the orchestra. Specifically, I delved into textures that subvert archetypal orchestrating strategies, particularly those related to balancing dynamic weights and frequency-range considerations in melody scoring. In *Fondale mobile,* all crucial motivic and textural arguments develop in extremely low, low, or mid-register instruments. High-register instruments, usually devoted to melody scoring, serve instead the role of harmony, colour, and sustain. This compositional argument, first displayed in the 2019 version, aimed to spotlight regions of the orchestra that are traditionally relegated to bass function or concealed from the listener's attention.

The piece develops in five sections:

(1) Introduction and contrabassoon (percussion and air sounds, mm. 1-37);

(2) Travelling rhythms (mm. 38-143);

(3) Lyrical expansions and contrabassoon (mm. 144-161);

(4) Semi-reprise of (2) (mm. 162-183);

(5) Coda (mm. 183-203).

The most extensive formal developments are characterised by interlockings and elaborations of a simple rhythmic cell of semiquavers (illustrated in the 'Rhythms' row in **Tables 4, 5**), contrasted with more spacious textures of repeated notes and pulsating unisons ('Background sustained single note(s)' row in **Tables 4, 5**). Rhythmic elaborations in sections (2) and (4) also travel across instrumental families (mm. 38-143, 162-183 – **Fig. 6**). The introduction (mm. 1-37) anticipates the semiquaver rhythmic cell as unpitched or very low-pitched material, muffled by low glissando textures (**Fig. 5**).[33]

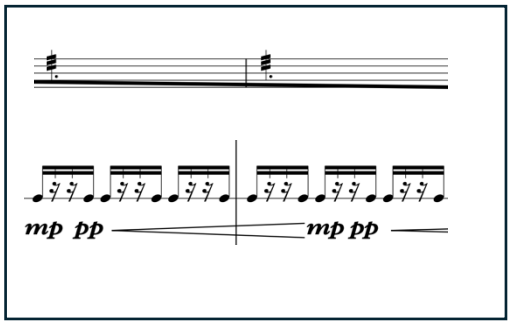


Figure 5 – *Fondale mobile*, rhythmic cell (mm. 9-10)

In composing this piece, I had the opportunity to reflect on the 4E music cognition framework: embodied, embedded, extended, and enactive (Ryan & Schiavio, 2019; van der Schyff et al., 2018). This 4Es suggest a holistic interpretation of music cognition, emphasising how interactions among the brain, body, and environment influence learning, listening, performing, and experiencing music. The prospect of conducting my own orchestral piece brought physical sensations into play, as it required me to communicate my music to the players (extended) through my bodily movements (embodied), and to shape the performance environment (enactive) within the broader

[33] The 'Introduction' section (mm. 1-37) was composed from scratch as part of the 2022 version of the piece.

social and professional context of the orchestra (embedded). I took these aspects into account during my compositional process; as a result, they influenced my musical decisions related to form, orchestration and transcription.

By connecting musical imagery and my performer experience (Clark et al., 2012), I could anticipate practical issues and solve them creatively in the design phase. That reflected, for example, in compositional choices like: (1) concealing (e.g. mm. 2-8) or (2) highlighting changes in the orchestration (e.g. off-beat chords in mm. 44-45, 52); (3) distributed entries when doubling in unison (e.g. mm. 145-156); (4) instants of composed chaos (mm. 92, 97, 109-110 – **Fig. 7**). These compositional devices not only made my conducting more organic and effective – such as by allowing preparation time in the music before vigorous arm gestures to cue a strong attack, or prior to sudden change in the beating, as in the already mentioned in mm. 44-45, 52, 92, 97, et sim. – but they also



Figure 6 – *Fondale mobile*, travelling rhythms example (mm. 53-58)

simplified and accelerated the rehearsal process. When I premiered the small orchestra version in 2022, [34] I could focus on clear musical outcomes such as ensemble cohesion, tempo, and expression, and rehearse specific excerpts effectively within separate instrumental sections. Therefore, the multidisciplinary approach I adopted in designing the new version of the piece contributed to a successful performance, even with limited rehearsal time.

Tables 4 and **5** illustrate micro-components of textural and formal developments.

Although *Fondale mobile* did not focus on eye-ear cross-modality or sensory illusions as closely as some other works in this portfolio, cross-modality was still a part of my compositional ecosystem by virtue of embodying the conductor throughout the composing process.



Figure 7 – *Fondale mobile*, m. 92

[34] The concert was recorded and broadcast on RAI Radio3 – Radio3 Suite.

Table 4 – *Fondale mobile* (2022), analytical view (mm. 1-143)

Coloured cells indicate the presence of main developing textures (first column), in correspondence with measures (second row). Vice versa, uncoloured/white cells are used when a texture is not present.

TEMPO	92	72	50	92	Accel ... Rall...	92	Rall...	72	92	Accel ... Rall...	92	72	92	72	92	72	92
Mm.	1	2-32	33-37	38-40	40-43	44-60	61	62-65	66-72	72-73	74-101	102-107	108-110	111-123	124-125	126-129	130	131-139	140-143
Rhythm									DEVELOPING TEXTURE										
Percussion			Timp. + B.D.			Timp. + Mar.		Mar.			Timp. + Mar. / T.t.	Timp. + B.D.	T.t.		B.D.		T.t.		
Glissando																			
Low strings		mm. 1-25																	
Cbsn solo																			
Plucked strings																			
Repeated notes								Fl + Ob Bsn I,II + Tr I, II											
Background sustained single note(s)																			
Air sounds																			
Loud, sudden Tutti											m. 92, m. 97								

Table 5 – *Fondale mobile*, analytical view (mm. 144-203)

Coloured cells indicate the presence of main developing textures (first column), in correspondence with measures (second row). Vice versa, uncoloured/white cells are used when a texture is not present.

TEMPO	50	92	50	72	92	Accel... Rall...	92	Accel...	108	50
Mm.	144-161	162-163	164-167	168-174	175-181	182-183	184-188	189	190-200	201-203
	DEVELOPING TEXTURE									
Rhythm										
Percussion		Timp. + Mar.		Mar. / B.D.	Timp. + B.D.	Timp.	Tubular Bells + Timp.			B.D. + Cym.
Glissando										
Low strings										
Cbsn solo	(/ + Cor Anglais + Horn I + Violas)		(Repeated notes)							
Plucked strings										
Repeated notes										
Background sustained single note(s)										
Air sounds										
Loud, sudden Tutti										

With *Their wings have eyes*, *Inner engines on a private trail*, and *Fondale mobile*, I have summarised my principal areas of expertise and investigation, regarding instrumental soundscaping, electroacoustic composition, and writing for orchestral forces. More explicit correlations between auditory or visual cues and existing or recalled sensory inputs have matured in later years of my PhD. These will be exposed in the subsequent chapters.

3. CROSS-MODAL APPROACHES

This chapter presents my approach to cross-modal stimulation and its applications into compositional practices. In the following two pieces, I focused on constructing audiovisual ambiguity through retrospective revelations to the audience and gesture-sound misalignments.

3.1 Retrospective revelations to the audience

– Those who have the right to yell – won't

Instrumentation:
flute, violin, viola, double bass, tape.

Duration: 12 minutes.

Those who have the right to yell – won't (2021) was commissioned by the Eutopia Ensemble[35] as part of their concert season 'Grido – Le Strade del Suono 2021', commemorating the 20th anniversary of the 27th G8 summit. Held in Genoa in 2001, that summit was marked by extreme brutality against protesters, classed as human rights violations.[36] The extra-musical premises for this commission were crucial to my writing process and compositional decisions about staging, techniques, arguments and form. My reading of the theme of the protest contemplated both visual and sonic features. In

[35] A YouTube video of the premiere is available: https://www.youtube.com/watch?v=8hlNO4jAxKw (Accessed December 2024).
[36] Amnesty International, " Genoa Policing Operation of July 2001: A Summary of Concerns," AI Index: EUR 30/012/2001 (November 1, 2001), https://www.amnesty.org/en/library/info/EUR30/012/2001/en (Accessed December 2024).

sounds, I used the concept of heavily unbalanced textures to symbolise ideas gaining their power from repeated aggressive outbursts rather than from their originality or potential for development. In addition, I wanted to translate such disproportion between dynamic presence and musical relevance into a physical experience for performers and audiences. To do so, I separated the ensemble into two subsets, situating one player before and three behind a large room divider on the stage (**Fig. 8**). With this ensemble partition I was pointing to the physical and emotional fracture between visible and invisible abuse, assault and reflection.

As per the performers' visual disposition, the flute player is the only one in the front-facing position, standing theatrically between the divider and the audience. A stereo pair of speakers is placed along the same line. Therefore, flute and speakers act as a duo, and their sound material tends to be strongly intertwined. This bond is particularly evident in the first section, where the electronics consists of an eventful and oversaturated collage.

Short samples of protest noises were taken from riots in Italy (namely shoots from the G8 in 2001 in Genova, and the more recent 'No-green-pass' mob in Rome),

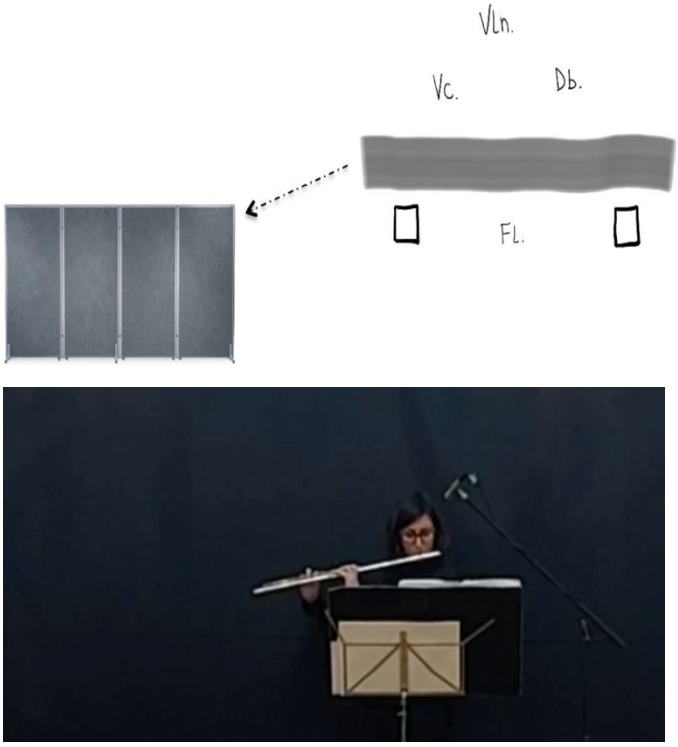


Figure 8 – *Those who have the right to yell – won't*, staging scheme

France (July 2021, against the health pass), and Brazil (May 2021). The samples' selection criteria were merely artistic. The collage resulted in rhythms, percussive reverberations and distorted slogans, condensed in a representation of busy and violent sound environments.[37]

The formal arch of the composition consists of three sections: (1) loud and reckless reiteration of seven couples of foreground and background musical events, physically situated before and behind the dividing screen (mm. 1-152); (2) a peak, signified by the string trio texture emerging from the electronics (reh. G-H); (3) a terminal section, fading over, shadowing a quieter field recording (reh. H to end).

Most of the pitch material in this composition derives from the recordings utilised in the tape. Extended techniques are used to connotate soundscapes' expressively through instrumental means. The following paragraphs will discuss considerations regarding the sources selected for composing the electronic track, their correlation to instrumental soundscaping, and the piece's structure.

3.1.1 Foreground and the invisible

In line with the partition idea, I handled the music material in opposite ways for the two instrumental groups. While violent, fast and repeated attacks hit from the electronics

[37] Two years after this piece, I produced another attempt at dealing with spectral saturation using the same material in *Un fiume in pena* (2023). Keeping a nearly identical form, I removed the electronic track and substituted it with percussion (hence a flute + percussion duo); strings were changed into bass clarinet and trombone (see Portfolio Appendix).

and the solo flute in the foreground, the concealed string trio in the background plays gentle, slow, and soft gestures. Sounds with a complex spectrum, aggressive attacks and buzzing components, such as multiphonics, percussive air sounds, and singing in the instrument are privileged in the flute part. The profile is kept very similar across the repetitions. Every time the flute and electronics stop abruptly, there is a timid interpolation from the string trio. The start of each fragment is unperceivable and obscured by the intensity of musical events in the foreground; conversely, each subsequent attack from the foreground cuts off the elaboration in the background and behind the stage divider.

Because of extreme dissimilarities of dynamics and juxtaposed materials, both groups equally attract the ear's attention (Bregman, 1990; McAdams & Giordano, 2015). Amplification also played a role in blending sound qualities and impacting the localisation of the original sound sources. From the public, much of the visual content in the performance is blocked and overpowered by the scenic prominence of the flute; sensory illusions result, as audiences can only see the flute player in front of the opaque screen, visually and musically standing alone as a leader/dissenter. The three hidden players are revealed to the audience only at the end of the concert.

An element that subtly insinuates in the electronic texture, from the beginning of the piece through the climactic point, is a factory siren I recorded in Montmartre, Paris, in 2017. This siren produces a long-sustained sound, followed by a downward and upward glissando covering a minor 7^{th} (with microtonal approximations – **Fig. 9**). The main climactic point of the piece corresponds to the siren's orchestration in the string trio

texture. That does not necessarily synchronise with the actual siren in the tape (mm. 152 & following – **Fig. 10**), although the same pitches and oscillations are played. Glissandi are, in fact, the foundation of all musical materials developed in the string texture. I proceeded with the glissando's progressive widening by enlarging the intervallic cells: commencing with a minor 2nd transformed then into a 3rd and 4th, ultimately 5th and 6th. Minor and major intervals are intersected or alternated (e.g. mm. 84, 105), with occasional recapitulations of subsequent intervallic cells (e.g. m. 125, with the undulatory glissando from major 3rd to minor 6th in the double bass). Starting from the lowest possible pitch in the respective range of each instrument, mixed with non-harmonic sounds (e.g. m. 24), the highest pitch reached in each section becomes the starting point in the following section. This reflects a design in which all the parts are progressing steadily and organically from low to high register.

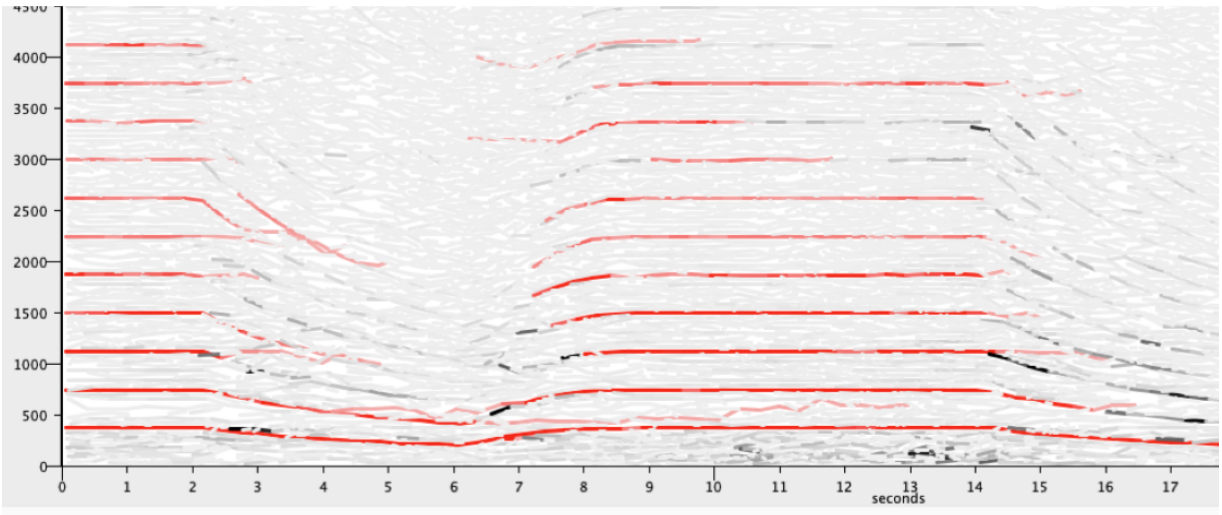
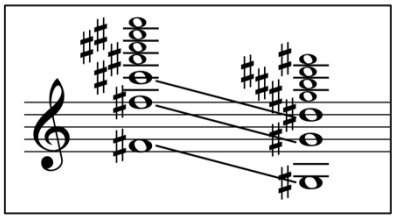
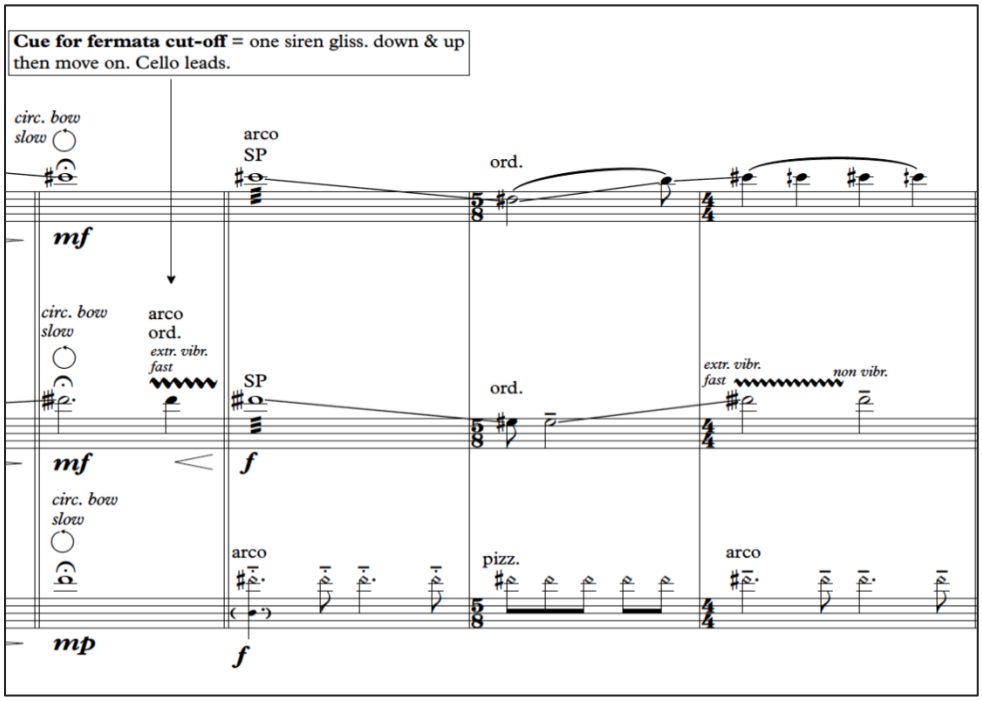


