DOUBLES AND DUPLICATION: A STUDY OF THEIR APPLICATION AS MUSICAL MATERIALS AND COMPOSITIONAL DEVICES—MIRRORS, STILL LIFES, ECHOES, DISPLACEMENTS

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Abstract

The submitted portfolio and accompanying thesis focus on the subject of doubles and duplication and their application as musical materials and compositional devices in my own work and, to a lesser extent, throughout the history of music and other artistic disciplines. In this study I look at the acoustic, structural, perceptual and aesthetic implications derived from the duplication of sonic materials, instruments, objects, setups, gestures and performers.

From a general perspective, the use of duplication raises a number of issues of perceptual and acoustic nature: the effect and auditory conditions generated by the performance of identical sounds by two or more sonic sources, the importance of synchronicity or asynchronicity in the suggestion of aural and visual analogies, the role of distance in the establishment of auditory correspondences, the degree of similarity required by specific materials to be identified as doubles, the role of the performer in creating a sense of gestural and performative duplication, the relationship between acoustic and acousmatic sources in the delineation of sonic parallels, etc.

In this thesis, the subject of duplication is chiefly regarded from spatial, performative and sonic perspectives. The sections focusing on spatial issues examine the function of duplicated setups of objects and instruments in the space of performance. The analysis of performative elements addresses the role of gestural duplication and doppelgangers as musical and scenic resources. Finally, the sections on sound investigate the perceptual and aesthetic effects of duplicated sonic sources, echoic interactions and sonic displacements. This thesis is structured into two main parts. The first part (chapters 1 & 2) examines the different possible categories and models of duplication and their usage throughout music history. The second part (chapters 3 & 4) focuses on the application and different roles of duplication in my own music.

The issue of duplication has been explored in the works composed throughout the research process. A total of six pieces (approximately 105 minutes of music) have been written over the course of this PhD. The issues present in these compositions have been thoroughly examined in my thesis, becoming the main object of study. Each of these works approaches duplication in a different manner, highlighting the versatility and potential compositional applications of this phenomenon.

__Acknowledgements__

I would like to thank all the people who helped me in the process of developing this research project.

Firstly, I would like to express my gratitude to Professor Aaron Cassidy for the interesting and inspiring tutorials as well as for his sense of curiosity, critical thinking and deep commitment to my research project.

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Finally, I would like to acknowledge my family's commitment to my music and academic endeavours. Without their support, the development of this thesis would have been impossible.

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Composition portfolio (chronological order)

Title and year	Instrumentation	Duration	Première	Recording(s)
Huella y Horizonte (2014-2015)	Tenor saxophone, 5 differently-sized steel sheets (5 percussionists), large hanging metal sheet, transducer loudspeakers, MIDI controller keyboard (1 player)	26'	Bernaola Festival Spain (November 2015) Pedro Pablo Cámara (saxophone), Ensemble This Ensemble That (percussion)	Audio: http://www.abelpaul.net/huellayhorizonteaudio.htm Video: https://www.youtube.com/watch?v=J5WKd_ofIlA
Isla y Continente (2015)	Two metal sheets (two percussionists), transducer loudspeakers	11'	Royal College of Music London (February 2016) ReConvert	Audio: https://www.mixcloud.com/abel-paul/isla-y-continente-2015/
Piel y Distancia (2015)	Violin, viola, violoncello, unplayed violin, transducer loudspeakers and MIDI controller keyboard (one player)	12'	St Paul's Hall, Huddersfield (December 2015) NOU Ensemble	Audio: http://www.abelpaul.net/pielydistanciaaudio.htm Video: https://www.youtube.com/watch?v=1FCl-B--WiI
Gyre and Gimble (2016)	-Voices: silent soprano, mezzo soprano, tenor, baritone, choir (soprano, mezzo soprano, tenor, baritone) -Instruments: 4 percussionists (3 steel sheets, reel-to-reel player, one timpani), strings (vl, vla, vcl, double bass—mainly played with transducers), MIDI controller keyboard (1 player) -Unplayed instruments: 2 pianos, tam-tam, metal sheets, bass drum, snare drum (all of them utilized as sound boxes for transducer loudspeakers), prepared air fans -Transducer loudspeakers	22' 30"	Internationale Ferienkurse für Neue Musik Darmstadt (July 2016) Staatstheater Darmstadt, Staatsorchester Darmstadt, Johannes Harneit (conductor)	Video: https://goo.gl/fOIuCN

Nombre y Vacío (2016-2017)	Piano, percussion (reel-to-reel player, one timpani, small percussion instruments), double bass, unplayed tam-tam, MIDI controller keyboard (1 player), transducer loudspeakers	11'10"	Museo de Arte Contemporáneo, Santiago de Compostela (December 2016) Vertixe Sonora Ensemble	Audio: https://soundcloud.com/abel-pa/nombre-y-vacio-vertixe-sonora-santiago-de-compostela-12-2016
Mano y Mente (2017)	Percussion (reel-to-reel player, different bowls, crotale disks, unplayed tam-tam, water, small dry beans, marbles, golf balls, Baoding balls), transducer loudspeakers	20'17"	Festival Mixtur Barcelona (March 2017) Miquel Bernat	Audio: https://soundcloud.com/abel-pa/mano-y-mente

__Supplemental compositions__

This secondary list of scores includes an earlier work (*I reached A through the throng through the threshold through the throb*), mentioned in my thesis due to its particular significance for the main subject of research. This list also includes a couple of pieces that, even if composed during the PhD, are the product of different professional engagements. These works are, to a large extent, unrelated to the actual research subject (see appendix).

I reached A through the throng through the threshold through the throb (2011-2012)	Soprano, silent soprano, invisible choir, flute, clarinet, piano, percussion, vln, vla, vcl, unplayed piano, unplayed instruments (utilized as sound boxes), loudspeakers, small motors and light bulbs	20'	Münchener Biennale (May 2012) Klangexekutive Ensemble Errico Fressis (conductor)	Audio: http://www.abelpaul.net/ireachedaaudio.htm Video: http://www.abelpaul.net/ireachedavideo.htm Score: https://1drv.ms/b/s!AoRvEdlR5f1XghH-Aq_3can-88hq
Title 14 (2014)	Flute, clarinet, alto saxophone, harp, piano, vln, vla, vcl	10'	Impuls Graz (February 2015) Klangforum Wien Clement Power (conductor)	Score: https://1drv.ms/b/s!AoRvEdlR5f1XghIneneGq8ILxDmh
Room & Elbow (2016)	Violin, viola, violoncello, percussion, unplayed violin, unplayed piano, transducer loudspeakers and MIDI controller keyboard (1 player)	13'	Reina Sofía Auditorium Madrid (November 2016) Vertixe Sonora Ensemble Pedro Amaral (conductor)	Audio: https://soundcloud.com/abel-pa/room-elbow Score: https://1drv.ms/b/s!AoRvEdlR5f1XghNW6zjjT5YnCifN

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<u>Introduction: duplication versus repetition—an etymological starting point</u>

In order to establish a conceptual framework for the definition and elucidation of the term "musical duplication" it seems relevant to determine a terminological distinction between the traditional notions of duplication and repetition. A demarcation should be drawn between these two often interchangeable concepts, frequently regarded as semantically analogous. A closer look at their etymological origin, however, reveals a seminal divergence, a distinction that constitutes the conceptual backbone of this thesis and whose specificity is central to my research and, to a certain extent, to my compositional language.

The term duplicate stems from the Latin word *duplicatus,* defined as "having two parts, double".[1] Repetition*,* on the other hand, derives from Latin *repetitionem*: the "act of saying over again".[2] This etymology shows a patent distinction in the conceptual nature of the two words. Repetition implies a clear temporal sense, a linear progression of events taking place in a dynamic context. The etymology of duplication, on the other hand, manifests a static nature, a description of attributes rather than an action, a spatial situation. "Saying over again" implies a sense of action in sequential time, an activity that is reproduced identically and successively within a specific time span. "Saying" is an action verb that implies potentiality, the possibility of a dynamic act within a particular temporal frame. This temporal implication does not necessarily need to be linear but could also be subjected to different levels or modes of perception, therefore abandoning the notion of time as a flat, regular expanse. Deleuze expresses this clearly in the "Repetition for Itself" chapter of *Difference and Repetition*. Here he distinguishes between three main time categories in which repetition occurs. The first, "passive synthesis", relates repetition to habit and recurrence. This is a circular model by which events operate in a cyclical manner, as if determined or governed by an external natural force such as seasonal changes or the alternation between day and night. The second model of time, *"*active synthesis" is characterised by temporal linearity, by the placement of events in time according to memory: a model in which discontinuities are introduced by establishing relationships between distant events. Here, memory operates as a creator of identity, allowing specific experiences to be remembered. The third level, "empty time", is characterized by a vision of the absolute in which time is free from simple recurrence, defined by an event so mighty

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[1] Harper, D. (2001-2017). *Online Etymology Dictionary*. Retrieved from:
http://www.etymonline.com/index.php?term=duplicate&allowed_in_frame=0
[2] Harper, D. (2001-2017). *Online Etymology Dictionary*. Retrieved from:
http://www.etymonline.com/index.php?allowed_in_frame=0&search=repetitionem

that it becomes an object of eternal return, a greatly emblematic phenomenon by which repetition takes the form of an everlasting recurrence.

These temporal aspects—cyclical, non-cyclical and absolute—impregnate the etymological notion of repetition. This temporal nature is of a special significance when we apply the term to music. Since music is typically considered a temporal art, repetition is often regarded as a sequential recurrence of events that occur within a particular time frame. The role of memory is crucial at establishing points of connection between separate events, introducing hiatuses in the continuity of temporal lines. Subsequently, repetition in music could be directly related to Deleuze's notion of "active synthesis", emphasizing the importance of memory as a tool for the construction of identities that may be able to fracture a linear perception of time.

Stockhausen's famous quote, "Repetition is based on body rhythms, so we identify with the heartbeat, or with walking, or with breathing" (Lee & Stockhausen, 1999), describes a sequential conception of repetition by adding a sense of bodily regularity, a sensory association to the pace of our physiological features, an intersection between memory and biological evenness. This notion of repetition could be placed at the junction of both of Deleuze's "passive" and "active synthesis" categories: our sensory capabilities intertwined with a set of natural, predetermined conditions. Similarly, Dewey's notion of "rhythm" speculates about an innate, instinctive sense of repetition. This is derived from the observation of recurring natural events (such as night and day cycles, seasonal changes, etc.) whose regularity is deeply rooted in human subconsciousness. The expression of rhythm in any particular art form is therefore a subliminal manifestation of some of the iterative conditions of nature.

> Underneath the rhythm of every art and of every work of art there lies, as a substratum in the depths of the subconsciousness, the basic pattern of the relations of the live creature to his environment. (Dewey, 1987, p.155)

Repetition in music is usually associated with a linear, consecutive conception of time. This is explained by the irreversibility of sonic events, which usually cannot be catalogued as iterative if played or performed backwards (with the exception of extremely chaotic or invariable materials such as white noise or stable, continuous sounds). Most sounds consist of attack and decay, two elements that if played in reverse give us a completely different sonic result. Sound is usually finite and exists as a directional entity. This is, however, relative when we approach the spatial and visual domains. The silent video recording of a moving object or set of objects (such as a bell swinging) implies a clear directionality. When we play the video in reverse, however, we obtain an essentially identical (or almost indistinguishable) result. Visual irreversibility (such as the demolition of a

building or dropping an object) implies a certain narrative or the imperative logic of a natural force such as gravity, an effect comparable to the attack/decay dialectics inherent to sound. This inevitably prevents the event from repeating itself, as the final state of the object involved is not restorable. However, the notion of reversibility and non-directional time is of a particular importance when we address repetition in a spatial and visual context. As Michel Chion remarks:

> Between the orders of sound and image: given a comparable time scale (say two to three seconds), aural phenomena are much more characteristically vectorised in time, with an irreversible beginning, middle, and end, than are visual phenomena. (1994, p.19)

Naturally, the term repetition is often applied to the description of spatial elements. Its original etymological sense is thus expanded, transferring a temporal character to the description of iterative elements within the spatial domain. It is often remarked how dominant space (and the perceptual mechanisms involved in its comprehension) is in relation to time. This particular weight of the spatial domain has often caused terms with an originally temporal connotation (such as repetition) to acquire a new meaning, a new semantic content applicable to the description of spatial features. Laclau holds a particular view on the hegemony of space over time. According to his position, this preponderance is precisely constructed by repetition.

> Through dislocation time is overcome by space. But while we can speak of the hegemonization of time by space (through repetition), it must be emphasized that the opposite is not possible: time cannot hegemonize anything, since it is a pure effect of dislocation. (1990, p.42)

This statement gives repetition the character of a nexus, of a link between space and time. It is also regarded as a mechanism that determines a sense of spatial hegemony. In this regard, Laclau also states that "the 'spatialization' of an event consists of eliminating its temporality" (1990, p.41). However, this idea of a spatial preponderance may be contested precisely by affirming the opposite: repetition is the translation of a temporal element into the spatial domain. This creates a more complex relationship between the temporal and spatial realms. Space is then free from the simple categorization that describes it merely as a negative of the temporal, as an immutable, fixed domain. Foucault criticizes this traditional, rigid conception of space:

> Space was treated as the dead, the fixed, the undialectical, the immobile. Time, on the contrary was richness, fecundity, life, dialectic. (1980, p.70)

Dynamism in space is therefore partially generated by the use of repetition, which imprints an immediate feeling of temporality to this domain. Repetition operates as a junction, as a point of union between the temporal and spatial realms without drawing a clear borderline between the two. Thus, repetition is an element with a dual nature, equally significant for the understanding of both the temporal and the spatial realms and the possible intersections between them.