Figure 9 – factory siren: spectrogram

Figure 10 – factory siren: melodic outline and orchestration





After the climactic expansion in the second half of the piece, an environmental recording of very different quality is introduced, with fade-in and fade-out curves that gradually and slowly increase and decrease over several minutes (**Table 6**). At this stage, there is no strict synchronisation between live instrumental and recorded events, and the notation reflects more spontaneous interactions based on reciprocal acoustic cues. Especially toward the final fade-out of the audio track, the bass flute and double bass react to each other's phrasing on a single note, following the flow of the recorded audio without willingly counting to synchronise. The entire duration of the piece would not vary, but the organisation of details in the last measure is delegated to the performers who do not share eye contact.[38]

[38] A principle I later expanded in *Resight*. See §§ 4.2.1-3.

Table 6 – *Those who have the right to yell - won't*, analytical view

pt. 1: violent outbursts

Measures														
Tape	1-23	-	25-44	-	46-62	-	64-83	-	85-104	-	106-124	-	126-160 ca.	-
Flute	2-23	-	25-44	-	46-62	-	64-83	-	85-104	-	106-124	-	126-150	-
outburst n.		1		2		3		4		5		6		7
String trio	~	24 (15")	~	45 (15")	~	63 (15")	~	84 (15")	96	105 (25")	~	125 (25")	~	𝄐 150-152
Cue	Sounds of protests								Bartok pizz.	Sounds of protests				Civil siren (m. 152)

pt. 2: post-siren mediation

Measures														
Tape	(continues into soundscape) - 179													𝄐
Bass flute					175 (25"ca.)		176 (15"ca.)			177-179 (40"ca.)				𝄐
String trio	153-173		174 (15"ca.)		-		176 (15"ca.)			-		179		𝄐
Cue	(siren continues)				for strings cut-off = bass flute solo		for strings = bass flute trill after repeated lip pizz.		for strings cut-off = bass flute harmonics after repeated pizz.		strings start synchronised ad lib.			

3.2 An imaginary sensory object

– *Crumpled Questions*

Instrumentation:
flute, clarinet, percussion (susp. cymbal, thunder sheet, bass drum), piano, violin, cello.

Duration: 4 minutes.

I continued to explore extended instrumental timbres and soundscape orchestration in a short-duration miniature composed for the University of Birmingham New Music Ensemble. The musical subject originated from an imaginary sensory object: a crumpled sheet of parchment paper, with text and music written on it, presented in an imaginary warped structure and barely decipherable. Mental imagery according to the Stanford Encyclopaedia of Psychology,[39] is defined as an involuntary act of "representation that results from perceptual processing that is not triggered directly by sensory input." Hence, I imagined the experience of touch and vision as recalled sensory inputs for music making. *Crumpled Questions* (2022) draws, in sound, an observation of such imaginary object, seeing/listening to its contour, textures, colours, angles and rough edges. Furthermore, I included my own reflections as spoken words and quoted existing music as a representation of meta-musical creativity in my practice.[40] Invisible and imaginary visual suggestions flow through this piece.

[39] https://plato.stanford.edu/entries/mental-imagery/

[40] Meta-musical (or metamusical) creativity is being studied in terms of composers' careers (McArton, 2022).

The kernel of the piece was an extremely quiet and fragile sound obtained by preparing the piano with a long jute rope tied to the lowest C string. The unmeasured and continuous gesture of pulling the rope gently and sliding fingernails through its end also has a visual component. That, combined with the piano resonance pedal, produced a barely audible base-layer. The quiet buzz could be easily associated with low-frequency environmental sounds and misinterpreted as part of the surroundings rather than the music (e.g. mm. 14-20). In contrast, the pianist's gestures along the rope are visually impactful and occupy a sizeable part of the stage (**Fig. 12**). That misalignment of volumes and gestures may suggest that what is visible is not audible.

Spoken words in the flute mouthpiece (mm. 21-28; 36-44; 54) also constitute profiles with accents and tones following the text.[41] The instrument creates a mechanical filter and distortion to the performer's voice. This texture produces a contrasting effect to that created in the piano: it may suggest that what is audible is not visible (i.e. a wind player speaking in the instrument).

Motivic materials are disguised within textures through (1) fragmentation (e.g. flute and clarinet, mm. 23-24; 29-32; 51, et sim.), (2) playing techniques (e.g. violin and cello mm. 38-47), (3) use of extreme regions of instrumental tessituras (e.g. piano mm. 47-51), and (4) all these methods combined (e.g. mm. 49-51; 58-66 – **Fig. 11**).

[41] Words used are from one of my conference paper drafts, to signify the intersectionality of extra-musical and meta-musical sources in my practice.

Figure 11 – citation and motivic fragmentation in *Crumpled Questions*

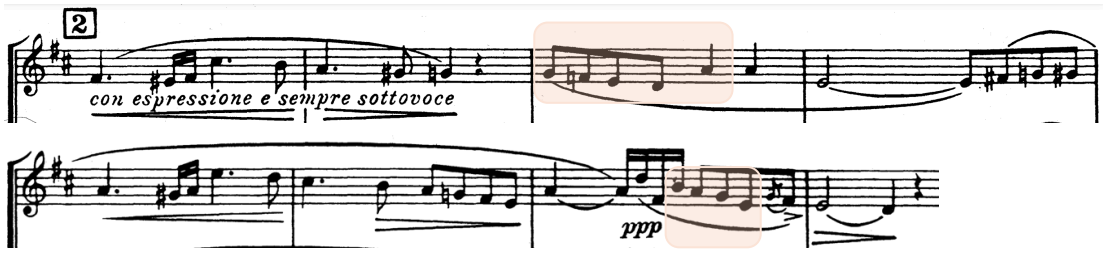


Fig. 11a – G. Verdi, *Un ballo in maschera* (1861), Preludio. Milano, Casa Ricordi (mm. 27-34, Fl)



Fig. 11b – G. Verdi, *Un ballo in maschera* (1861), Preludio. Milano, Casa Ricordi (mm. 35-39, Vln I)

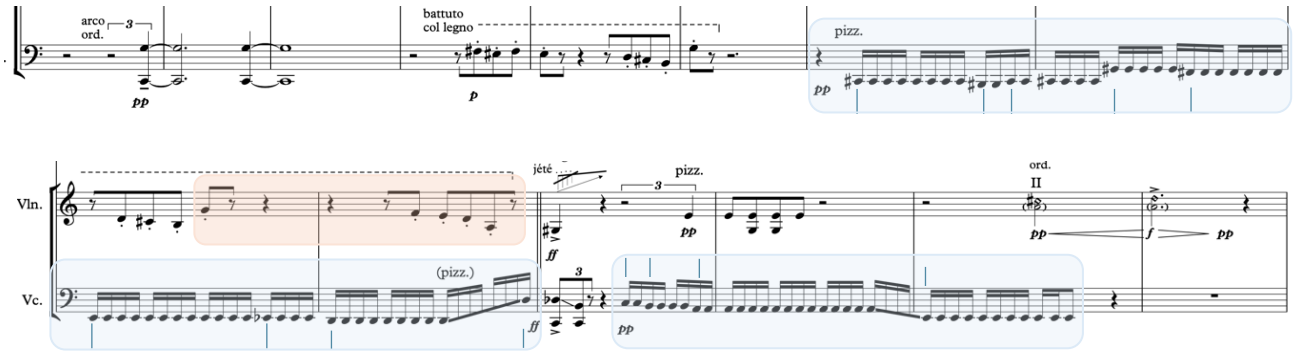


Fig. 11c – fragmented quoted melodies in *Crumpled Questions* (mm. 35-48, Vln, Vc)

Another significant element of contrast in the piece is the piano solo digression (mm. 52-57): this code-switching moment introduces a sudden shift in timbral qualities and musical style, creating a rupture in the formal structure. The overall cross-fading design within different instrumental groups – which had been systematically repeated in the previous sections – is interrupted here. The pianist transitions from playing in the soundboard to a more conventional 'cadenza' on the keyboard. In the context of extended techniques and orchestration of inharmonic sounds (e.g. the buzzing rope and spoken voice), this shift added a layer of unmet listening expectations to the formal development.



Figure 12 – piano + rope technique demonstration

Given its short duration, *Crumpled Question* provided an ideal framework for experimenting with imaginary sensory objects and their translation into sound objects. As demonstrated, the piece included numerous and diverse sonic features, as well as meta-musical and extra-musical references. In the next chapter, I will further explore meta-musical aspects in larger-scale compositions.

4. SENSING INVISIBLE BORDERS

In the third year of my research, I had the opportunity to compose a mixed-media opera – *Radice Posizione Distanza* (2023) – sponsored by the European Capitals of Culture (ECOC), European Festivals Fund for Emerging Artists (EFFEA), GO! 2025 Nova Gorica-Gorizia, along with other international partners, and Piccolo Opera Festival where the world premiere was hosted. This project was configured as a transnational collaboration focused on the territories intersected by the Italian-Slovenian border, to embrace the region's liminal socio-cultural identity and natural heritage. In the same year, I was also invited to write a composition for string quartet and electronics – *Resight* (2023) – centred on the theme of memory. The Ligeti Quartet premiered the piece at the CrossCurrents Festival in Birmingham, recorded and broadcast on BBC Radio3, and subsequently performed it again in Colombia's largest cultural venue, Centro Nacional de las Artes of Bogotà.

Both the opera and the string quartet incorporate similar dovetailing of pre-recorded and live material, namely in dealing with perception and transfiguration of places. Most importantly, auditory cues play a generative role in the musical development, while affecting mental and emotional recollections of space. I will examine the two works in the same chapter as they have these crucial aesthetical matters in common.

4.1. Embodied territories

I started my collaboration with Piccolo Opera Festival and the GO! Borderless Opera team with a short residency in January 2023, to gain first-hand impressions of the territory of Gorizia/Nova Gorica. The region embodies a unique and complex mix of socio-historic imbrications from Austrian, Latin and Slavic cultures since the foundation of Gorizia in 1001. In celebration of the twin cities' appointment as European Capitals of Culture 2025, several commissioning institutions encouraged initiatives concerning relevant themes such as multilingualism, landscape, local history, borderless identities, folklore and green innovation. Besides consulting historical and literary sources[42] about the unsettled national border's chronicles, I visited several cultural landmarks: among them, the Museum of the Border at Valico del Rafut, Gorizia's Museum of the War, Solkan Bridge over the Soča River, Trg Evrope/Piazza Transalpina, and the Parco Basaglia ex-asylum (**Fig. 13**). Given my artistic focus on perception and my research-oriented approach to composing, I felt the need to develop an original storyline and self-authored libretto for my opera, rather than modelling the plot on any existing play or biography.

Initially, I was debating whether to build a dramaturgy based on the life of the Slovenian-speaking musician Lojze Bratuž (1902-1937), who was poisoned by a group of Fascists (Kacin-Wohinz, 2004). The philosopher Carlo Michelstaedter[43] (1887-1910) and his poems were also relevant to the picture of Gorizia I was reconstructing for my opera.

[42] Primarily in Italian.

[43] In Gorizia's monologue (*Radice Posizione Distanza*) I quoted Michelstaedter's poem *Alla sorella Paula* (1905-1910).

Later, I found an undeniably promising inspiration in the dismantlement of Gorizia psychiatric hospital in the 1960s and associated matters, such as the alleged sanity/insanity distinction in the framework of post-war traumas. Oppressive treatments were used on long-term psychiatric patients in Italy until the 'Basaglia Law' of 1978 was approved.[44] In fact, Franco Basaglia's activism in Gorizia instituted community-based therapeutic methods to rebuild the patients' dignity, eventually leading to the general ban and closure of asylums in the country (Badano, 2024). Still nowadays, Gorizia ex-asylum's back fence coincides with a segment of the border, fact that, in my view, could be emblematically linked to the points of Franco Basaglia's psychiatry reform and the anti-asylum movement, and offer interesting scenarios for operatic innovations.

Based on these considerations, I started formulating ways to transform perceived borders and their effects into experimental music dramaturgies, especially considering the integration of natural, civil, psychological and psychogeographical elements. When visiting the town and surrounding locations, and listening to conversations among locals, I noticed an intricate stratification of cultural influences, intertwining the most ancient roots with modern history and relatively recent events, with unresolved divisions in the community and orientations in continuous progress. That reinforced my idea of representing Gorizia (mezzosoprano) not just as a city, but also, and mainly, as a

[44] The Italian Law 180 of 1978, also known as the 'Basaglia Law,' brought significant reforms to mental health care, resulting in the deinstitutionalisation of psychiatric hospitals. Among the outcomes of this law was the discharge of psychiatric patients from mental hospitals, who were then cared for either in newly established community services or at home. Additionally, compulsory treatments were greatly limited and managed in public hospital only under specific and strict circumstances, and no new patients could be admitted to existing mental hospitals or new mental hospitals could be constructed.

psychotherapy patient facing frequent identity crises. The opera stages a therapy session in three scenes. Within them, I worked on portraying trauma triggers using auditory cues, which I then manipulated to shape form and orchestration. To mirror the personification of the city, I introduced the character of the psychotherapist as the only other role in the opera, named Dr Reka (bass), after the Slovenian word 'reka' for 'river'. The Soča River (i.e. Fiume Isonzo in Italy) was long contemplated as a charismatic manifestation of a natural border, war witness and companion by artists, poets and historians belonging to the region. Similarly, the character of Dr Reka acts as a solid boundaries-holder, flowing in its riverbed unaffected, and still able to bring submerged memories to surface, towards the unification of a (psychological) landscape.



Figure 13 – scenarios from Gorizia

From top left to bottom right: Ex-Ospedale Psichiatrico Provinciale di Gorizia (Gorizia ex-asylum); Solkan Bridge over the Soča River; Parco Basaglia ex-asylum, back fence tracing the national border; commemorative plate lying on the Italian-Slovenian border and former Iron Curtain in Trg Evrope/Piazza Transalpina, Nova Gorica

4.1.1 *Radice Posizione Distanza*

Characters and Voices:
Gorizia/Nova Gorica (mezzosoprano, also actress), Dr Reka (bass).

Instrumentation:
flute (also piccolo, harmonica in Bb, slide flute), oboe (also slide flute), Bb clarinet (also Bb bass clarinet with bell preparation, slide flute), bassoon (also contrabassoon, slide flute), horn in F, trumpet in C + harmon/wah-wah mute (also slide flute) trombone (+ harmon/wah-wah mute), tuba, percussion 1 (crotales + bow, hi-hat, ratchet, sack of glass, timbales, snare drum, bass drum), percussion 2 (tubular bells, sizzle suspended cymbal, tam-tam + bow, woodblocks, marching machine, slapsticks), grand piano with preparation + electronics (stereo, fixed media), violin 1, violin 2, viola, cello double bass.

Duration: 30 minutes.