The heterogeneous nature of repetition is particularly evident when we apply the term to visual arts, to its production process and its ulterior experience. Warhol's *Marilyn Diptych* is based on the multiplication of the actress' image 50 times. When we contemplate the canvas from a distance we have an impression of its totality: two main areas, colour on the left and printed in a fading black-and-white on the right. This holistic impression is immediately challenged once we physically approach the work and the grid of portraits becomes apparent. A look at a closer distance immediately implies a temporal experience: our sight moves from left to right or up or down within the grid, configuring a freely designed itinerary through the network of Marilyn's faces. The visual experience of the work acquires a temporal dimension; the portrait is repeated within a temporal structure whose duration and configuration is dependent on our visual trajectory and observational velocity.

Figure 1: Warhol, A. (1962). *Marilyn Diptych* [silkscreen].

In this kind of work, repetition operates as a visual envelope that immerses the observer in a context of perceptible analogies, variations and transitions. Simultaneously, the viewer is located

within a temporal envelope: the painting imposes a succession of events upon the observer who is not fully able to apprehend the essence of the work if he or she does not follow a particular temporal path. In this case, repetition functions as a generator of potentiality: the iteration of Marilyn's image eliminates the possibility of a global or unitary observation of the work while it allows the creation of different, non-linear, perceptual itineraries through the dense net of portraits over varying time spans. Bourriaud fittingly speculates about the temporal conditions that may arise during the process of observation of an artwork.

> All images are moments, just as any point in space is both the memory of a time x, and the reflection of a space y. Is this temporal factor frozen, or to the contrary, is it a producer of potentialities? (Bourriaud, 2002, p.80)

Similarly, Bourriaud describes the work of art as a dynamic set of networks, as an incomplete framework that allows changing interpretations, perceptual angles and possible associations.

> The contemporary work of art does not position itself as the termination point of the "creative process" (a "finished product" to be contemplated) but as a site of navigation, a portal, a generator of activities. We tinker with production, we surf on a network of signs, we insert our forms on existing lines. (2005, p.19)

This aspect of potentiality is, in my eyes, inherent to the very notion of repetition. It implies an indissoluble linkage with the temporal domain, to the succession of experienced (and experienceable) events. The multiplicity of repeated portraits suggests a lack of gravity, an absence of a clear centre that generates an array of possible interpretations, a number of visual/perceptual routes, which are at play during the observational process of the work. As Foucault puts it:

> […] in concentrating on this boundless monotony, we find the sudden illumination of multiplicity itself—with nothing at its centre, at its highest point, or beyond it—a flickering of light that travels even faster than the eyes and successively lights up the moving labels and the captive snapshots that refer to each other to eternity, without ever saying anything: suddenly, arising from the old inertia of equivalence. (1977, p.89)

Let us now focus on the etymological nature of the word duplication: "having two parts". This etymology makes reference to a classical spatial conception: a static depository of attributes rather than a context of temporally induced changes, successions and variations. This very conception refers to a static, inert context, descriptive rather than prescriptive: "having" as opposed to "saying". The term duplication alludes to the very nature of the objects, to their intrinsic properties, which are perceived as equal or identical by the observer. In duplication, the role of the temporal axis is traditionally discarded in favour of an immobile, static and invariable spatial

notion. The term duplication implies the presence of two or more objects in space that share the same configurations, delimited by identical (or perceptually indistinguishable) spatial boundaries. This notion of limits, of confines that demarcate the extension of a particular object, is at the core of the notion of duplication.

An object needs to be defined, its intrinsic properties demarcated and distinct from the surrounding extension of space. The delineation of the limits of an object is essential for the very principle of duplication, for the generation of replicas of its observable (and eventually non-observable) attributes. The delimitation of space is a constant issue of speculation in the fields of visual arts and architecture. The idea that a certain space has limits does not only imply the assumption that matter is segmented, divided, but also that it possesses a specific nature, a defined character. Tschumi raises these questions in a rather aphoristic and provocative manner by focusing on architectural issues.

If space is a material thing, does it have boundaries? (1996, p.53)

If space has boundaries, is there another space outside those boundaries? (1996, p.53)

Architecturally, if defining space is making space distinct, does making space distinct define space? (1996, p.55)

If architecture is the art of making space distinct, is it also the art of stating the precise nature of space? (1996, p.55)

The demarcation of a particular space does not only indicate its geographical limits but also determines its character, its unique features and configurations, its functionality. Defining a space does not only involve mapping its geographical extension but also generating its identity, ultimately outlining its properties and behavioural conditions.

The concept of limits is directly related to the very definition of architecture. What is meant by *to define*-"To determine the boundary or limits of," as well as "to set forth the essential nature of." (Tschumi, 1996, p.103)

The circumscription and demarcation of a concrete space is essential for the notion of duplication. An undefined expanse of space cannot be regarded as an individual, self-contained entity. Singularity and individuality are thus directly related to the idea of duplication. The visual domain is particularly effective in the act of confirming the spatial nature of duplication. The observable attributes of objects and their equivalences are immediately apprehended and corroborated by the observer's sight. This spatial/visual conception generally impregnates the

notion of duplication, relegating the temporal domain to a second plane. This term is often conceived as a multiplication of an element and its attributes rather than as the result of a temporal succession or a sequential process. A pertinent analogy is that of the mirror: an object that reproduces and multiplies an image in a context of immediacy and simultaneity, in a frozen, unalterable temporal framework. Consequently, the sense of direction, movement and the consecutive character that impregnates repetition does not operate here. The suggestion of potentiality—of paths of events that should be followed in order to construct a global picture—loses its significance. Conversely, and from a traditional perspective, duplication prioritizes the invariability of objects, the timelessness of the spatial realm against the flow and the succession of events of the temporal domain. This canonical conception is particularly effective when applied to the visual realm, to the recognition of identical (or seemingly identical) objects and spatial contexts.

The nature of musical duplication is much harder to elucidate as the presence of sound and gesture creates an almost immediate linkage to the temporal domain. However, in this thesis, the involvement of temporality is disregarded as much as possible, assuming the preponderant role of space and simultaneity. This is consistent with duplication's original etymological sense. Thus, the time domain, almost unavoidable when describing musical phenomena, is mostly overlooked or treated as an absolute element, deprived from any sequential or successive character. This clear detachment from temporal consecutiveness and linearity is a necessary aspect to establish a clear separation between the notions of repetition and duplication. Nevertheless, describing the essence of duplication in music poses an almost inescapable set of difficulties. The temporal nature of the actions and acoustic phenomena involved in the production of music is so deeply intertwined with the spatial realm that establishing a clear differentiation seems, at times, impracticable. In order to focus on the idea of duplication we have to avoid the idea of movement and qualitative duration (in a Bergsonian way).[3] Rather, we should focus on a context of spatial situations and invariable positions. Time should be regarded as an abstraction, as a uniform infrastructure in which instants do not imply movement and sequence. Deleuze, in relation to the moving image, analyses the dichotomy between abstract time [*temps*] and duration, underlying the importance of the latter for the creation of an impression of movement:

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[3] Bergson differentiates between duration (*durée*) and time (*temps*). *Durée* describes the subjective experience of time, conditioned by individual perception. Thus, one may experience the flow of time in a variety of different ways —slowing down, speeding up, etc. *Temps*, on the other hand, refers to the uniform time of science. For Bergson, the nature of *temps* is defined by the application of spatial concepts to time. This temporal regularity is experienced as a succession of single, episodic, spatial constructs—pretty much like the sequence of individual images in a film tape. In such a way, the individual thinks he/she is observing a continuous flow of movement, but actually he/she is just seeing a succession of fixed images and frames.