Opera making matured as one of my main specialisms since the earliest stages of my education in Rome. I approached the creation of *Radice Posizione Distanza* (2023) having a substantial familiarity with operatic writing, music dramaturgies and authoring or co-authoring librettos, previously exerted in *Il Rubinetto* (2012) and *On-Off* (2016-17) at the Teatro dell'Opera di Roma. My experience conducting and accompanying numerous operatic titles also guided my path and instincts, as I will explain in further detail.
The title, in Italian, *Radice Posizione Distanza* can have multiple meanings and translates into English as "Root Position Distance." I chose these words for they can relate to cultural, historical, social, and even geographical *roots*, while also alluding to somatic and psychological notions of *distancing*, *positioning* oneself toward the perceived *root* cause of traumas. Shifts in perspective, like those evoked in the title, encapsulate all the musical arguments in this work. The three words are intentionally written without punctuation, as I wanted to imply these feelings and concepts could be equally effective

if stated in reverse; they are expressed in alternating order along the dramaturgical progression, and any one of them could suddenly come to awareness or sensation at any point in the opera.

Straus examines “musical narratives of balance lost and regained” as a thread of disability in music. He argues that the war, even when the composers themselves are not disabled, engenders a pervasive experience of disability that influences their compositions (Straus, 2011). Understanding post-traumatic disability in crafting a music dramaturgy was a key aspect of my plan for realising this opera.

In presenting Gorizia city/woman’s multiple identities, I used Italian language, with some Slovenian, Friulian, German and Croatian inserts.[45] That served the purpose of tracing a collective and multipotential entity[46] in one single personification, simultaneously whole and fragmented, talented and oppressed by an overabundance of viable paths. To highlight correspondences between history, traumas, theatrical actions, words and orchestration, I based climactic points and sudden musical outbreaks (or tantrums) on the words ‘troppo’ and ‘preveč’, meaning ‘too much’ respectively in Italian and Slovenian, paired with sounds retrieved during my artistic residency. In structuring my characters

[45] With the supervision of the linguist Metka Malčic, University of Primorska, and the polyglot dramaturg Igor Pison.

[46] In psychology, multipotentiality theory has been studied for decades, mostly with respect to career choice and stress (Acter, Lubinski, and Persson Benbow, 1996).

and dialogues, I was also inspired by the model of Basaglia's narration in *L'istituzione negata* (1968).[47]

Since the casting progressed in parallel with the award of this commission, there was a possibility to collaborate with the artist Giulia Diomede, who trained as a classical actress beside singing, and thus had a considerable experience in combining singing and reciting voice control. I took this chance to customise Gorizia's part, incorporating the interpreter's skills into my narrative building: I aimed to interlace the fluidity of spoken sections with singing to enrich the expressive depiction of borderless identities.

Sensory illusions in this opera expand from the mental and emotional state of the protagonist, and relate to singing styles, as well as orchestration and dramaturgical choices, such as the composition of electronic cues with civil defence warning sirens. It is worth mentioning that the original location for the premiere was outdoor in Trg Evrope/ Piazza Transalpina in Nova Gorica, precisely by means of a raised stage along the former Iron Curtain. While it was eventually impossible to realise this plan, its liminal connotation greatly influenced and matched my dramaturgical focus. In other terms, my musical treatment of auditory cues was conceived for such site-specific staging, which was envisioned an affective counterpart surrounding the audience with present implications of the border.

The following paragraphs delve into such points and key phases of my creative process.

[47] Although Basaglia did not develop a specific type of talking therapy, his approach focused on engaging in dialogue with patients to encourage their freedom of expression, decision-making ability, and participation in the wider context of their care (see p. 51 of this commentary).

4.1.2 From maps to stage

The actual composition of *Radice Posizione Distanza* had a rather concentrated progression. Following my short on-site residency, I completed subject ideation, research and planning over a couple of months (January-March 2023), when I also sketched part of the dialogues for the libretto. At this stage, I engaged in language mentoring with the linguist Prof Metka Malčic, and in feedback sessions with the dramaturg Igor Pison to discuss context, advancements and efficacy of my dramaturgy. Subsequently, I spent two months composing the music, which I did directly in full score (March-July 2023). Finally, I revised and prepared all the necessary rehearsal and performance materials. This commission gave me the opportunity to reflect on what Italian and European identities signify to me, my origins and my artistic orientations. As part of my recognition of the background contexts, through artistic and literary sources, I went through and other composers' approaches to personification of places in contemporary musical contexts. I pondered the use of *Musicircus* principle in John Cage's *Apartment House 1776* (1976) and that of instruction scoring in Dmitri Kourliandski's *Maps of Non-Existent Cities*. *Saint Petersburg* (2015). The elements of psychogeography and dissemination resonated with my interests; still, I needed to keep investigating Gorizia's own genius loci for integration in a bespoke musical form. Recent interdisciplinary studies on urbanism and landscape's aesthetic also contributed to finding my unique approach to perceiving cities as compositions (Catucci & De Matteis, 2022). Another tangential reference has been Italo Calvino's novel *Invisible Cities* (1972), particularly the parallel between cities, their personalities and the writer's outlook through them (Calvino, 1983).

I invested a considerable amount of pre-composing time in discerning my central purposes and non-negotiable structural elements, and their expression throughout composing techniques and in relation to my research interests. I found that developing my subject narrative from scratch facilitated these objectives.

With respect to my research interests and considering the results of my discovery phase about Gorizia, I realised that pursuing a character-driven narrative could offer more opportunities than a plot-driven structure for focusing on sensory stimulation in the music, contemplating genre experimentations and variations on these topics. However, this entirely composer-led approach entailed complex studies and theatrical decisions, given the lack of any pre-existing prose or dialogic configuration. Hence, my central question became how to mirror auditory hallucinations, places personification and psychotherapy in a convincing experimental opera structure. To resolve such dramaturgy matters, I primarily used mind mapping as a self-reflective method[48] to better understand my practice generally, and in this case, to visualise character development and conflicts, references and underlying connections. Mapping the dramaturgy also allowed me to keep significant musical elements in focus, and to ask myself direct questions, such as: 'what is the orchestra?' – whose answer is, for obvious reasons, in the music-making (**Table 7**).

[48] About mapping and visualisation of compositional processes, see Wiggins (2007).

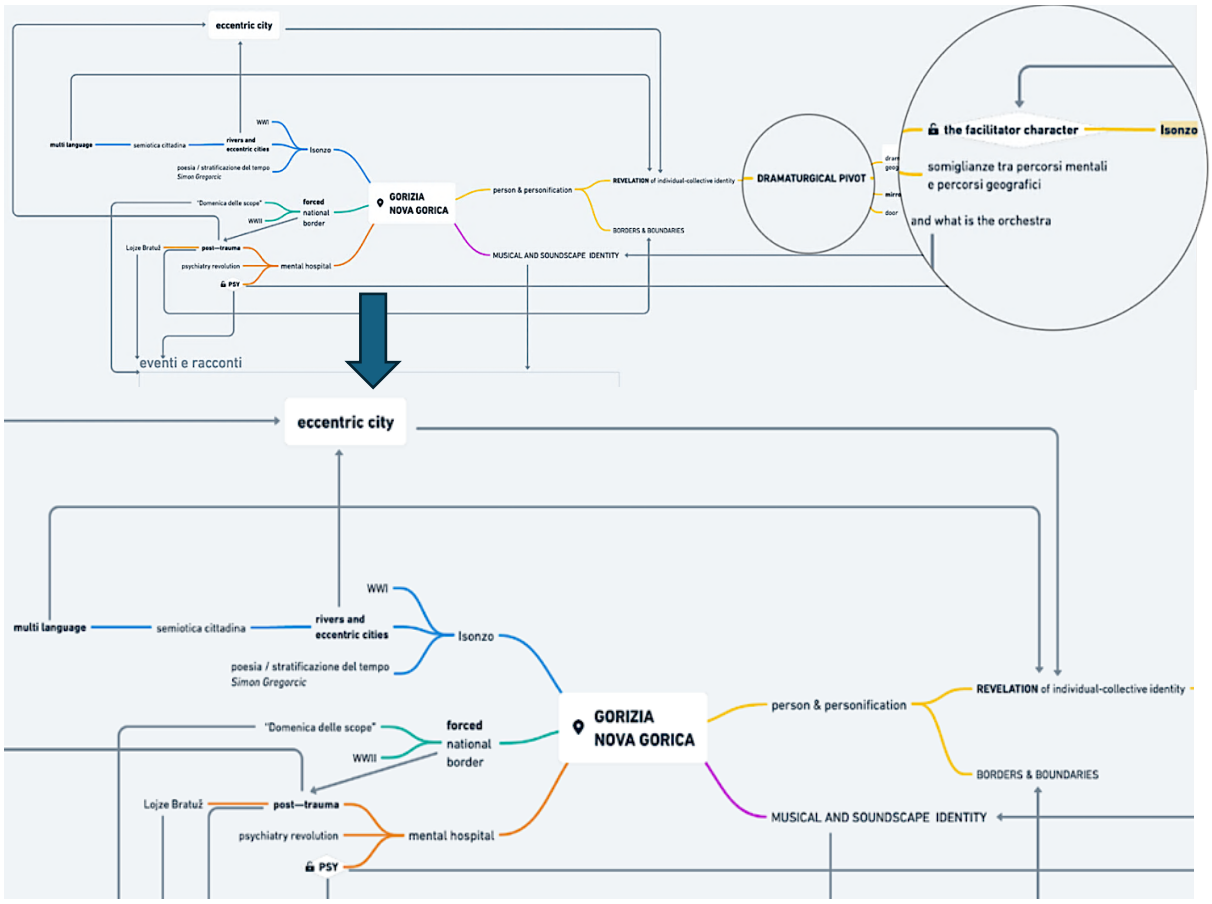


Table 7 – *Radice Posizione Distanza*, mind map of themes and characters

At this point, I began to think of this opera as a map itself, with multiple thematic ramifications and time layers; I started forming intuitive associations between sonic identities, theatrical effects and desired outcomes in terms of perceptual stimulation of the audience. In practice, that meant defining characters by differentiation of wording, singing styles and other musical features. I manipulated instrumental and electronic sounds to connote fragments of Gorizia's war memories and trauma triggers, be they actual sounds happening in the orchestra or ominous earworms.

The meaning I associated with earworms in the opera is that of the eternal song in the brain, derived from excessive exposure to that melody (Killingly & Lacherez, 2023). In this

sense, auditory cues have a generative function in the composition: musical developments revolve around sound identities and scored sound calls provoke reactions. Given that dramatic arguments are based not in vision but entirely in sound, *Radice Posizione Distanza* could virtually be interpreted as a radio drama or adjacent genres without any loss of information and efficacy.[49] The protagonist often reacts to ensemble's sound more than she reacts to the psychotherapist's observations, even when she gradually becomes more aware and accepting of Dr Reka's support. In the second scene, for example, Gorizia exclaims "Non la sente? Non la sente? Non è solo una canzone!"[50] referring to the melody cursing her from the ensemble: by insistently asking the doctor whether he is also able to hear that tune, she is trying to validate her sensations. The bass Dr Reka, on the other hand, embodies a facilitator, who helps navigating the uncharted territories of Gorizia's mind and ears; his role is never musically striking, but rather an unchanging and anchoring part accompanying the patient's recovery.



Figure 14 – on stage: prologue, crisis and phone call

[49] Excluding the opening prologue, crisis and phone call.

[50] Quote from *Radice Posizione Distanza*, mm. 230-234. The passage translates into English as: "Can you hear it? Can you hear it? It's not just a song to me!"

For the writing style and themes in Gorizia's spoken monologue, I drew inspiration from 'DAS EUROPA DER FRAU' in Heiner Müller's *Die Hamletmaschine*[51] (1977), which also implied further links with the European Capitals of Culture themes. Another aspect that guided my theatrical and compositional decisions in the music and the libretto resided in the ambivalent use of grammatical genders, homographs and homophones across different languages. Just to mention an example, the word 'pena' exists in Slovenian and Italian, with different meaning, identical spelling and pronunciation. 'Pena' can mean 'misery', 'pain', or 'penalty' in Italian, but also 'foam' in Slovenian. As Gorizia speaks several languages in the opera, this word is recurrent in her monologue, assuming multiple directions and meanings interchangeably, including as an onomatopoeia for civil defence sirens.[52] Another keyword is 'river', which is feminine in Slovenian. In fact, the ode *Soči* by Simon Gregorčič, the Soča River is celebrated as a beloved girl and 'daughter':

Krasnà si, bistra hci planin,
brdkà v prirodni si lepoti,
ko ti prozornih globocin
nevihte temne srd ne moti,
krasnà si, hci planin![53]

[51] As this text inspired a huge number of intellectual figures in Europe, contributing to the modern European identity, it is probably worth mentioning other composers who referred to it in their staged or vocal works. *Die Hamletmaschine Oratorio* (2000) by Georges Aperghis is composed on the original text by Heiner Müller; *Die Hamletmaschine* (1983-86) by Wolfgang Rihm, has a libretto written by the composer and based on Müller's play.

[52] 'Né fuggire, né possedere. La salute, come un fiume in piena… O fiume in pena?… Pena. Pe-na-pe-na-pe-na-pe-na-pe-na… (*come imitando un allarme*). Schiuma dunque. Pena dalla bocca - il dolore, perché: sapore di olio motore.' (*Radice Posizione Distanza*, full score, p. 36)

[53] An English translation (unknown translator) of *Soči* is available on the Encyclopaedia of Romantic Nationalism in Europe website. https://ernie.uva.nl/viewer.p/21/56/object/351-224025

The hypothesis of the city-woman Gorizia having a daughter-river seemed to hold a powerful dramatic potential. Hence, I transformed this poem into a low-fi recording and turned it into the river's voice carrying the final revelation in the opera (mm. 330-382).

In summary, the dramaturgy involves a Stage-Ensemble-City sonic interplay. The table below (**Table 8**) illustrates a retrospective analysis of macro and micro sections of the overall formal arc, with mental symptoms progressing from severe crisis to awareness. Coloured cells indicate musical episodes with electronic audio.

Scene 1	**Gorizia's symptoms [*radice*]**			
	O Gorizia tu sei maledetta			
	prologue: stage crisis — emergency call	1st defence sirens and song outburst	Fanfare/war calls/Furioso	song refrains in disguise
	m. 1 (~ 2'45"-3')	mm. 2-10	mm. 11-80	mm. 81-101
Scene 2	**Processing stimuli [*posizione*]**			
	Dr Reka's arrival	psychotherapy session pt. 1: trauma triggers		
	inner voices fading out	Dr Reka's unanswered questions — 2nd song outburst	Gorizia's recitativo monologue	overflowing song refrains — crisis
	mm. 102-117	mm. 118-213	mm. 214-215 (~ up to 4')	mm. 216-257
Scene 3	**Perspectives and revelations [*distanza*]**			
	psychotherapy session pt. 2: patient/dr interplay			awareness: person becoming city
	Dr Reka's analysis of memories and melodies	talking therapy fast concertato (3+2+3)	last Fanfare/ Furioso	listening to the Soča River — "ceased danger" aria
	mm. 258-279	mm. 280-323	mm. 324-329	mm. 330-382

Table 8 – *Radice Posizione Distanza*, dramaturgical progression

4.1.3 Dramaturgy toolkit: auditory cues and singing styles

The opening presents an unspecified incident on stage regarding the opera protagonist and due to unknown causes; hence, the conductor steps in on the stage to solve the problem and mimics an emergency phone call (i.e. electronic cue) to the 'GO! Borderless Mental Health Unit', which is fully audible to the auditorium. While that leaves the audience wondering whether the incident is real, an AI reader answers the phone call through the invented customer service line and redirects the conductor to the attention of Dr Reka, who assures he will promptly reach the theatre for an urgent therapy session (**Fig. 14**). I intended this scene as an uncertain sensory happening (from the performers' side), that could imply ambiguous expectations for the upcoming performance (from the audience's perspective).

The hold music during the call is a midi version of the famous war song *O Gorizia, tu sei maledett*a,[54] as a disguised motivic anticipation[55] of future core dramatic tensions and their resolution. In fact, that song is the central talking therapy object in the opera. I treated the tune as a pervasive triggering ear worm within musical structures and events. From this melody, I extensively derived pitch and intervallic content for the majority of evolving and recurring orchestral textures (**Figg. 15, 16 & 18**).

[54] Translating into English as 'O Gorizia, you are cursed!'. This antimilitarist folk song was composed (by anonymous) during World War I.

[55] A compositional procedure that recalls, in reverse, the final scene of Verdi's *Rigoletto* (1851). When the Duke of Mantua's voice and motif resonate in the distance, revealing that the dead body cannot be his, the tragedy of Gilda's murder is announced by the music, without words.