You cannot reconstitute movement with positions in space or instants in time: that is, with immobile sections [*coupes*]. You can only achieve this reconstitution by adding to the positions, or to the instants, the abstract idea of a succession, of a time which is mechanical, homogeneous, universal and copied from space, identical for all movements. And thus you miss the movement in two ways. On the one hand, you can bring two instants or two positions together to infinity: but movement will always occur in the interval between the two, in other words behind your back. On the other hand, however much you divide and subdivide time, movement will always occur in a concrete duration [*durée*]; thus each movement will have its own qualitative duration. Hence we oppose two irreducible formulas: 'real movement – concrete duration', and 'immobile sections + abstract time'. (2005, p.1)

The latter of these two formulas is particularly appropriate for the contextualization of duplication. The succession of immobile sections—which may be identified as spatial situations— produces a feeling of temporal uniformity. Time is therefore conceived as an abstract entity rather than one subjected to personal experience: *temps* as opposed to *durée*. This uniform conception of time allows us to focus on the spatial character of duplication without submitting to the complexities and inner workings of individual temporal perception. Therefore, in the course of this thesis time will generally be treated as a homogeneous, unchangeable domain. It will be regarded as a uniform framework generated by the spatial nature of duplication rather than the driving force that shapes and determines duplication's identity and behaviour.

If this set of premises is accepted as a preliminary hypothesis, a question is almost immediately raised: which are the components, the constituting elements that define a musical duplication and what are the conditions (performative, spatial and perceptual) under which it may occur?

Chapter one: categories of duplication

Duplication in music may be identified and classified according to the following categories:

1. spatial—physical space and physical movement within that space
2. sonic

These categories are sometimes linked and/or unified and occasionally utilized in opposition. At times, drawing a clear borderline between them becomes a nearly impossible task as they are completely interdependent. Clear examples of this dichotomy are observable in some of my works, chiefly in compositions where the use of duplicated performative gestures and instruments determines coincident sonic results. In these cases, two or more performers apply the same performative actions to identical instruments. The opposite phenomenon occurs when performative gestures and instruments are duplicated but the sonic results differ. This creates a feeling of audiovisual mismatch. These dichotomies are often observable in works such as *Huella y Distancia* (2014), *Isla y Continente* (2015) and *Gyre & Gimble* (2016). These compositions will be studied in detail in the next chapters.

The spatial realm is defined by observable, visually perceptible elements. These are mainly defined by the use of identical (or seemingly identical) gestures by two or more musicians. Additionally, the use of two or more identical instruments/objects (by one or various performers) fits into this category. Both the duplication of performative gestures and the use of identical instruments/objects may operate simultaneously or separately. In all cases, an observable analogy is created: a mirrored relationship between the physicality of playing and the use (or suggestion) of equivalent instruments. This context of duplication is only noticeable by visual means and it is insinuated by establishing a sufficient degree of sameness between the gestures and/or the instruments at hand. This category is particularly important for the delineation of complex relationships and corresponding identities within the stage or the space of performance. A clear link to the original etymology of duplication is manifested here: two physical parts, two (or more) corresponding elements that are directly observable and identifiable as spatial parallels.

The particular affiliation between the use of duplicated instruments and identical gestural configurations may be found in many of my works, some of which will be discussed in more detail in the next chapters. Due to the simplicity of the setup and the clarity with which the gestural universe is exposed, my work *Isla y Continente* (2015) could be regarded as an introductory example to gestural and instrumental duplication. In this work, scored for two large identical metal steel sheets, two percussionists create a set of mirroring spatial situations by modifying the sheets' bending positions in a coordinated manner. The sheets operate as acoustic screens, which are

sonically excited by surface transducer loudspeakers fixed to their surface.[4] Simultaneously, the nature of the materials played through the transducers is altered as these react to the changing curvature levels and various other techniques applied to the metal sheets. A considerable part of the work displays mirror-like situations in which the bending gestures and other performative movements are replicated. The gestures of the performers, directly imprinted onto the metal sheets, thus determine a number of observable arches and planes: a fluid and variable set of quasi-sculptural symmetries.

In this piece there is an immediate linkage between the use of duplicated gestures and the generation of mirrored spatial configurations. The use of identical sheets permits an analogous level of distortion or modification of the materials played through the transducers (as long as equal bending degrees are applied). This generates a feeling of sonic duplication, which is inextricably linked to the process of gestural mirroring. In this work, gesture operates as a catalyst that creates a direct relationship between variable observable spatial configurations and changing degrees of sonic distortion. It functions as an intermediate means that defines, circumscribes and conditions the work's audio-visual nature. Additionally, the specular character of the piece is reinforced by the actual aspect and shape of the metal sheets, as they physically resemble a mirror's reflecting surface.

Figure 2: excerpt from *Isla y Continente*. The different bending levels applied to the metal sheets are symbolized by curved lines above the staff. Most of the actions performed by the percussionists mirror each other (simultaneously or with a slight temporal delay).
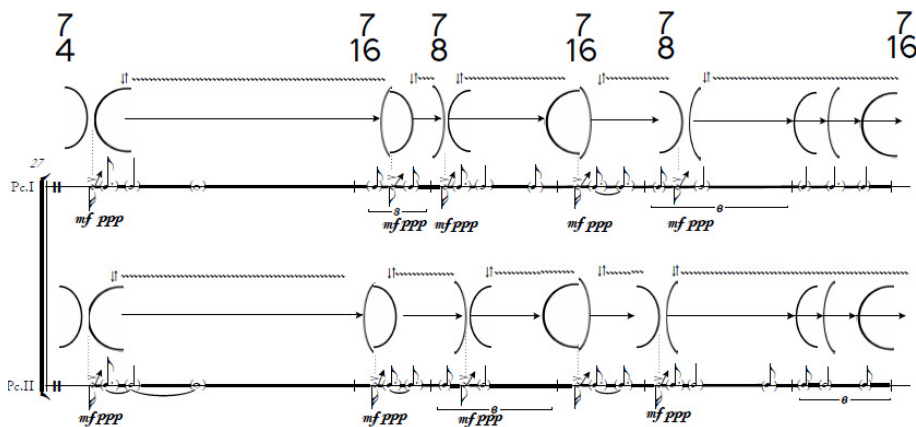
In music, physical gestures are usually linked to direct sonic results. The binomial relationship between gesture and sound determines the context of the audio-visual contract in music