Figure 15 – *Radice Posizione Distanza*, earworm analysis



Fig. 15a – *O Gorizia, tu sei maledetta*, melodic profile

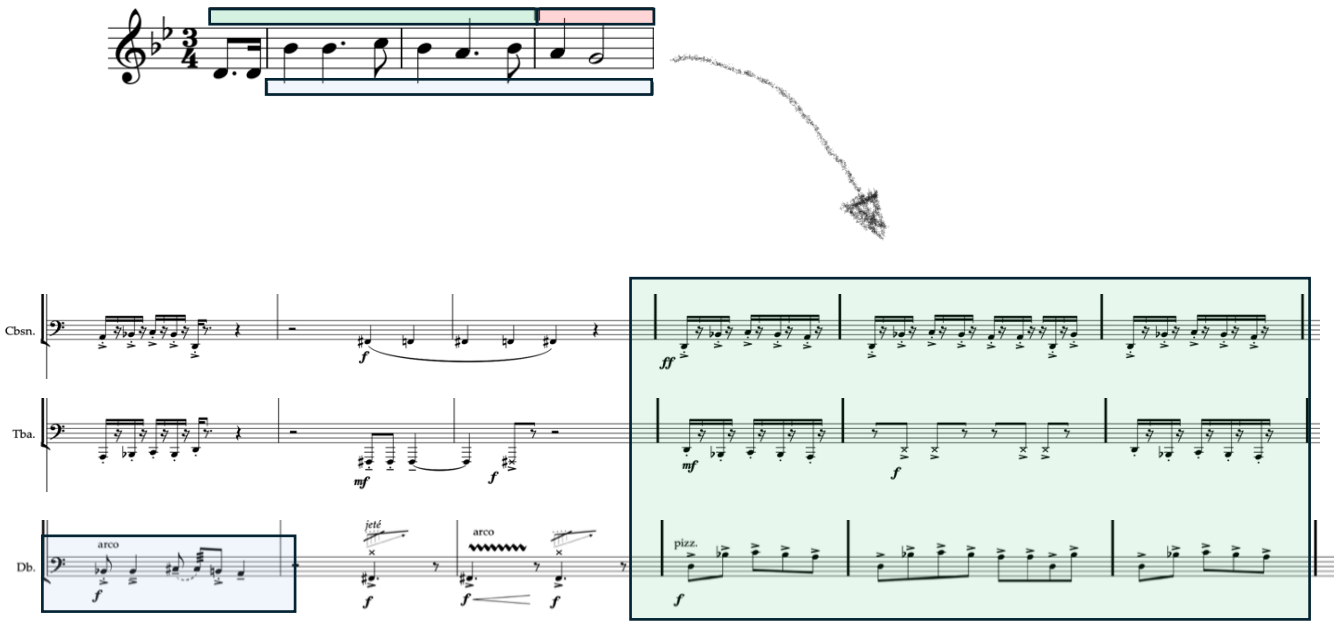


Fig. 15b – *O Gorizia, tu sei maledetta*, melodic segmentation and orchestration (colour-coded)

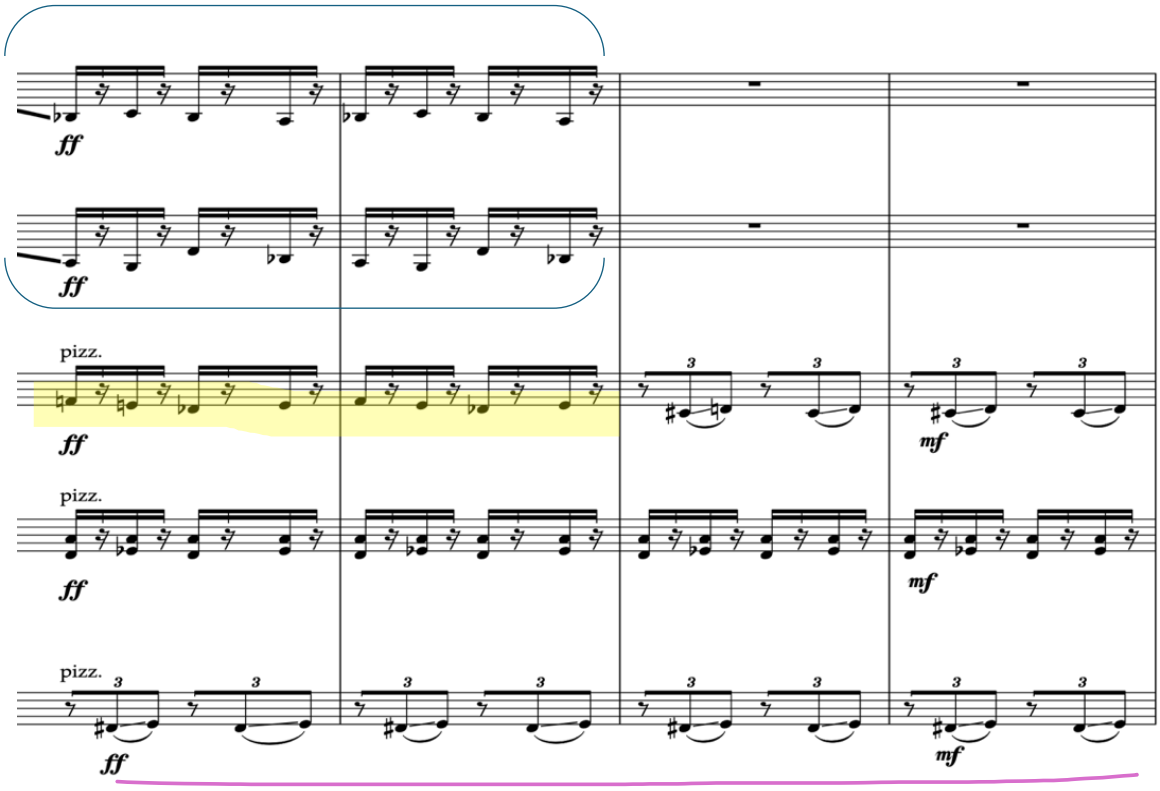


Figure 16 – texture derivations from *O Gorizia, tu sei maledetta*

Moreover, Dr Reka's vocal lines are entirely built on a combination of the same few notes, by inversions of the original intervals. A comparison between the war song's tune and Dr Reka's motif is shown in **Fig. 17**, illustrating transformations of ascending intervals into descending ones of the same type, and vice versa. The examined intervals are colour-coded to indicate segments of the melody. Those leaps' profile and their position in the musical phrase also adhere to the spoken language different intonations for questions (upward) and affirmations (downward). The singing style I associated with the psychotherapist's role exerts a plain and clear syllabic declamation, simple rhythms and a stable fluent tempo (*Gentle*, crotchet = 69). While the bass singer's part keeps repeating around the same notes and pace like recitation tones in Gregorian chant, his language swaps between Italian and Slovenian imitating Gorizia, in a symbolic adaptation to the patient's expressive needs.

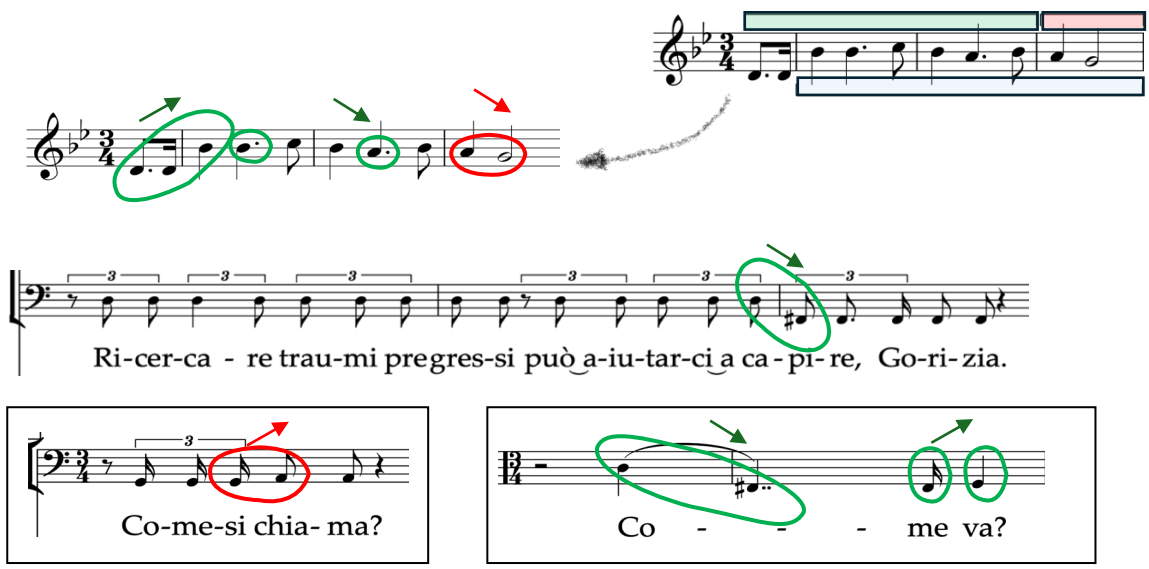


Figure 17 – earworm's derivations in Dr Reka's motives

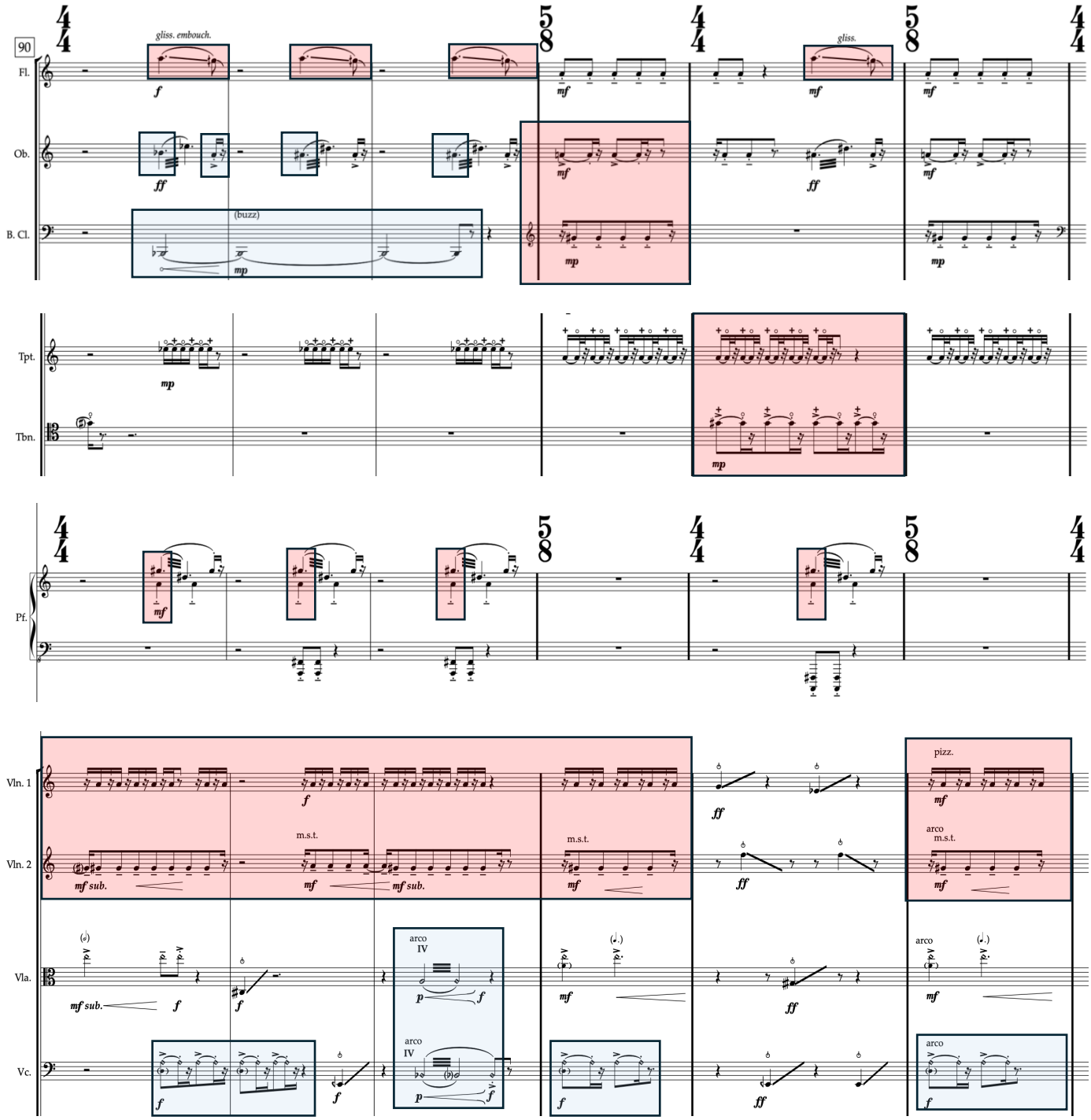


Figure 18 – *O Gorizia, tu sei maledetta,* further texture derivations

To embody a growing therapeutic relationship between the two characters, I gradually increased Gorizia's reactiveness toward Dr Reka, abbreviating durations and separations between questions and answers. This process climaxes in a fluent dialogic section, the "talking therapy concertato" (mm. 280-323) mostly in a fast irregular tempo (3+2+3) with metric modulations.

Immediately after that duet, a reminiscence of the ode *Soči* fades in, in a blend of digitally stretched and barely recognisable siren sounds and acoustic chords. As the poem's words become audible, Gorizia finally experiences a moment of illuminating awareness and sense of belonging, realising her multifarious and plural nature. Dr Reka guides this conclusion, suggesting that the woman is actually a city, and Soča is not Gorizia's daughter, as the poem could suggest, but instead Nova Gorica's river.

As articulated in the previous paragraph, the mezzosoprano/actress expresses herself through various recitation and singing patterns. In particular, warning siren sounds are another key element of sensory hallucinations driving theatrical developments and a material generator. The opera finale provides an evident example of how I used siren sounds to construct Gorizia's singing style and paradigm. This compositional strategy originated with a casual and very interesting document I saw at the Rafut Border's Museum, listing sonic profiles of civil defence sirens as they sounded in the years following World War II until after the dissolution of Yugoslavia. According to that page, different signal sequences corresponded to different risks for the population. A sixty-second long wailing sound would mean air raid warning; three calls of twenty seconds

each, separated by two fifteen-second pauses, would announce nuclear danger; one steady sixty-second sound would notify cessation of danger (**Fig. 19a**).

I decided to outline such profiles in the protagonist's part and use siren-like melodies to shape Gorizia's musical character as a personification of places. In the finale, and in correspondence with the awareness stage in therapy, I structured bars, tempi and phrases in a way that could reproduce a transition from nuclear danger to cessation of danger. Repeated notes, extrapolated from a Slovenian siren recording[56] from 1991 (**Fig. 19b**) substitute the long sounds, making it vocally idiomatic and possible for the passage to underpin the lyrics (**Figg. 19c, 19d & 20**). This pattern also permeates the two antecedent scenes and the prologue, especially occurring as sudden musical representations of innate fight-flight-freeze emotional reactions to threats – where the threat consistently involves any hint of the motif *O Gorizia, tu sei maledetta*.

As the ensemble plays a principal role in bringing calls and feelings in the opera, Gorizia's spoken monologue is accompanied by ensemble gestures around electronic textures, in an open-duration manner. Precisely, I used slide whistles refrains and extended techniques to resemble the infamous siren sounds, replicated from the electronic track over a long arch (mm. 214-215). I aimed at blurred textures like this to enhance the sense of sensory uncertainty.

[56] https://www.youtube.com/watch?v=BrdsSg5bg3E&t=55s (Accessed December 2024).

Figure 19 – transcription of siren profiles and warnings

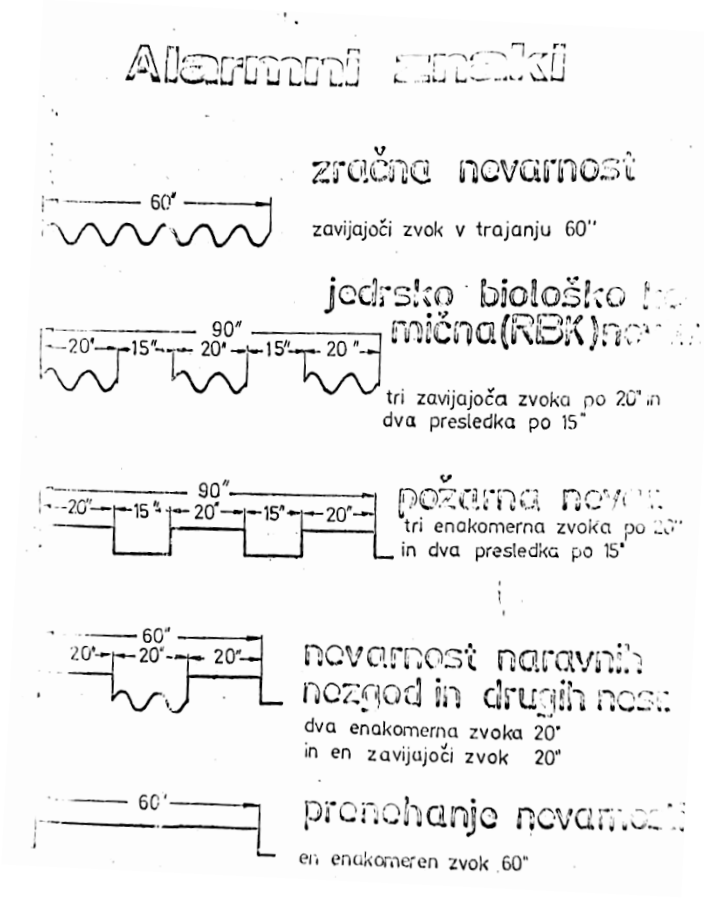


Fig. 19a – illustration of different alarm sounds and associated risks. Visual document taken from Museo del Confine, Valico del Rafut (2023)

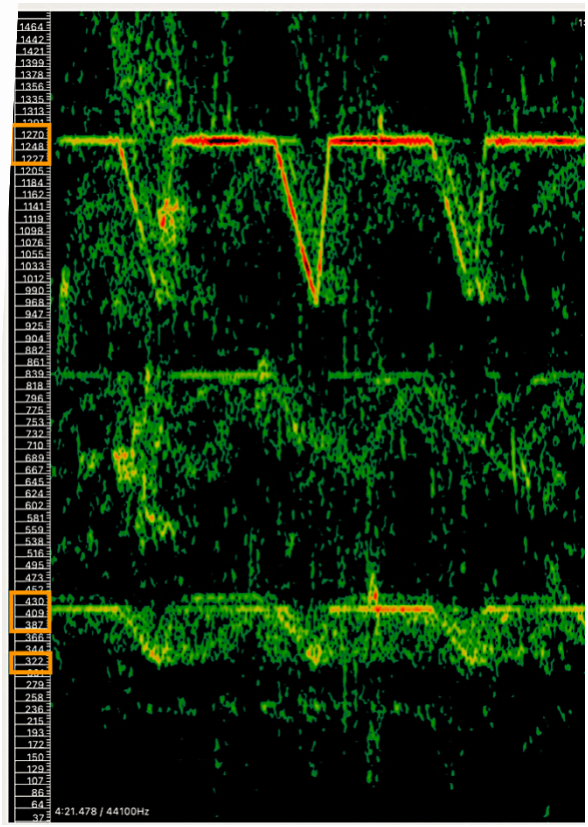


Fig. 19b – siren sound recorded in Velenje in 1991, (source: YouTube) - Melodic range spectrogram

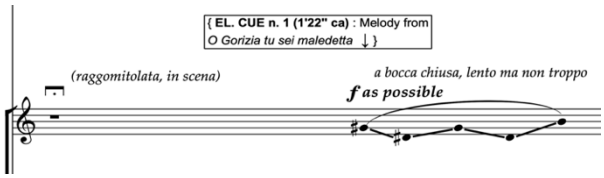


Fig. 19c – Gorizia/Nova Gorica siren-outlining melodic profile, in response to the hold tune during the prologue's simulated phone call (m. 1)



Fig. 19d – a later siren-singing return, in a fight-mode reaction to the same tune (hinted by the flute) at the beginning of Dr Reka's therapy (mm. 153 and following)



Figure 20 – siren profiles transcription into singing contours (mm.332-382)

With the objective to enrich the orchestration and mimic the soldiers' march, I embarked on a search for unusual percussion instruments. I found an online demonstration of a wooden set of aligned blocks, tied together, and pressed with a left and right oscillation

against a hard surface: the marching machine. Thanks to an online tutorial[57] and my father's craftsmanship, I had a purpose-built prototype for my opera project, which accurately imitated the sound of marching ranks (**Fig. 21**). I used this instrument mainly to characterise the Fanfare/Furioso episodes (mm. 11-80) and in combination with trumpet and winds' war calls.[58]



Figure 21 – marching machine built by R. Caneva, combined view

4.1.4 Project outcomes

The project culminated with a staged performance at the Lojze Bratuž Cultural Centre in Gorizia on March 24th, 2024, and the award of the Italian Ministry of Culture's special project funds to the commissioning Piccolo Opera Festival. To celebrate the 20th anniversary of Slovenia joining the EU and incentivise partnerships in the area, singers and instrumentalists forming the GO! Borderless Orchestra and the Cantus Ensemble

[57] https://www.instructables.com/Marching-Machine-Percussion-Instrument/ (Accessed December 2024).

[58] Trumpet war calls were transcribed from those in Francesco Rosi's anti-war film *Uomini contro / Many Wars Ago* (1970).

Zagreb were selected among Italian, Slovenian and Croatian established musicians. *Radice Posizione Distanza* was staged as the second and final opera in a new diptych[59] which I also conducted. Having a double role as composer and conductor in this production increased my possibilities to intervene on the score during rehearsals, and specifically in this case, I could highlight certain experimental features tailored to the interpreters, reacting promptly to unforeseen improvisatory directions. My presence on stage also reinforced the initial phone call episode's visual meaning and that widespread sense of ambiguity between composed cues, performance and reality.

[59] The first part of the diptych consisted of the opera *Pred vrati postave* (in English, 'Before the Law') by the Croatian-Slovenian composer Juraj Marko Žerovnik - https://www.go2025.eu/en/whats-up/news/operas-at-the-border (Accessed: December 2024).

4.2 Darkness

– Resight

Instrumentation:
violin 1, violin 2, viola, cello, tape.

Duration: 10 minutes.

After the opera, I wanted to further investigate sensory awareness and processes, to replicate them in microforms and as essential ingredients for the macro- music-making context. *Resight* (2023-24) for string quartet and tape dealt with memorisation and flashback. The final output reflects these paths and phenomena in its conception, structure and sonic material. I assembled the fixed-media track from personal archival recordings recalling minimally manipulated sounds from my childhood. Flashbacks, thus, happen in the tape, while memorisation and awareness refer to ensemble matters and abilities.

I thought of expanding experiences of not-seeing in this work, aiming to connect memory with performance in darkness.[60] I imagined a completely dark or dimly lit concert hall as an ideal component of the piece's presentation, for sighted audiences and performers to enter an unforeseen sensory environment. To perform in darkness (**Fig. 22**), the quartet is required to memorise their part and stay receptive to auditory cues from each other and the tape. Furthermore, single instrumentalists are spaced out on the stage; the strings disposition should form an inverted semicircle (**Fig. 23**), which "intentionally restrains

[60] I considered the title *Resight* a possible unifying thread for perception, vision and space-related explorations, inspired by the English homophones *sight*, *site,* and *cite*.

eye contact between the players and channels sensory stimulation into the listening."[61] A situation that excludes the sight, would hinder cross-modal emotional transfer and vision-elicited emotional processing (Logeswaran & Bhattacharya, 2009) – otherwise embedded in musical performance – in favour of hyper-listening and co-listening (Chattopadhyay, 2022).



Figure 22 – *Resight*, premiere (March 2024)

[61] Source: Programme notes.

There is no conductor or acting conductor in the ensemble, and no visual cues are inferred. Auditory cues in *Resight* have a generative function within both the compositional form and the live performance framework. Similarly to Haas' invitation sounds and my notation in *Those who have the right to yell – won't,* I used certain starter sounds signalling the beginning of a new musical section, and whose meaning is not only sonic, but also that of aurally guiding the performers' navigation and interplay. However, *Resight* is created on rhythms, for which I needed some alternative form of aural grid to enhance synchronisation and a suitable, spacious yet cohesive notation system.[62] As for auditory synchronisation of pulse-based sections, I disregarded in-ear solutions such as click tracks; my purpose was instead to embed any pulse into the tape.

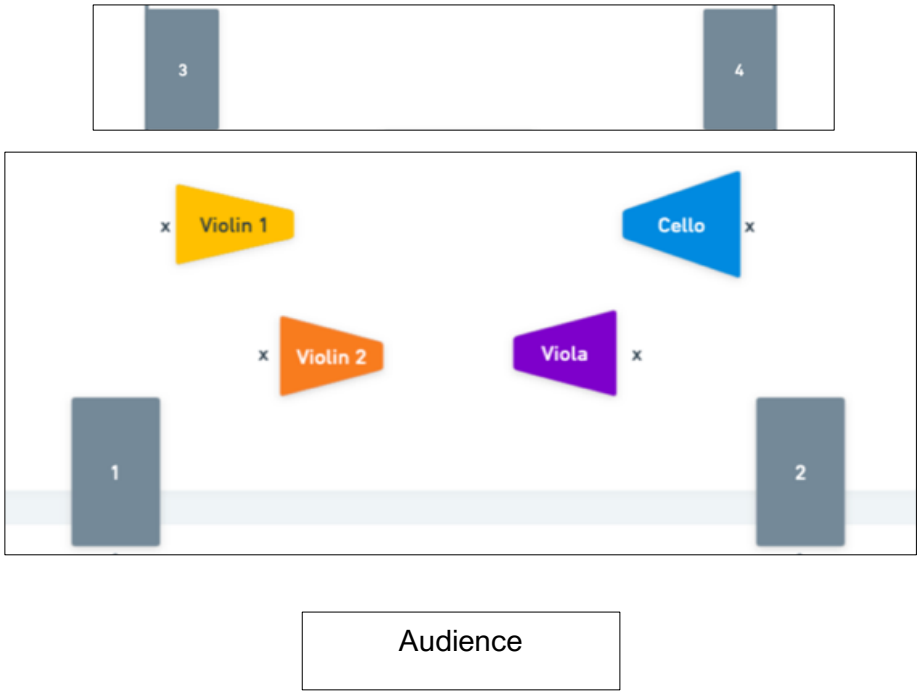


Figure 23 – *Resight*, staging scheme

[62] See §§ 1.3.1, 1.3.2 & 3.1.

4.2.1 Eye contact excluded

Resight starts and ends on a 'tutti' setup comprising the full quartet and fixed media. Textures intensify from rhythmical sounds of wet clothes' dripping, mallards' quacks, or cicadas chorusing that initiate and lead to a mixed-media interplay. Ostinato sections can start either as a full ensemble layout (mm.1-10) or with solo instruments progressively layering in imitation (mm. 10-16; 19-24; 27-28). Each of such long rhythmical expansions grows in complexity over a duration of about one minute. Pulses and repetitions are interspersed by more flexibly timed episodes, with unmeasured gestural sounds in the quartet or long rests anticipated by the recorded orchestral tuning and detuning cues (mm. 16-18, 25, 26). Through this construction I composed a sequence of synchronised and unsynchronised contrasting textures and recurring sound memories (**Table 9**).

Synchronised 'tutti' actions consist of full ensemble events and correspond to solid tempo signatures with conventional bar lines in all cases (e.g. mm. 3-10, m. 29-60). Unsynchronised textures in the quartet consist of layering repeated patterns with or without a sense of pulse. Otherwise, unsynchronised rhythmical excerpts may have different duration in each part; in those sections a steady pulse is shared across the quartet, as drawn on the original audio cue in the tape, and instrument layering repeated patterns although downbeats do not necessarily align (e.g. mm. 10-16).

Tape Cue	ducks	drops	1st Orchestra (de)tuning	[-]	drops	2nd Orchestra (de)tuning	bubbling, drops	3rd Orchestra (de)tuning	bubbling, cicadas	— plane	plane, cicadas →
Quartet Cue	Tutti	Viola	[-] Tutti	→	Cello	[-]	Tutti	[-]	[-] Cello	→	Tutti
Measures	1-10	10-15	16-17	18	19-24	25	26		27	28	29-60
Timecodes	0'00''	1'36''	2'22''	3'01''							
①					0'00''	1'36''		2'38''	2'44''	3'10''—3'45''	
②											
Durations				~ 3'26''							~ 9'30''

Table 9 – *Resight*, analytical view

This table illustrates an overview of generative auditory cues, their organisation and content, strings setup, durations, timecodes and corresponding measures. Blue cells indicate unsynchronised episodes and related starting cues.

4.2.2 Mixed-media notations for the dark

In 'solo-to-quartet' developments (mm. 10-15, 20-25), each instrument in the quartet plays a rhythmical pattern in repeat. I set string entry sequences to a fixed recurring order (**Fig. 25**) that is shifted the second time. Viola (m. 11) and cello (mm. 20, 28) lead instrumental cues in the ensemble following their pertaining cues from the tape. In turn, violins can decide when to start playing their patterns, after two or three repeats of the previous instrument (e.g. mm. 12, 21). These instructions apply throughout all repetitions in similar structures, where each instrument is consistently paired with its recurring pattern of notes and playing techniques (**Fig. 24**). This compositional device allows overall variety while also restricting musical material to a few elements in single parts, which was my solution to integrate memorisation into the compositional design and notation.

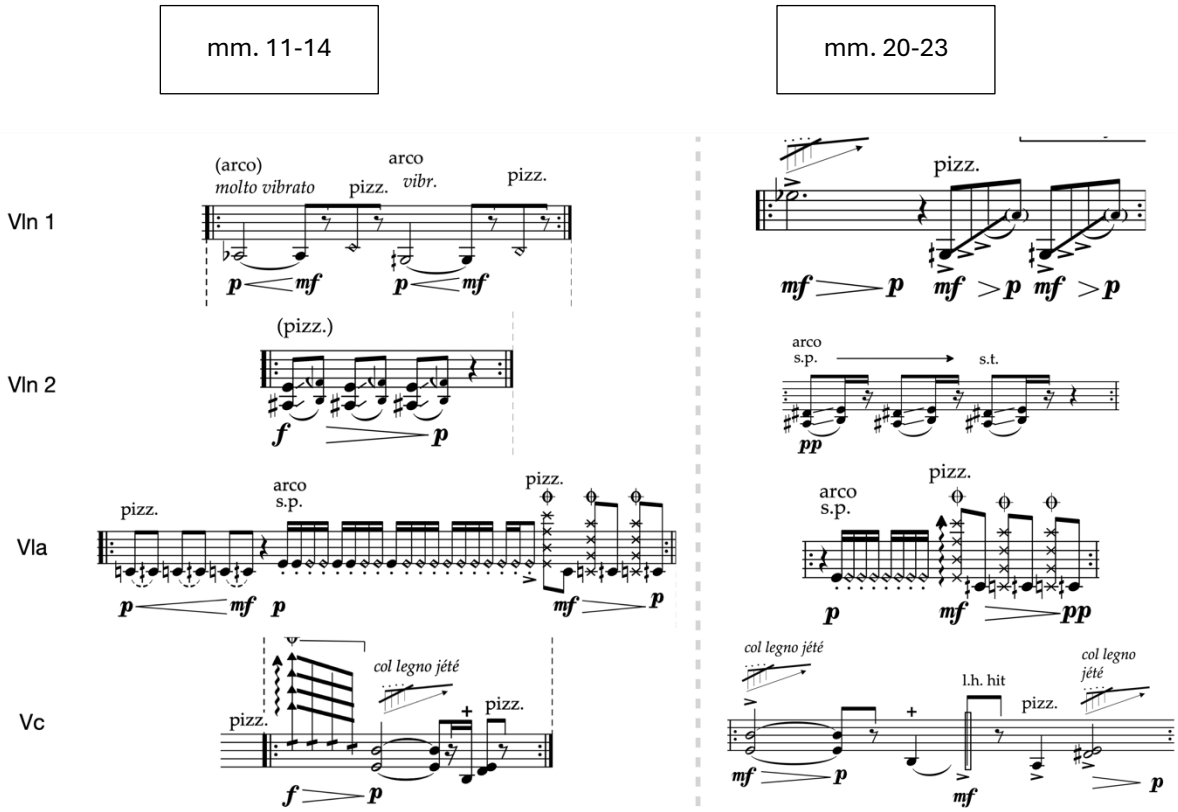


Figure 24 – *Resight*, instrument-pattern pairing

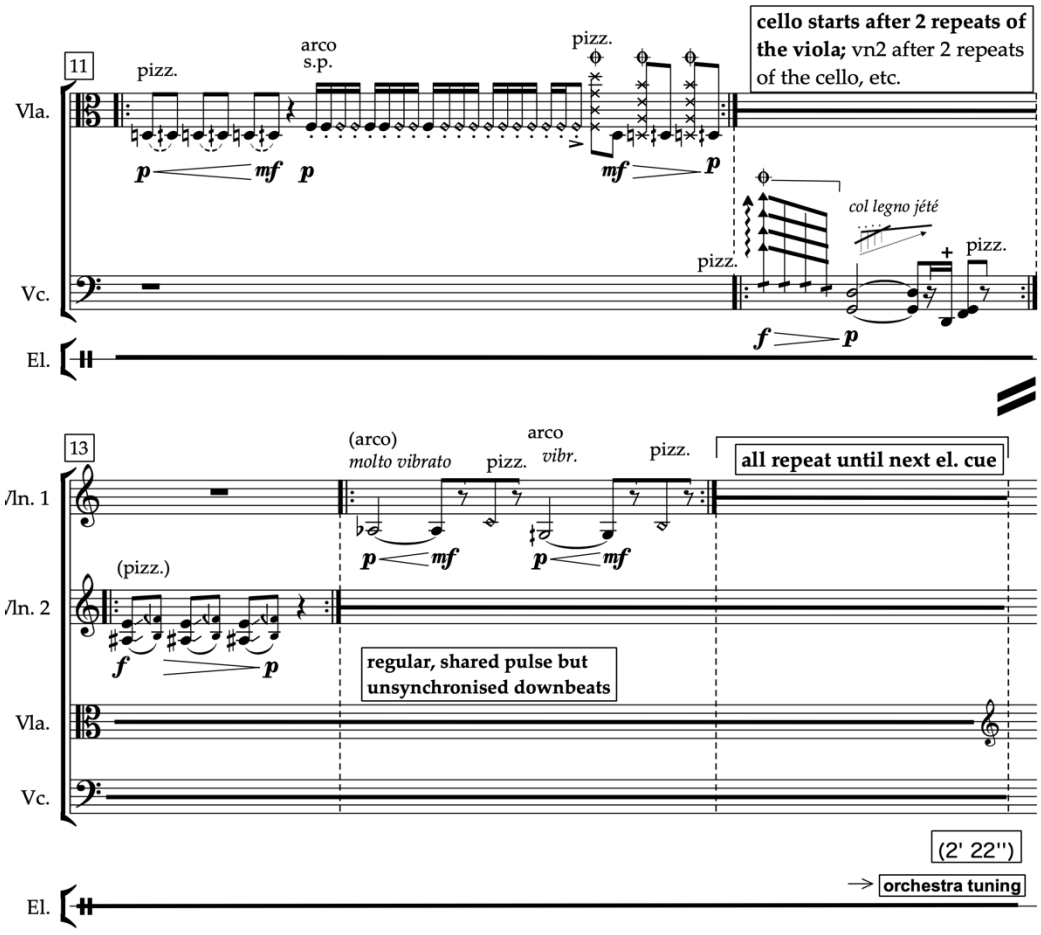


Figure 25 – *Resight*, notation and set sequence of entries (mm. 11-14)