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[4] Unlike standard loudspeakers, surface transducer loudspeakers (from now on generically referred to as "transducers") lack a diaphragm that moves back and forth, pushing the surrounding air to create sound waves. Instead, surface transducers incorporate a pad, which conducts the vibration (audio signals transformed into mechanical energy) onto the surface against which they are pressed. In such a way, any particular resonant surface or object can be excited by the transducer's vibration. Consequently, the object's oscillation causes alterations in the surrounding air pressure generating sound waves. In my works, the following models of surface transducers are normally used: www.goo.gl/RSZ3TG (diameter: 45mm, impedance: 4Ω, power rating: 5W) and www.goo.gl/ZBCf5y (diameter: 28mm, impedance: 4Ω, power rating: 3W)

performance. Nevertheless, physical gesture can be detached from its sonic outcome, becoming a significant musical object in itself, escaping the dialectical relationship implied by a concrete sonic result. This is particularly relevant in works where the physicality of gesture—the performer's movements—becomes a musical object in itself without involving any sonic outcome. This is observable in works with a clearly gestural character such as Cecilia Arditto's *Alrededor de la Música* (2006).[5]

The almost unavoidable influence of sequential time also impregnates the functionality and directionality of gesture. Again, a sense of time as objectified parameter is required to understand the role of gesture in a context of duplication. Gesture should then be regarded as singularity rather as a linear, directional phenomenon. It seems necessary to avoid focusing on its inherent narrative character, on its multiple layers of potential meaning and implied ramifications. Instead, we should look at it from a non-dynamic perspective, regarding it as a generic, static object. Thus, a feeling of a spatial parallelism is established: an architectural construction rather than a set of temporal relationships. As a result, gesture contributes to the delineation of complex spatial relationships, to the demarcation of mirrored performative realms. This detachment from the time axis is intended to specify as much as possible the architectural character of gesture in detriment of temporally oriented, standardised theatrical and choreographic theoretical and practical principles.

Three different categories—or levels—may be addressed in order to examine gesture from a spatial perspective, and are roughly coincident with the spatial levels described by Overlie's choreographic theory of viewpoints (Bogart & Landau, 2005). These categories are defined by the following elements:

1. spatial relationships—the distance between the objects and bodies involved in the production of gestural relationships
2. topography—the placement of the body in relation to its surroundings
3. shape—the contour or outline of the body in space: angles, geometrical position, lines, etc.

These three levels of classification are easily applicable to the analysis of gesture in music performance. Consequently, and from an illustrative perspective, they may also be utilised for the gestural analysis of *Isla y Continente*.

A clear sense of distance is established between the two metal sheets (ideally, they should be placed as far as possible from each other). Thus, each metal sheet is perceived as an autonomous object and not as the constituent of a single performative entity. This allows gestures to be perceived as individual phenomena once their physicality is transmitted to the surface of the sheets. The topographical aspect is particularly relevant for the spatial configuration of this work. The position

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[5] Video recording of this work: https://vimeo.com/142054986

of the metal sheets within the performance space (whether they are placed among other instruments, on an empty stage, facing each other, slightly oriented towards the audience, etc.) greatly determines the general audio-visual outcome of the piece.

Ultimately, the delineation of particular shapes (curves, parabolas, etc.) as a direct result of the actions applied to the metal sheets defines the materiality of the piece. The configuration of imitative and mirror-like relationships by the application of similar or identical performative gestures constitute the visual—and by extension sonic—set of materials upon which the work is structured.

Gesture may be regarded as an autonomous category in its own right, a visible envelope that anticipates and conditions the production of sound while influencing significantly the listener's global reception of a particular performance. In the context of this thesis, gesture will be often regarded as an autonomous object, emancipated from a specific sonic result and, in some cases, independent from a direct involvement with the performance of a particular musical instrument. This objectification allows physical gesture to become independent from any other medium. In such a way, a feeling of duplication may be established between two gestural realms without necessarily involving two identical or similar instruments/objects, spatial contexts and/or corresponding sonic universes.

The sonic realm focuses on the significance and role of identical sound sources in the process of suggesting or delineating musical spaces. Generally, in the context of this thesis, sound is regarded from a situational rather than from a temporal perspective. This approach allows the analysis of specific sonic parallelisms, antiphonal phenomena and symmetries that may be effective for the demarcation and circumscription of aural contexts.

The generation of spatial demarcations through the use of sound duplications may play a number of different roles in a context of music performance. They may be used for the expansion or reduction of the very space of performance by establishing sonic bridges and antiphonal relationships between two or more focal points. Simultaneously, they may be utilized to fracture spatial uniformity or, contrarily, for the creation of regularity within a changing context of spatial configurations and stratifications in a piece of music. Sonic duplications may involve a direct correspondence with the visual domain, that is, the observable simultaneous performance of two or more instrumentalists whose sound is reflected between each other. Additionally, they may be used as acousmatic sources whose presence may only be identifiable through the listening process. The acousmatic domain may be defined by the presence of speakers or by sound from invisible/offstage performers (or combinations of both). The spatial character of duplication is especially revealing when related to this particular realm. Possibly, the lack of visual references may imply a more direct involvement with the aural conditions as the signifier (sound) is the sole element responsible for the

creation of spatial relationships between the available sources.

In *Isla y Continente*, the sonic sources are also duplicated. A single audio file is played simultaneously through each of the transducer speakers fixed to the metal sheets, which are consequently sonically excited. This audio file consists of a single sinewave that outlines a meandering melodic line throughout the duration of the piece, determining a sonic stratum common to both of the instruments. Even if the processes of manipulation (bending and other techniques) applied to metal sheets greatly distort the sonic nature of the original audio, a shared sonic materiality is perceivable throughout the piece. This generates a particular, circumscribed auditory space, determined by the sonic equivalences produced by the two metal sheets.

The hybrid domain is evidently defined by the intersection of the spatio-performative and sonic realms, by all the possible combinations between the gestural, instrumental and sonic categories in which at least one is duplicated. These can be roughly divided into six main groups, some of which are only functional when regarded from a merely speculative, non-practical perspective:

Table 1: possible intersections of gestural, sonic and instrumental categories in the suggestion of aural and performative duplication

GESTURE	SOUND	INSTRUMENTS/OBJECTS
Identical	Identical	Identical
Identical	Identical	Different
Identical	Different	Identical
Different	Identical	Different
Different	Identical	Identical
Different	Different	Identical

Any number of these categories may be explored simultaneously or consecutively in the same work, depending on the number of performers and the intended spatial and structural configuration. This number of possible combinations may also be enriched by the inclusion of the acousmatic realm as one of the generators of duplicated identities. In such a case, the only parameter that would be subject to duplication would be sound, adding a new set of possible configurations to the equation:

Table 2: possible intersections of gestural, sonic and instrumental sources in the suggestion of aural and performative duplication from an acousmatic perspective.