To compose and organise calmer suspended sections after the orchestral (de)tuning cues, I introduced a second type of notation (mm. 16-18, 26-28). Instead of bar lines and staggered repeat signs, I used boxed cells around individual gestures to suggest a different material treatment in performance (mm. 16-18, 26). That is, not to observe any regular pulse or time signature grid, but to vary speed, free repetitions, onsets and dynamics. 'Instrument-pattern' pairs still stand in these sections, with modes of attack relapsing in the same part where they were first presented: pizzicati reappear in violin 1 (mm. 26, 29-31) and harmonic glissandi in viola and cello (mm. 17, 26). Measure 28 in the score assembles most kinds of previous notations: before the downbeat of the final synchronised section, the music features dissimilar textures fading in and out in the tape, two distinctive electronic cues for the cello, and the cello marking the new tempo for the full ensemble (**Fig. 26**).

4.2.3 Perception affecting duration

The string quartet sonority in this piece is composed of plucked and percussive techniques (e.g., pizzicato, jété col legno, hand palm stopped strings), but also subtle variations of bowing overpressure (e.g., m. 29 vertical tremolo in violin 2), fingering half-pressure in timbral trills, harmonics and harmonic glissandi (mm. 17-18, 26), and high-pitched fragile timbres merging those in the electronic material (e.g., mm. 33-59). A sound blend is completed by the quartet's amplification. Darkness and amplification

combined also enhance the ambiguity of sonic events, such as orchestral string tuning and detuning cues happening in the electronic track rather than live in the quartet.

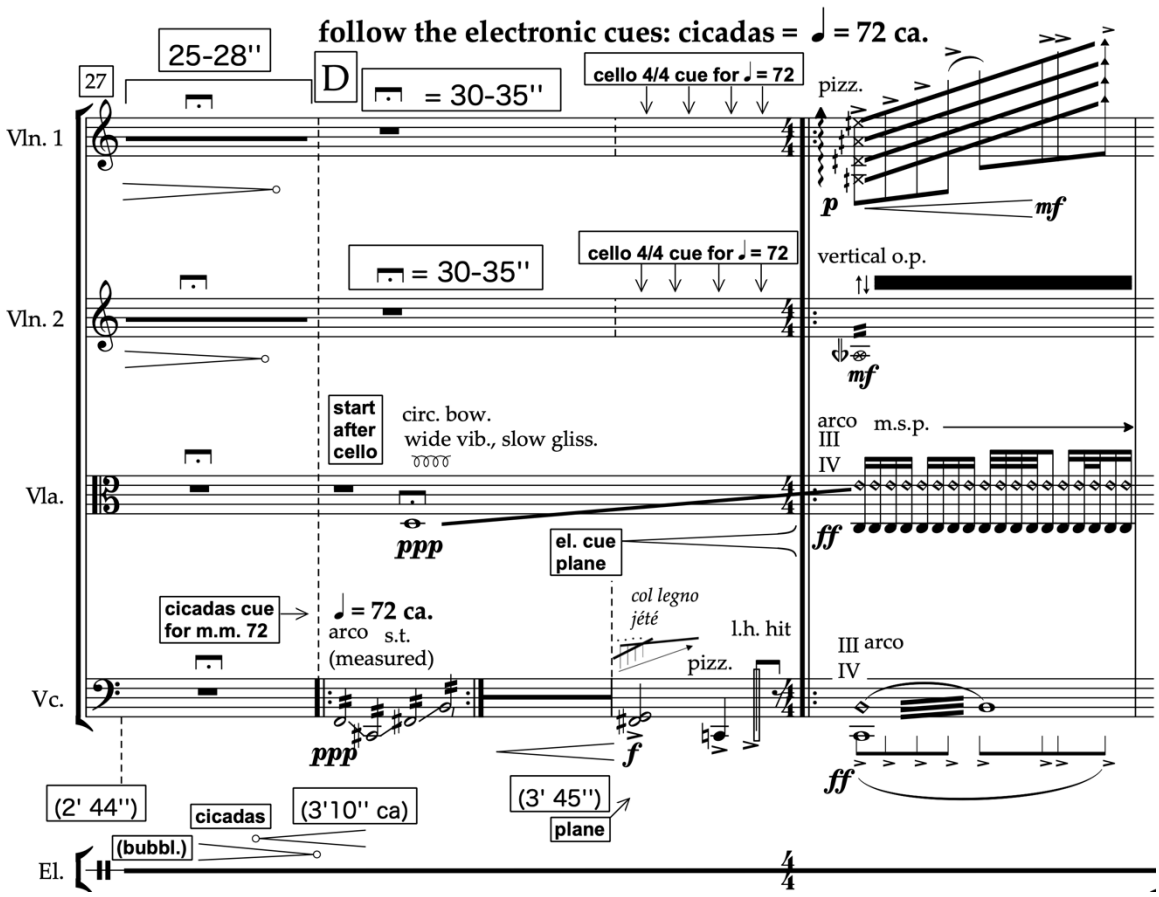


Figure 26 – *Resight*, notation in mm. 27-29

Potentially, interpretations can differ in durations, subject to the performers' perceptions of timbre during flexible duration episodes, consequently spending more or less time exploring those sounds. Two audio files are to be launched in performance: the first corresponds to the beginning of the piece, while the second can start after 3'26" or later, depending on live improvisational sonorities (e.g., m. 18). In the final 'tutti' synchronising texture, chorusing cicadas and loud plane sounds emerge and mask almost in a counterpoint with cello (mm. 29-32, 43-52). Dynamics cross-fade in waves: the quartet are brought forward and back, dovetailing the opposite dynamic in the tape (mm. 33-36, 46-52), for expression as well as to frame by compositional means an effective listening to each other and to the audio track. Even there, with homogenous bar lines and time signatures, an overly prescriptive synchronisation is not among my compositional objectives, as it could prove ineffective when performers are distanced and unable to establish eye contact in darkness. I was much more interested in the experience of aspiring to synchronisation through auditory cues only, and in a context of not-seeing.

5. INTERACTIVE SPATIAL AMBIGUITY

> "[...] architecture is not a noun, it's a verb. Architecture tells us where to go, how to feel and how to behave. [...] For instance, a window will be opened exactly where you can see the mountain top, or an apple tree in the garden. This is good architecture; it articulates the world for your enjoyment and performs the task of a verb."
>
> (Pallasmaa, 2023)

Beside opera and mixed-media performance in darkness, I finalised my research by linking sensory illusions to participatory avenues. Namely, I worked on an interactive sound art installation where the performance entailed visitors to discover subjective site-specific composition paths by walking in a visually empty space, potentially blindfolded, guided by their listening experiences. While I previously applied cognition-driven structures in an operatic context and eye-ear cross-modal approaches in ensemble compositions, in *Eclipse* (2022-24) I could redirect my attention toward the visitors' possible moves in reaction to interactive immersive soundscapes.

5.1 Looking for a question

– *Eclipse*

Setup:
interactive immersive sound installation (site-specific, 20.2-ch matched loudspeaker dome, 5x Makerfabs ESP32 UWB Pro DW1000 boards).

Duration: open and variable, subject to the visitor's engagement; ideally about 20 minutes.

Eclipse was loosely inspired by Sinigaglia's novel *Eclissi*, where the metaphor of a total solar eclipse symbolises the effects of the night in the middle of the day[63] on loneliness, age, landscape, wildlife, eventually unlocking decades-old unwanted memories and revisitations of relationships, perceptions and behaviours. In the beginning, my conjecture was to transform that novel's plot into an opera, for which I had produced abundant preliminary esquisses between 2018 and 2020.[64] Nonetheless, the way I ultimately intended those topics felt deeply experiential and individualised. Instead of presenting a staged composition to spectators, my preferred approach was that of engaging the audience in an active, tangible, rolling, first-person experience, where the audience were in charge of establishing a subjective distance from the surrounding sound sources by walking closer or farther from them. Fixed and travelling auditory cues would stimulate ambiguous sensory perceptions, in a flexible frame that would prove responsive and pre-determined at once. Some musical events would be affected by the participants' chosen walking trajectories, as well as their walking pace, and the amount

[63] The eclipse is described as an extraordinarily bright night (Sinigaglia, 2016, p. 99).
[64] I formally started working on a composition project about *Eclipse*, soundscape and visual cues during the Kone Saari Residency in 2020. https://koneensaatio.fi/en/grants-and-residencies/eclipse-visual-cues-and-soundscape-orchestration-2/ (Accessed December 2024).

of time they would spend exploring. These were my aspirations, for which *Eclipse* installation can be regarded as an original artistic response to Sinigaglia's novel, developed independently from it.

This standpoint became increasingly apparent as I shared the project with Milad Mardakheh. We elaborated the idea of unfolding a narrative not 'in the presence' of visitors, but in response the visitors' presence and spatial position. Reflections on human wayfinding, possible behavioural scenarios and context-specific interaction patterns became a fundamental element for our collaborative and cross-disciplinary research.

As the book's protagonist claims he is "looking for a question"[65] (p. 31), this became a pivotal argument in *Eclipse* interactive installation. I considered this oxymoronic act of 'looking' for something existential during an eclipse – that is a temporary absence of light – particularly relevant to my artistic research on visual inputs' removal. Furthermore, the need of formulating 'the right question' toward self-discovery could validate an insightful context for interactivity features in sound and spatial exploration.

I started my process by reviewing sonic memories associated with the literary storyline in *Eclissi*.[66] As memories were all unlocked in natural scenarios, I adopted soundscape composition as a unifying constituent of my ideas for a curated interactive experience. Drawing from my initial operatic hypotheses, and to upscale those into an interactive

[65] Original in English.

[66] These were the harbour soundscapes, birds' songs ceasing abruptly, and other less specific quiet natural soundscapes.

immersive installation with a sensory focus, I needed to address predictability and discoverability relations. Early compositional questions concerned aesthetic translations from operatic mindsets into interactive fields: (1) what boundaries would define control and flexibility in the visitor's experience, and (2) what systems and synchronicities would trigger auditory memories linked to the visitor's position in the room.

My decisions about compositional narratives were grounded in strategies for unlocking musical contents along physical paths. That touched the problem of 'desire lines', which I define – in the context of my practice and objectives – as the community's contribution to placemaking by interacting with their surroundings. According to Malone's description (Malone, 2018) the expression 'desire lines' refers to:

> [...] paths that people create through regular usage. They appear where people repeatedly choose to walk and usually signify a route from A to B that's quicker than the formal path provided. In most cases they indicate the mismatch between what local people want and what designers think people want.

Therefore, I built on literature, knowledge, and outcomes previously accomplished, to define possible implementations of desire paths in my interactive installation. I zoomed in on how to prepare a community engagement plan based on soundscape-based desire paths – rather than landscape-based. I kept the idea of a visually empty space, and looked for relatable interactive community projects, such as Rūta Vitkauskaitė's *Meditation Opera* (2019).[67] Potential limitations in all these experimental aspects –

[67] https://rutavitkauskaite.com/projects/ (Accessed: December 2024).

pertaining to spatial explorations, sensory cues and compositional strategies – needed to be accurately studied and tested in the next phases.

5.1.1 Soundwalks, gaming, and treasure hunts

The overall installation scheme has been well-defined since the early stages of its creation. I anticipated three to four distinct soundscapes playing in the room as ongoing drones. Each soundscape would constitute an auditory scene for interactive spatial exploration – in a space with nothing to see. Tests demonstrated the influence of visual cues on distances' auditory perception (Calcagno et al., 2012). When excluding the fundamental visual component, the actual site is rebuilt only aurally by the listeners' minds. As buried memories appear to be spontaneously unlocked by specific affective environments in the novel, Mardakheh and I envisioned possible transitions within scenes of Eclipse to be released by the visitor 'stepping onto' a geographic sonic trigger (**Table 10**). We named that 'transition audio'.

Scene 1	trigger ?
Scene 2	trigger ?
Scene 3	trigger ?
....	

Table 10 – *Eclipse*, preliminary storyboarding notes (August 2022)

That design resembled an experience of kit assembling or gaming in a real-life setting, but also the practice of soundwalks and treasure hunts.[68] The concatenation of scenes in the preliminary draft was also shaped on the principles of soundwalk mapping, as in

[68] See § 1.3.2.

Schafer's Salzburg Soundwalk (Schafer, 1977).[69] In the Salzburg Soundwalk, the 6:45 bell strike cues the end of stillness inside St Peter's church, underscoring that timing is crucial. In fact, some sounds can only be experienced in a specific order and by the listener who arrives at the location at precise times and under certain circumstances.[70] It may also be necessary to stay still in a location and listen for a sound as a cue to access the next destination. However, flexibility is also inherent to soundwalking. Should the listener decide to ignore the map, the core purpose of the experience should still materialise in other forms and meanings. These were all features to implement and fulfil in *Eclipse*.

Given the complexity of interactive immersive environments, we focused on identifying circumstances that would align with our objectives. Anticipating to what extent visitors' actions could challenge the technical and aesthetical unfolding of the experience seemed equally crucial. Intertwined layers of research included (1) sound, (2) space, (3) different time categories, (4) technology systems and interfaces.

Initially, complete darkness was one of the foremost desirable features of an ideal venue. The venue also needed to be spacious enough to allow for varied varying walking paths while remaining free from trip hazards. After inspecting various local halls and galleries and evaluating all known aspects of the project, we chose to set the installation in the Bramall Music Building Dome room for the advantages of existing BEAST facilities.

[69] Ibid. p. 39.

[70] e.g. noise pollution could hinder the listening experience; it could also occur that sounds that were audible in 1977 are no longer present.

However, the Dome room could not be darkened (**Fig. 27**). That redefined our priorities and motivated me to reflect on aspects of 'not-seeing' beyond darkness, as those remained critical to my artistic investigations.



Figure 27 – Bramall Dome, set for the installation

In parallel with technological advancements by Mardakheh and intensive testing sessions – matters I will discuss thoroughly after the next paragraph – I organised musical materials into fixed-media compositions, as proofs for separate scenes. These were *Studies on Eclipse* [71] (2022) and *Influences* (2023).

From Sinigaglia's novel, I selected two categories of soundscapes I could concretely reproduce in Birmingham: (1) harbour and underwater sounds, and (2) a birds' chorus. Following this prompt, I realised most of the installation's audio by means of environmental recordings at the Edgbaston reservoir and underwater recordings in a bathtub. The latter were first processed in *Influences*, whose 4-channel version I diffused publicly during a BEASTdome concert (**Fig. 28**). That corroborated the foundations of *Eclipse*'s aesthetic boundaries.