GESTURE	SOUND	INSTRUMENTS/OBJECTS
No gesture	Identical	Invisible (acousmatic live performance and/or loudspeakers)
Visible gesture vs. no gesture	Identical	Visible (live performance) + invisible (acousmatic live performance and/or loudspeakers)
Visible gesture vs. no gesture	Identical	Visible (non-instrumental live performance: singers/actors)[6] + invisible (acousmatic live performance by singers/actors and/or loudspeakers)

Additionally, and for the sake of completion, the category in which all the parameters are duplicated (same gesture, same sound and same instruments/objects) should be mentioned. This does not truly belong to the hybrid realm but is rather an absolute expression of the conjunction between the aural and visual domains. This particular case may be effectively described by the term "point of synchronization" (coined by Michel Chion in *Audio-Vision*). This is defined, according to the author, as follows:

> A salient moment of an audiovisual sequence during which a sound event and a visual event meet in synchrony. It is a point where the effect of synchresis [...] is particularly prominent, rather like an accented chord in music. (1994, p.58)

According to Chion, these sync points in which both the visual and the aural are fully confluent may operate, from the perspective of gestalt psychology, as punctuations and breaks within a sequence, as points of convergence and/or as markers of a particular semantic field.

Another possible level of categorization would necessarily include the parameters of virtual and/or dislocated space. The first of these two is defined by the inclusion of video references as generators of duplicated identities (e.g. a live performance combined with its simultaneous (or

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[6] The role of the singers/actors in this particular context is regarded from a perspective of identical (or as similar as possible) use of vocal ranges, speech and other vocal techniques.

previously edited) video recording and projection). Here, all the visual and aural analogies are built upon a virtual medium, an equivalence obtained by the creation of a virtual space within the actual space of performance.

Simon Steen Andersen's family of pieces *Next to Beside Besides* (2005–2006) is a paradigmatic example of the exploration of some of these issues. These compositions, scored for any combination of amplified double bass, saxophone, accordion, percussion, piccolo flute, violin, piano and/or guitar, consist of gestural translations of an older piece, *Beside Besides* (2004) for solo cello. These works are defined, according to the composer, as "translations of the movements or actions, rather than an instrumentation of the resulting sounds" (Steen-Andersen, n.d.).[7] These gestural materialisations may be played solo or in any combination of instruments as chamber music works, as individual pieces, *ritornelli* or interludes between other pieces. The gestural "skeleton" of the original work is replicated and reproduced on the specific geography of each individual instrument. Gesture is treated as a transferable, malleable and unifying musical object. A sense of reproducibility is particularly noticeable in the simultaneous performance of this work by a number of different players: the gestures are duplicated choreographically, triggering a similar sonic response even if the nature of the instruments is completely unrelated.[8]

Figure 3: performance of *Next to Beside Besides* on five snare drums. Retrieved from: https://www.youtube.com/watch?v=rcO7zua6NOE

This transferability (and therefore duplicability) of gesture may tangentially be related to Walter Benjamin's notion of "gesture quotability", a concept formulated in relation to Brecht's epic theatre:

> Quoting a text implies interrupting its context. It will readily be understood, therefore, that epic theatre, which depends on interruption, is quotable in a very specific sense. That its texts are quotable would be nothing very special. But the gestures used in the process of acting are another matter. (Benjamin, 1998, p.19)

[7] A detailed description of these works' underlying ideas may be found on the composer's website: http://www.simonsteenandersen.dk/eng_art-nexttobesidebesides.htm
[8] Video recordings of different versions of this work in which the process of gestural duplication is clearly observable: https://www.youtube.com/watch?v=FPJdLMWIiLM , https://www.youtube.com/watch?v=rcO7zua6NOE&t=2s

The multiplication of the gestural structure transfers the original musical content from one instrument onto the next one: it is transportable, quotable. The nature of the music and its reception remains virtually unchanged by the process of quotation, its identity stays unaltered. This process of gestural duplication has been extended and elaborated by Steen-Andersen in *Self-reflecting Next To Beside Besides,* where the audiovisual realm is expanded by the use of video in a Russian doll-like process. In this work, the video recording of one of the piece's versions—or "choreographic translations" according to the composer (Steen-Andersen, n.d.)—is played simultaneously with a different version by the same performer; a video of a second "translation" together with the first video and a new version, etc. This process could theoretically continue ad infinitum and incorporate an indefinite number of performers. The sole condition is that at least one musician plays a live version of the piece, combined with an indeterminate number of videos of himself/herself executing a different version. Duplication is suggested by the use of an almost choreographic set of common gestural elements between the player's live performance and his/her own projected image. Duplication transcends here the performative sphere, entering the virtual realm by the use of video. The space of performance, however, is expanded and/or fractured by the suggestion of an alternative, parallel room. In such a way, space becomes an object of simulation rather than a necessary substructure for the delineation of duplicated musical identities.

The dislocation and division of the space of performance by non-audiovisual means may also be a mechanism for the establishment of duplicated identities. An extreme example of this may be observed in Stockhausen's *Hoch-Zeiten* (2003),[9] the 5th scene of *Sonntag aus Licht*. This work is performed simultaneously by five choral ensembles and five orchestral sections located in two different halls. Each instrumental and choral group performs at independent speeds, occasionally mirroring each other. The musical structure of the choral version is basically replicated in the orchestral score, with the exception of a number of added instrumental duos and trios. On seven occasions, the orchestra is blended into the choir, and the choir into the orchestra, over loudspeakers, creating "windows" between the two simultaneous performances. The audiences change halls during the intermission and listen to an alternative, second version of the same piece. Here, duplication is suggested by the compartmentalization of the space of performance into two independent, parallel, almost hermetic halves that only rarely interact with each other but share common musical materials. This extreme model may be, however, simplified and reduced to the mere architectural division of the stage into identical compartments. Here, duplication is no longer created by a virtual spatial configuration in which analogous similar points of reference mirror and reflect each other. Rather, it is imposed by the physical division of the stage or the space of performance into different structural sections, all of them encapsulating a potential set of individual

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[9] Audio recording of this work: https://www.youtube.com/watch?v=bDvBkL9Xm48

sonic and performative universes. In such a way, duplication is not only outlined by the behavioural conditions of individual and collective performances but also by the spatial context itself. Thus, duplication may be determined by spatial segmentation as opposed to the establishment of referential bridges between two or more sonic and/or gestural sources.

The identification of these categories of duplication may not always be easy to ascertain, as the nature of the audiovisual contract is often ambiguous, involving several simultaneous layers of perceptual involvement. The use of duplication in any of the previously enumerated categories may be fully intended from a compositional point of view, as the result of a particular structural process or as the product of a coincidental juxtaposition of events. Nevertheless, the conscious use of duplication in any of its multiple forms and possible combinations is constant throughout music history. The use of duplication may not be intended, per se, but may emerge as a result of other structural, acoustic, spatial, rhetorical, theatrical or poetic strategies. The next chapter will address the significance of duplication in the history of music. Most of the examples examined there will be characterised by a fully intentional, deliberate use of duplication, omitting those in which it may occur as an accidental, peripheral phenomenon.