[71] See Portfolio Appendix (media folder).

5.1.2 Towards the installation

– Influences

Setup:
fixed-media, 4ch audio.

Duration: 6’ 16’’

In *Influences* I applied methods of soundscape composition, expanding the concept of finding oneself along imaginary or invisible paths, previously presented in other compositions. Recordings derive from three types of underwater actions I captured with a hydrophone in a full bathtub (**Fig. 29a**). From the quietest to the loudest, these were: (1) a figure-of-eight motion in calm water, (2) my voice talking underwater (3’23’’ – 3’40’’), and (3) the water jet pressure on the hydrophone kept underneath the faucet (**Fig. 29b**). Raw takes of the latter were rich in spectral nuances resulting from water motions and producing a ‘low growl’ (1’36’’-2’00) that I kept almost unprocessed. I also added indoor recordings of a rainstorm, to smoothen transitions within the soundscapes’ different features in the piece (e.g. 0’00-1’04; 4’12’’).

In preparation for *Eclipse*, I aimed to explore auditory narratives based on prolonged drones against shorter and sudden inserts of different sounds (**Table 11**). Therefore, I divided musical materials into two contrasting categories, differing in treatment: (1) underwater drones and (2) piano playing inserts with a trigger function. At this stage, I had yet to finalise whether inter-scenes transition audio in *Eclipse* would all be associated with the same ‘sound call’. Repeated sound calls would imply that future installation visitors could more easily distinguish and learn the interactive structural progression,

managing their expectations and decision-making each time that same sound would emerge. Hence, in *Influences*, I assumed that this were the case.

Thinking of future multisensory implications, I introduced piano playing in such calling/transitioning function. The piano sounds are inaudible at first (2'12''), then gaining presence towards the end. After an initial stereo version of the piece, the 4-channel setup provided further solutions for a more refined sound image. In practice, textural sounds would be diffused around the audience separately from the 2-channel piano, routed to the stereo mains. Even though *Influences* did not require any itinerant features or adjustments to the audience's disposition, its diffusion through the BEASTdome multichannel system proved an essential step in the longer-term goal of setting up *Eclipse* installation in that venue. Piano cues culminated with a distorted solo cadence, expanding from the subwoofer pair to the dome ring and upper ring as an arpeggio merged into a thunder (5'40'' – 5'51''). This point eventually found a direct correspondence in how I used and spatialised audio for transitioning zones in *Eclipse,* progressing from localised to diffused sound image as each transition was initiated and accomplished. Furthermore, the dissimilar nature of piano playing and underwater soundscapes highlighted their complementary roles and interlaced compositional layers. Thus, I translated this cue/background relationship through reactive/fixed cues in the developing interactive framework.

Composing and performing *Influences* equipped me with clearer views, stronger skills and deeper awareness about perceiving the space aurally in more experimental outputs.

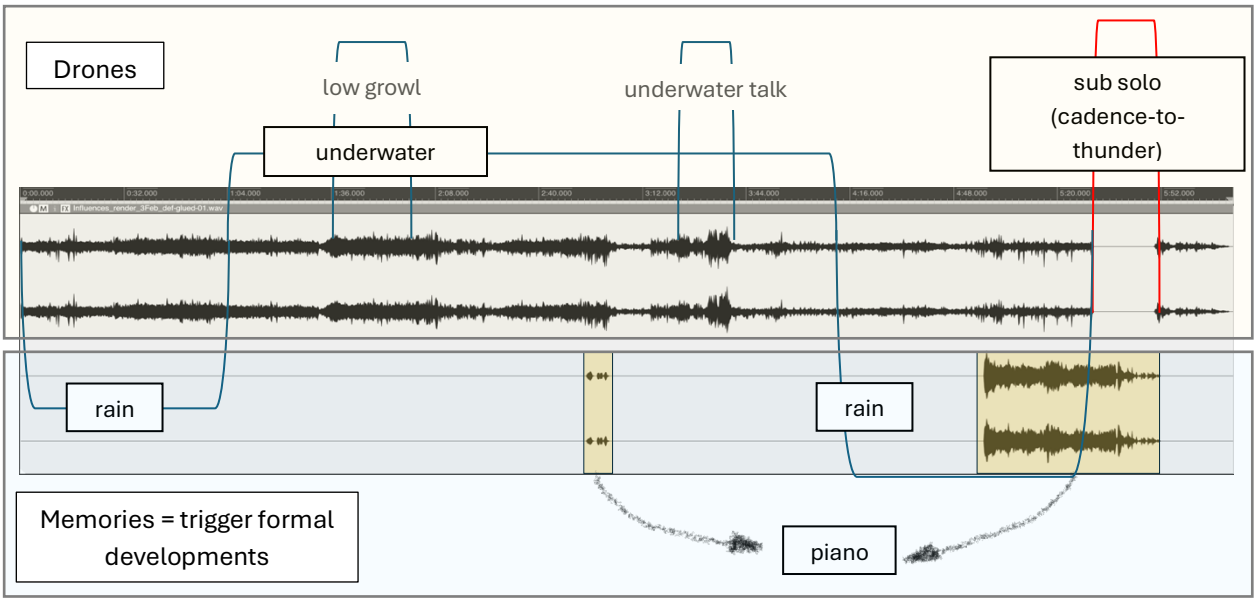


Table 11 – *Influences*, waveform and formal overview



Figure 28 – performing *Influences* (BEASTdome, February 2023)

Figure 29 – underwater recording documentation



Fig. 29a (above) – underwater recording setup. The picture displays the hydrophone on a bathtub and a copy of E. Sinigaglia, *Eclissi* (2016) - pp. 8-9.



Fig. 29b – water jet flowing on and around the hydrophone for underwater recording.

5.2 *Eclipse*: Solo explorations

Given the emphasis on unsighted orientation in this project and the idea of unravelling subjective paths in solitude, it seemed immediately pertinent that the *Eclipse* should run for one visitor at a time. This format not only exposes the participants to an opportunity to develop connections within sound and space but also ensures a more intimate and personal experience. Spending alone time immersed in an interactive soundscape could cultivate the "emotional power of space" (Bêka & Lemoine, 2023) via the awareness of one's own movements and environmental reactions without being seen or influenced by other visitors.

Secondarily, we expected that hosting a single visitor at a time would also maximise data transmission efficiency in any interactive environment.

Once we had refined purposes and frameworks, we started evaluating suitable tools for position tracking – which eventually allowed for more sophisticated intersections between composing, curating, and programming.

5.2.1 The 2022-23 hypotheses

Designing and realising *Eclipse* interactive sound installation involved elements of experiment logging for the two-year duration of the artistic process. The first hypothesis (August 2022) for an interactive technology system could have included numerous ultrasonic proximity sensors placed around the walls, and multiple piezo elements secured to the floor, with a floating rope to hold on to, crossing the room transversely and serving as a tactile delimitation of walkable areas in darkness (**Fig. 31**). In theory, proximity sensors could have been used to locate the visitor within the installation space,

while piezo buzzers could geographically correspond to triggering points in the room. That embryonic arrangement would have involved health and safety concerns and complex procedures to prevent trip hazards, potential damages to the thinnest pieces of technology, as well as extremely lengthy cabling. Furthermore, when we attempted to verify this hypothesis in the Dome room, the HC-SR04 ultrasonic sensors' sensitivity and strength resulted underperforming in sizeable spaces, which became the final impediment to these arrangements. We continued to investigate further viable pathways[72] to run the experience efficiently, until Mardakheh's research introduced Ultra-Wide Band (UWB) technology as an innovative option for indoor position tracking applied to music and sound art.

5.2.2 Wearable technology

After months of individual work and several partial tests, we returned to the Dome room in 2023 for an updated configuration. *Eclipse*'s final equipment consisted of five pieces of Makerfabs ESP32 UWB Pro DW1000:[73] four antennas, placed at the four corners of an 11m^2 square floorspace in the Dome room, were programmed as receivers ('anchors'), while the remaining antenna operated as a mobile transmitter ('tag'). The tag became a piece of wearable technology, secured to the

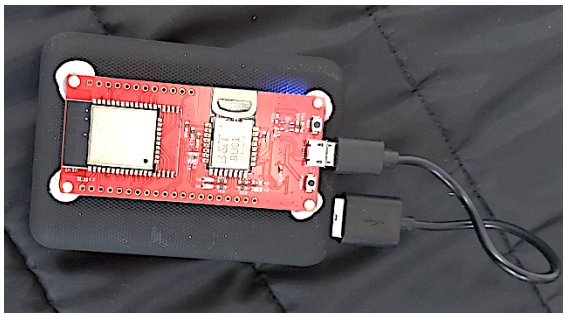


Figure 30 – wearable UWB antenna

[72] After evaluating GPS technology, we decided to not follow this hypothesis, to overcome interferences or inaccuracy. Optical and infrared sensors were briefly considered, although UWB seemed the most advanced, accurate and reliable technology for indoor position tracking.
[73] https://www.makerfabs.com/esp32-uwb-high-power-120m.html (Accessed: December 2024).

visitor's ankle with a phone holder band, facilitating unrestricted spatial exploration. To enhance the overall setup's compactness and portability, we powered all antennas through USB power banks (**Fig. 30**).[74]

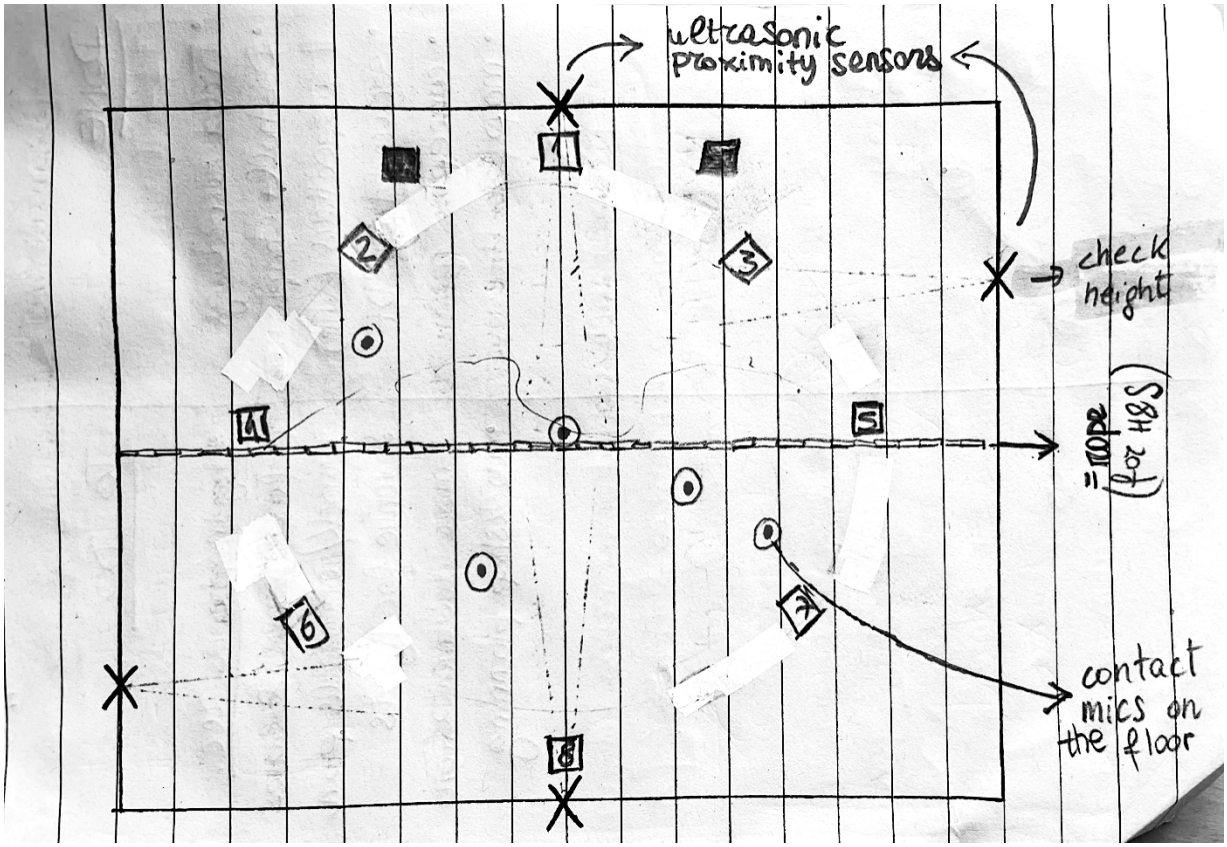


Figure 31 – *Eclipse*, pre-testing sketches (August 2022)

Ultrasonic proximity sensors, safety rope, and piezo elements hypothesised in the pre-testing phase were eventually all substituted by UWB technology. That enhanced transmission and interactivity efficiency for hazard-free explorations of the Dome room at the University of Birmingham.

[74] The programming and interfaces for the project were created by Milad Mardakheh, presenting innovations in machine learning and UWB indoor positioning technology. The installation patch was run in Max MSP.

5.2.3 From stage to maps

Through the wearable UWB pack, the visitor's position data were calculated and tracked on pre-composed maps relating to the installation narrative and sequence of four scenes (**Table 12**).[75] Each auditory scene corresponded, geographically, to a large circular area in the floorspace. A smaller area (i.e. transitioning zone) was included within the larger circle of each scene. Volumes of scenes and transitioning zones were controlled separately – and interactively. We set the volumes to be maximum in the centre and minimum at the periphery of any zone. Transitioning zones were associated with the transition audio so the visitor could find and locate them and progress through the narrative – should they choose to. In fact, except for an automated transition between the introduction and the first scene, the progression would be triggered through the next scene only if the visitor found the transitioning zone and spent a certain amount of consecutive time in it. This behaviour was implemented by adding a timer; also, the transition audio was composed of two parts, the second part being started after the timer (**Table 13**). It is essential to highlight that maps were kept in the installation patch only: those remained invisible to the visitors and for them to discover by walking in the empty room.

Fixed and spatialised auditory cues became the preferred method to attract the listener to specific areas in the venue. With a similar intention to that of Hildegard Westerkamp in *Kits Beach Soundwalk* (1989), I used my recorded voice to direct, pinpoint and contextualise moments and locations during the experience of the installation.

[75] Maps were designed using Desmos Studio: https://www.desmos.com/calculator/jvmxskwpyn (Accessed: December 2024).

Comparably, whispers around the dome ring would only be audible in the speaker's proximity, promoting a variety of listening habits and encouraging both holistic and confined listening spots.[76] My narration in words played in all scenes except the third and included either prompts/instructions (i.e. in the transition audio) or storytelling (i.e. at the beginning or end of a scene).[77] We called these voice inserts 'beacons'. To enhance and facilitate navigation, highly localised cues were placed in the vicinity of transitioning zones. As a visitor would border the transitioning zone, that would start the transition audio fade-in, potentially as an invitation to progress into the following scene. As this happens, the previous transitioning zone disappears, and the exploration can restart in the following scene. It is only possible to return to Scene 1 after completing a whole round of *Eclipse*.

After all *Eclipse*'s goals were identified and addressed, we found an answer to the principal matters of human-computer interactions and sensory responses, such as: (1) what would happen to the composition if visitors were too fast or too slow at walking and transitioning, (2) how to guide trajectories and suggest there is something to engage with, and (3) what would happen if visitors do not engage. Solutions are summarised in the following points:

- There is only one element of interactivity, given by the visitor's position;

[76] Another feature rooted in the soundwalk practice (Kolber 2002).

[77] Transition audio, for example, included polyrhythmic bells and my voice saying: "You are close: keep listening."

- Dynamic processing is connected to spatial audio: the visitor's position affects single channel volumes and triggers transition audio;
- Spatialisation is dynamic, with separate spatialisation trajectories for 7-ch and a mono channel for the audio-guide. Spatialisation is pre-written, unaffected by position data;
- Visitors may transition or not, depending on time spent in transitioning zones;
- Maximum volume levels are achievable in the centre of the room/scene/zone;
- Transitioning zones in subsequent scenes are located progressively closer to the centre of the room (see **Table 12**).