Chapter two: brief history of duplication

This chapter is, to the best of my knowledge, the first known attempt to provide a comprehensive overview of the history of musical duplication. The implications of duplication have been especially significant for the development of different stylistic and technical features in the history of music and architectural acoustics. This text offers a broad perspective on these issues and simultaneously attempts to create a historical contextualization for my own works. The use of duplication is surprisingly common in music history, providing a large number of illustrative examples that may be related, directly or tangentially, to my own music. In this regard, some of the technical and aesthetic issues arising from the history of duplication are, in many ways, coincident with my current concerns and interests as a composer. These synergies are not determined by any concrete chronology. Correspondences may be established between my compositions and early musical examples, as well as with modern paradigms. Ultimately, this chapter strives to describe this somewhat peripheral branch of the Western musical tradition and to frame my work within it.

This chapter is divided into two sections. The first concentrates on the history of duplication in music from a spatial, architectural and acoustic perspective. The second centres on the history of duplication by focusing on performative aspects. Drawing a clear line between these realms is often a complicated task as they often cross-pollinate and complement each other. In spite of this permeability, the historical analysis requires a certain degree of differentiation for the sake of cohesiveness and clarity. Those examples whose particular nature has implications for both realms will be examined in either the first or second section, distributing them according to their more significant and prominent features.

2.1)   <u>Spaces, architecture and acoustic effects</u>

The history of musical and acoustic duplication is deeply intertwined with the phenomenology of echo.[10] As a pre-anthropogenic acoustic effect it may have operated as a primeval aural mirror, as a mechanism to discover and recognize our sonorous identity. Bard-Schwarz (2014), in his analysis of Lacan's "mirror stage" (1953), theorizes that echo is a tool for self-recognition as significant as the mirror, being a potentially relevant factor in the development of the child's personality.

> What we refer to as the acoustic mirror might just as well have been called the echo stage; as such, it would provide the support for the later mirror stage, both grounded in concrete universal experiences. Lacan has asserted that the mirror stage relies on the obvious and ubiquitous experience that small children between six months and a year and a half rejoice in seeing themselves reflected in mirrors, the face of the (m)other. I think it is equally obvious that all children rejoice in hearing their voices echo in cavernous spaces, that children love to hear their footsteps, clapping hands resonate in large, enclosed rooms. This pleasure is surely just as foundational as the jubilant assumption of an image of an ideal self in the (visual) mirror. (Bard-Schwarz, 2014, p.58)

It is perhaps a remnant of this infantile fascination for the recognition of one's reflected sonorous identity that has led humankind to the artificial emulation and recreation of the phenomenon of echo through the ages. This has been achieved by several spatial and architectural means, from the discovery and creation of specific reverberating spaces to the design of sophisticated studio echo chambers.

2.1.1) Prehistory

It is an impossible task to elucidate the exact first moment in which duplication may have been consciously used as a musical or sonic resource. From a speculative point of view we could indeed regard the phenomenon of echo as a revealing and fundamental element: the human voice reflected by the rocks and internal geography of caves, cliffs and wells, the multiplication of an individual's bodily sounds by the reflection on specific geographical features. From a purely practical perspective, echo may have primarily served as a tool to estimate the depth and extension of natural reverberating spaces such as caves or deep canyons.

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[10] Echo is defined, in order to differentiate it from reverberation, as a reflected sound with a delay exceeding 100ms. The reflected sound should be perfectly intelligible. In average conditions (25ºC and dry air) the reflecting surface must be at a distance of at least 17.2 m from the actual source considering the average velocity of sound in dry air (343 m/s).

[…] prehistoric people were not studying the acoustics of their tunnels as such. Our explanation is that since they advanced in darkness, they had to make sounds, or in a narrow tunnel, just hum with a closed mouth [...] using the sound as a kind of sonar: the response of the cave or of the tunnel to this signal might tell whether there is space ahead and where to advance. Reaching the location of maximum resonance (the acoustical main antinode) is very impressive: the whole tunnel resonates to a simple *hm* and the sound can be heard outside the tunnel, in the main cave [...]. Progressing further inside the tunnel, one naturally finds oneself pausing at this remarkable sound location. And the dot shows precisely where this living sound point lies, possibly identifying it for use later on. This demonstrates the use of resonance in a *functional* way. (Reznikoff, 2012, p.104)

Interestingly, archaeoacoustic research conducted in European caves and outdoor spaces (Reznikoff, 2012) suggests a direct correlation between Paleolithic paintings and the areas that produce longer and better resonances: the more reverberating the space the larger the amount and quality of the paintings. The idea of establishing a direct parallelism between the earliest examples of representation and the acoustic properties of echo is particularly appealing. One could hypothesize that there may be a linkage between acoustic duplication (hearing one's voice reflected by the geography of a particular space) and pictorial representation: replicating ("echoing") the visible elements of the natural world onto specific walls and rocks.

The study at Sainte-Baume was remarkable especially at the cliff called Pin de Simon. Reflected from the opposite cliff, there are indeed quite noticeable echo effects. There are seven cavities in this area of the cliff, but *only the two that are painted produce good echo effects* coming from the opposite cliff. In the first cavity, the best effects (4–5 echoes) are obtained where five of the eight major paintings are concentrated, in particular in front of a picture of a human with open hands and fingers facing the sky and the opposite cliff. (Reznikoff, 2012, p.107)

Moreover, some archaeologists suggest a connection between the subjects depicted on the walls and the nature of the echoes produced in the spaces where they are found. Steven J. Waller (1993) noticed that in a number of French caves the pictures of horses, bison and other large herd animals were located in chambers with a high level of sound reflection. The images of silent, stalking predators such as felines were, however, placed in poorly resonating areas. This reveals a direct link between visual representation and the experience particular acoustic environments. The characteristic sound of the animals may have been imitated by the use of the voice and percussive instruments such as lithophones, possibly in hunting ceremonies or game invoking rituals (Waller, 1993). Echo was a generator of unusual auditory experiences, completely different from the rest of acoustic realities familiar to Paleolithic societies. This probably led to consider echo as a

supernatural or magical phenomenon: reflected sounds and voices coming from another world beyond the depths of caves and canyons.

2.1.2) Ancient Greece and Rome

The mysticism associated with echo is present in the belief systems and cosmological views of early human groups (Waller, 1993). These supernatural aspects were also incorporated into the mythology of some early civilizations. The Greeks deified this phenomenon in the form of a nymph, condemned by Hera to speak only by repeating the last few words she heard from her interlocutor. As Blesser & Salter point out,

> Ancient Greece, as a transitional culture between prehistoric tribes and modern society memorialized the myth of Echo in plays, stories, and myths. […] Rather than interpreting an echo as a delayed sound reflection from a surface, the ancient Greeks heard it as a distinct voice with symbolic meaning. (2001, p.77)

From an architectural and acoustic point of view, the Greeks devised ingenious acoustic mechanisms for the modification of the acoustic properties of their theatres, including the creation of artificial reverberating echo vessels (Barba Sevillano, Lacatis, Giménez & Romero, 2008). In the 5th book of the *De Architectura,* Roman architect Vitruvius describes Greek *echeia* (literally "echo-vases"). According to Vitruvius, these vases were made of bronze and of a size proportionate to the theatre where they were to be placed.