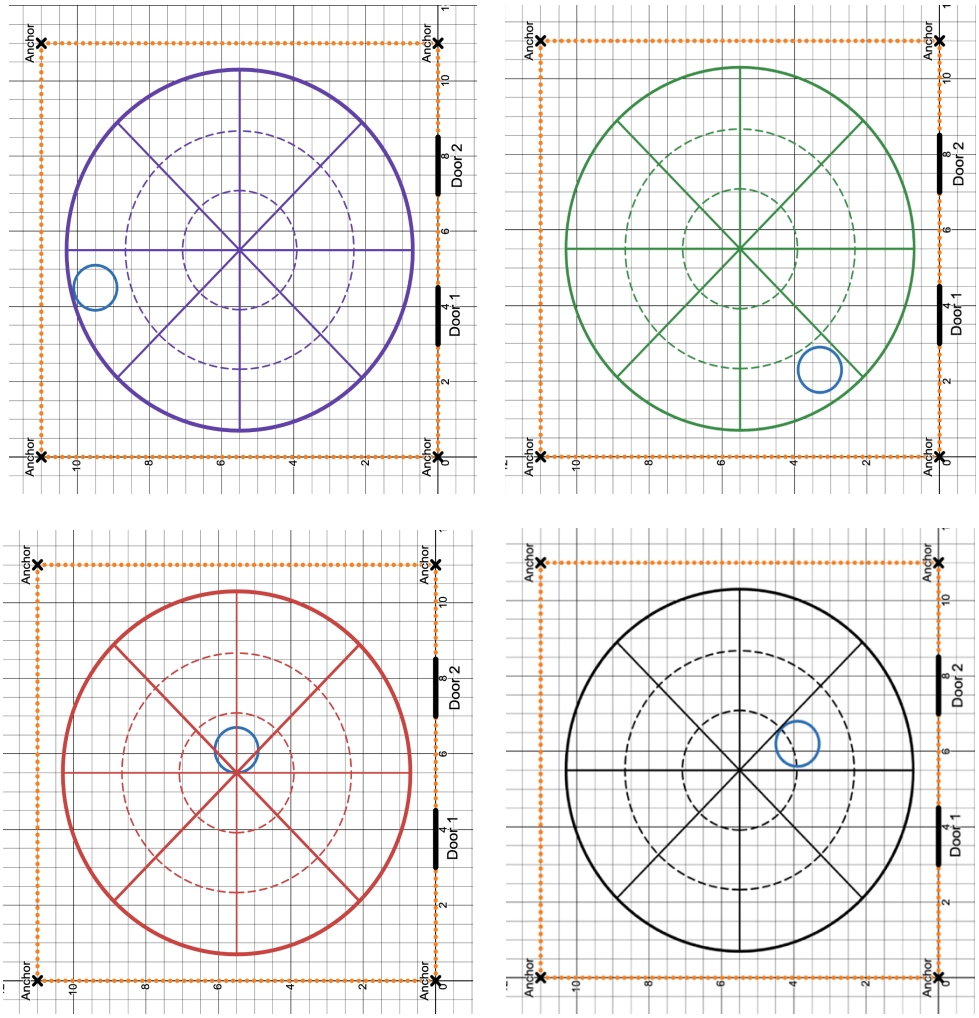


Table 12 – *Eclipse*, final maps

Scenes 1-4 from top left to bottom right: scene 1 in purple; scene 2 in green; scene 3 in red; scene 4 in black. The maps' orientation reflects the user's view from the centre of the room.

Table 13 – *Eclipse*, sequence of scenes and transitions

∞		Input Audio	Transitioning Mode
Introduction	*Exploration might last forever* (1'47'')	ch 8 ('beacon') [featured] + 7 ch [silenced]	automatic
	Exploration might last forever: play and replay, forward and back, forget and remember again. Or, what matters may instantly align at unexpected times and places. This space is empty. Like an eclipse, it contains darkness and intangible memories waiting to be illuminated. Walk through it to light them up, follow your paths and natural pace. Catch any attractive sounds: they will point to memories. Wherever you are, a memory may suddenly surface, like a bell's chime. Does it ring a bell? Remember: we are looking for a question. This will shape the surroundings.		
Scene 1	*Beaks and birds* (4'26'') ∞	7ch + 1 ch ('beacon')	Bells sound calling + guiding voice: "you are close, keep listening." + participant's position in localised transitioning zones for ≥ 4 seconds = Bells sound change to signal completed transition
	These are beaks and birds. "Birds can see things we cannot see. Birds have wings, and their wings have eyes. They know when the night is coming."		
[transition 1-2]	(0'08'') ∞ + (0'19'')		
	you're close: keep listening.		
Scene 2	*Come closer* (4'21'') ∞		
	"Night is night, no matter how long." ——————————— Come closer.		
[transition 2-3]	(0'08'') ∞ + (0'19'')		
	you're close: keep listening.		
Scene 3	*Underwater talk* (4'24'') ∞	8ch	
[transition 3-4]	(0'08'') ∞ + (0'19'')		
	you're close: keep listening.		
Scene 4	*Underwater talk* (coda) (0'57'') ∞	7ch + 1 ch ('beacon')	
	…and it's not over, yet.		
[transition 4-1]	(0'08'') ∞ + (0'19'')		
	you're close: keep listening.		

5.2.4 Composing trajectories

As explained in the previous paragraph, visitors were able to control the volume of each single channel by walking from the periphery to the centre. Spatial ambiguity derived from assigning different coordinates to the transitioning zone in each scene. In this way, the visitor was stimulated to revisit trajectories later in time or find new ones, possibly wanting to spend more time experiencing the installation.

I composed *Eclipse*'s fixed-media scenes in 8-channel audio. Built on the experience of performing *Influences*, I allocated 7-channel audio for textural soundscapes and the remaining one channel for auditory cues or audio description (i.e. the beacon). Subsequently, these 8-channel compositions were inputted into the Max MSP installation patch. A separate patch was aptly programmed for drawing and managing spatialisation trajectories (**Fig. 32**).

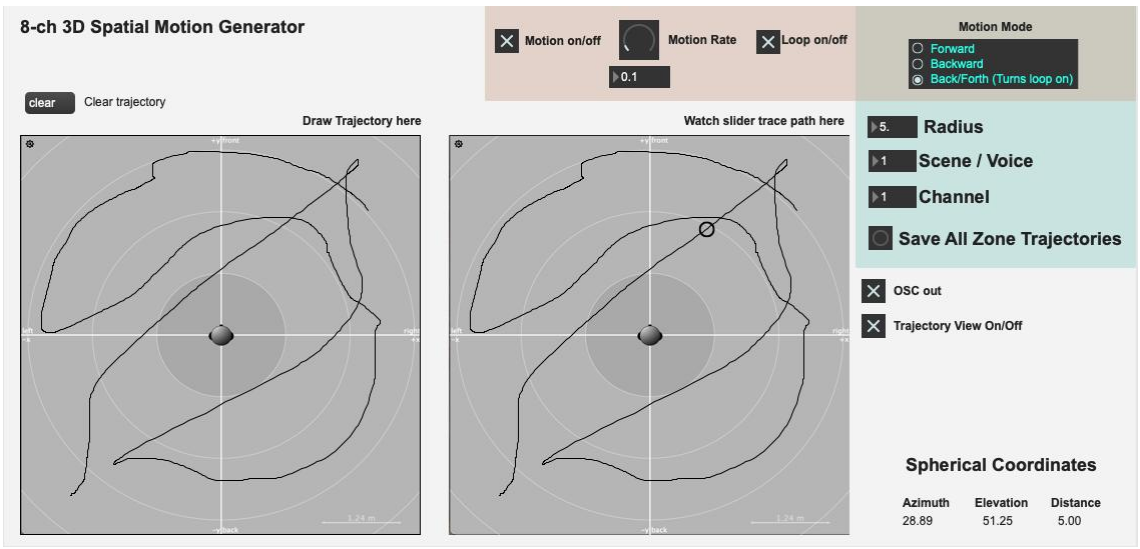


Figure 32 – *Eclipse*, spatialisation patch UI (source: M. Mardakheh)

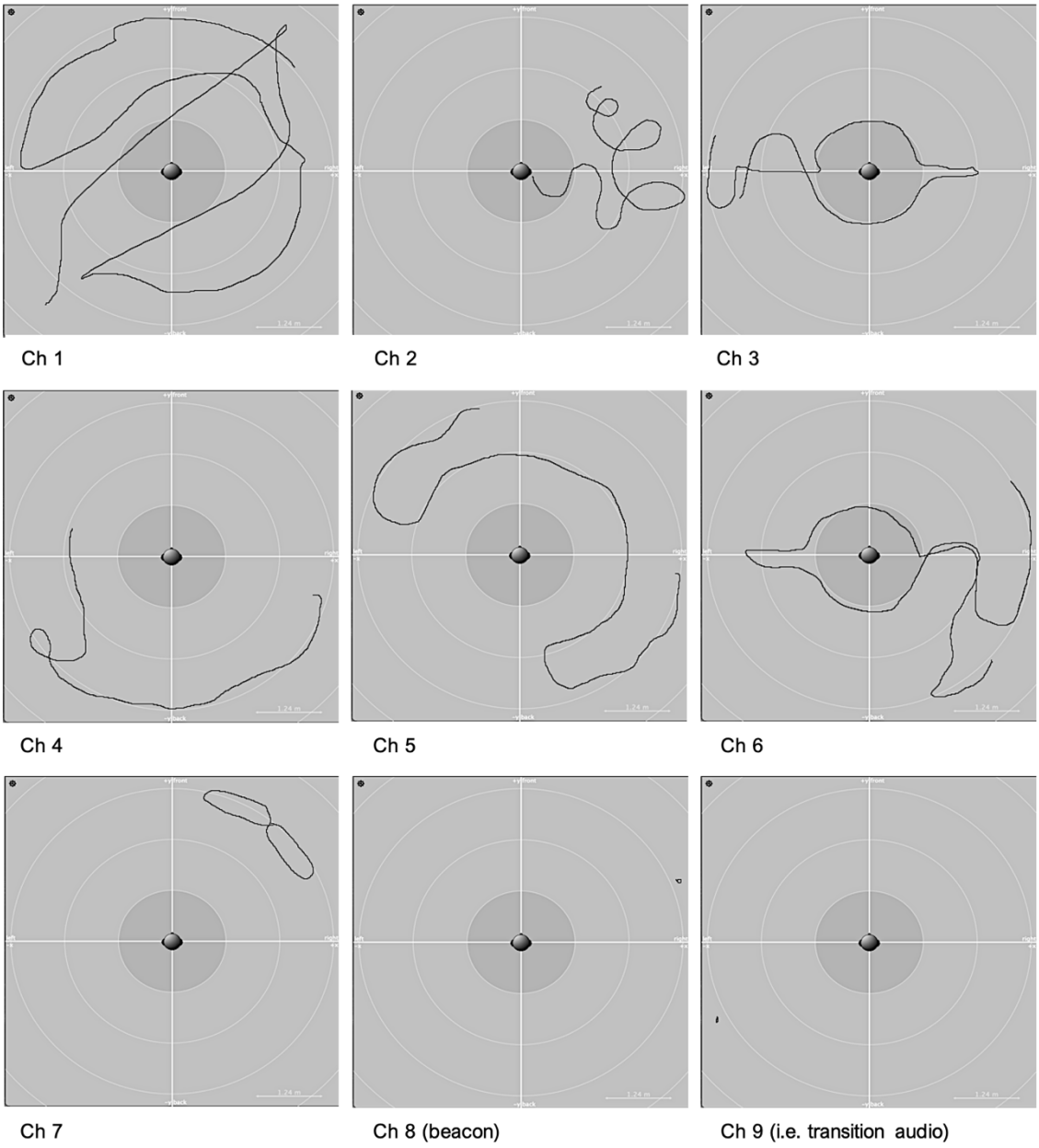


Table 14 – *Eclipse*, spatialisation trajectories overview

Through the spatialisation patch it was possible (1) to draw a specific spatialisation trajectory for each audio channel of each scene or transitioning zone, (2) to control the speed, and (3) to loop each trajectory singularly. In spatialising soundscapes, I privileged a smooth diffusion, with slow moving individual trajectories throughout the full loudspeaker dome (20.2-ch). Differently, due to dealing with a voice recording, the beacon channel's trajectories were confined into one speaker (**Table 14**).

5.2.5 First public opening

Eclipse's first public opening took place in July 2024 with the support of the University of Birmingham Public Engagement Fund for Research. We hosted a booking system for solo experiences (30 slots, 20 minutes per person). However, the audience's participation exceeded our expectations: not only available slots were fully booked, but additional visitors attended without a reservation and/or as a group or couple.

To all participants, we offered a brief induction and the opportunity to walk the installation with or without a blindfold. Most people chose to embrace the blindfold after a first sighted run, to compare the two sensory statuses (**Fig. 33**). We found that restricting the interactivity to just one feature successfully allowed visitors to recognise that feature by themselves, play with it and enjoy being in the space without overloading the senses.

As the transitioning zone moves towards the centre of the room over the course of Scenes 1-4, it becomes increasingly easier to locate it in the space. However, it may become increasingly estranging to focus on the beacon and the transition audio when the

overall scene volumes are at the maximum level (i.e. close to the centre of the room, like in transitions 3-4 and 4-1).

In this respect, we observed remarkably different attitudes toward experiencing the installations. Some participants were trying to solve the game and decode a rule to complete transitions systematically, as quickly as possible; some others were more into the listening than the walking (or vice versa); some appreciated listening to single layers at the periphery; some decided to stay in the centre of the same scene and move away from transitioning zones once their function was understood.[78] These behaviours we could observe from outside, following the visitor's position on the map[79] through the User Interface. Some visitors shared impressions informally with us; there were no surveys for the audience, which can be a point to consider for future versions of this installation. Structured participatory research could potentially help develop further nesting of interactivity layers and narratives, as well as further public engagement strategies. The success of the initiative encourages us to continue expanding this project, which has a strong potential for interdisciplinary applications – also in fields other than music and the arts. [80]

[78] Further documentation of the public visiting *Eclipse* is available at https://eclipseinstallation.site/#gallery (Accessed: December 2024).

[79] See § 5.2.3.

[80] Such as in community building, education, psychology, or health. It is proved that movement and music imagery may elicit empathy and release repressed emotions, helping rehabilitation after several issues (Pratt, 2004, p. 836).



Figure 33 – *Eclipse*, public opening (July 2024)

6. CONCLUSIONS

This composition portfolio has delved into the concepts of cross-modal stimulations and sensory illusions across various media and artistic outputs. My contribution was situated within a broader context of contemporary composers who have explored performance in darkness, experimental music theatre, soundwalks and soundscape composition – Georg Friedrich Haas, John Cage, Carola Bauckholt, Hildegard Westerkamp. I focused on establishing connections between vision removal and spatial awareness to propose potential avenues for creating new compositional structures and concert experiences. Simultaneously, I was interested in fostering presence, emotional and sensory materiality through the act of listening.

I adopted multidisciplinary lenses, drawing insights from composition, architecture, acoustic ecology, music psychology and perceptual studies to analyse those parts of my creative process that involved embodiment and space. I worked on instrumental, electroacoustic, mixed media, opera and interactive sound installation, fostering collaborations as an integral part of my research.

The second chapter of this thesis presented three pieces for different lineups featuring soundscape orchestration and musical imagery as compositional principles. *Their wings have eyes* and *Inner engines on a private trail* display distinct soundscape evolutions starting from the same audio sample. Musical imagery, as a characteristic of myself as a conductor, has supported the composition of *Fondale mobile's* new version, validating a continuous feedback loop across my methods of designing, composing and performing.

In the third chapter, I illustrated *Those who have the right to yell - won't,* and *Crumpled Questions*, both originated via cross-modal approaches for eye-ear illusions. The fourth chapter touched on psychological, invisible and sensory borders, topics I intersected in my opera *Radice Posizione Distanza* and string quartet with electronics *Resight*. The quartet and the opera also shared similar generative uses of auditory cues – either from the electronic track or intrinsic to the ensemble – to cross-reference and unlock musical narratives. Expressive, perceptual, and technical aspects of compositions designed for performing without seeing emerged in *Resight,* as well as in *Those who have the right to yell – won't*. The fifth chapter was devoted to interactivity matters and spatial perception, as developed in the interactive sound installation *Eclipse* and its direct antecedent *Influences*.

"Exploration might last forever" – claims *Eclipse's* opening line – and further cross-disciplinary research, artistic outputs, self- and environmental awareness could spring from my explorations, involving other disciplines, or other roles in the music field. Collaborative efforts, such as the opera and the interactive sound installation, have led to undoubtedly satisfying outcomes, with strong significance, public engagement and prospects to grow. Additionally, *Eclipse*'s public opening, in partnership with Milad Mardakheh, has already demonstrated a considerable potential to expand as a gamified experience, a tool for learning and teaching, artistic and social wellbeing innovation. These compositions were some potential practice-led answers addressing the need to unite the senses through the ear. In the midst of our ocular-centric societies, I attempted

to produce musical evidence of research path that intertwines sonic aspects of the sensory experience, in performance as in everyday life.

That connected to the original spark of “activist musicking”. Experimenting with altering the senses by removing the sight, proved to have highlighted the grounding – yet ambiguous – effects of sound. The practice of composing music consistently for multisensory outcomes has sharpened my understanding of emotional spaces – a key objective I have aimed to communicate through my music.

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