> Then, having constructed niches in between the seats of the theatre, let the vessels be arranged in them, in accordance with musical laws, in such a way that they nowhere touch the wall, but have a clear space all round them and room over their tops. They should be set upside down, and be supported on the side facing the stage by wedges not less than half a foot high. Opposite each niche, apertures should be left in the surface of the seat next below, two feet long and half a foot deep. (1960, p.143)

> On this principle of arrangement, the voice, uttered from the stage as from a centre, and spreading and striking against the cavities of the different vessels, as it comes in contact with them, will be increased in clearness of sound, and will wake a harmonious note in unison with itself. (1960, p.143)

Although there is no archaeological hard evidence of the existence of the *echeia* (Barba Sevillano et al., 2008), it is certainly suggestive to think that these bronze vessels may have served as primitive echo chambers, not only for the amplification of the actor's voice but also as filters that resonated according to specific frequencies. Similarly, from a purely speculative point of view, they

could be regarded as one of humankind's first attempts to produce a primitive stereophonic effect by purely acoustic, non-performative means.

The creation of echo effects in relation to the design of a public space is particularly evident at Olympia's Zeus Sanctuary. The *stoa* (portico) of this magnificent building, known in ancient times as "Echo Stoa" for its acoustic properties, consisted of a 325.5 x 40 feet structure sustained by an internal colonnade in the Ionic order and an external one in Doric style (Darling, 2004). This space was particularly remarkable due to its unusual reverberation, according to the geographer Pausanias.

> Some call this Portico the Echo Portico, because when a man has shouted his voice is repeated by the echo seven or even more times. (Pausanias, 1992, p.513)

Apparently, the generation of these echoes did not respond to any religious or sacred purpose, nor was it related to the fascination for the acoustic phenomenon per se. According to Blesser and Salter (2001), these echoes may have been used to obliterate clear communications over a wide space, allowing the creation of multiple small acoustic arenas in which politics and commercial transactions were discussed. The overabundance of reverberation would have prevented the conversations from being understood.

The Greeks utilised duplication from a performative and acoustic perspectives in surprisingly elaborate and ingenious ways. The Romans, as direct inheritors of the Greek tradition, copied and developed extant architectural principles. The basic structure of the public Roman basilica was gradually adopted by the first Christian churches, especially after Emperor Constantine proclaimed Christianity as the official religion of the Roman Empire in the early 4th century and the consequent need for larger worship spaces became apparent (Fazio, 2013). Originally, basilicas were public spaces in which a variety of social, political, legal and commercial transactions were carried out. Possibly, the secular character and the lack of pagan implications of these buildings (in contrast to earlier Greco-Roman temples) determined their transformation into worship spaces for the new faith (Fazio, 2013).

The basilica of Maxentius and Constantine in Rome, with a rectangular ground plan of over 90x65m and a maximum height of 40 meters (Pau & Vestroni, 2013), is perhaps the most grandiose example of late Roman architecture and is a model for later Roman churches. The large size of these basilicas (surpassed even in later Byzantine basilicas such as Hagia Sophia, with a volume of over 250,000 m³ (Woszczyk, 2014)) and the materials of which they were made (usually stone and marble) created highly reverberating acoustics. Raes' and Sacerdote's (1953) measurements of two large Roman basilicas (Saint John of the Lateran and Saint Paul outside the Walls, both with

dimensions over 200.000 m³) showed reverberation times ranging from 5 to 10 seconds. The nature of this long reverberation implied consequent modifications and adaptations in the liturgical music sung in these spaces. As Blesser and Salter point out,

> Only slow, simple singing would avoid the aural soupiness of reverberation that seemed to last forever. The more rapid and complex singing that had existed earlier (and would again later) would have been acoustically degraded to total unintelligibility by long reverberation. (2001, p.92)

The first monophonic chants of the liturgy adapted efficiently to the nature of these spaces. The simplicity of the first Christian chants from the post-Constantinian period onwards favoured vocalization and the comprehensibility of the liturgical text in detriment of rhythmical complexity and heterophony (Lubman & Kiser, 2001).

2.1.3) Middle Ages

As we will examine more rigorously in section 2.2.4, religious music in the High Middle Ages was characterised by the gradual development and crystallization of liturgical chants. Among these chants, responsorial and antiphonal psalms emulated, to a certain extent, the acoustic properties and rhetorical context associated with echo. An architectural innovation of the time, the choir, was typical of large northern European monastic churches from the 11th century onwards (Crocker, 2000). The choir became as a particularly convenient space for the singing of antiphonal and responsorial psalms. Located in an elongated space between the nave and the sanctuary in the western side of the chancel, the choir was defined by a set of long seat rows (stalls) that ran lengthwise to the nave. Typically, there were two or three rows on each side of the architectural choir facing each other (Crocker, 2000). This particular setup allowed the monastic community to sit on two identical sets of mirroring stalls, creating two symmetrical semichoirs (Crocker, 2000). The spatial division clearly enhanced the singing of antiphonal and responsorial psalms and canticles. The performance of antiphonal chants benefited from the sense of acoustic duplication generated by the symmetrical confrontation of the stall rows. It is unclear whether the structure of the architectural choir originated as a reaction to antiphonal and/or responsorial singing or, on the other hand, whether the liturgical chants adapted to the physical space of the choir. My hypothesis is that the development of both musical and architectural elements was a progressive and mutually influential process, generating a gradual confluence between text, music, architecture and a dramatized use of space.

The development of polyphony during the *Ars antiqua* period (ca. 1170-1310) roughly coincides with the consolidation of Gothic architecture. The new cathedrals and spaces of worship built according to Gothic stylistic precepts generally experienced an increase in volume by the development of high vaults and colonnades, not only to satisfy the congregation's demands for larger worship spaces but also as a demonstration of power and religious glorification (Meyer, 2002). This volumetric enlargement, the reflection produced by the columns, and the use of acoustically non-absorbent materials such a stone, marble or stained glass usually generated highly reverberating acoustics with variations depending on the particularities of regional architectural and stylistic idiosyncrasies (Meyer, 2002).

Reverberation in medieval worship spaces may have also helped to create aural contexts, which encouraged discipline and orderliness within monastic communities. The 12th century Cistercian Abbey of Thoronet in France produces an echo that lasts for more than eight seconds (Kerisel, 2005). Any sound, including the faintest of footsteps or whispers, is greatly magnified by the acoustics of the nave (Crunelle, 1993). This extraordinary echo would have prevented any member of the monastic congregation from speaking aloud or singing in an uncoordinated manner. As a reflection of the severity of monastic life and new religious ideals, Cistercian churches are typically austere, bare of ornamentation, narrative sculpture and superfluous furniture (Kinder, 2002). This creates uniquely reverberating spaces in which the acoustic reflection of the monks' voices and bodily sounds would have been probably functioned as a mechanism of self-control and submission to the community. Nevertheless, there is a simultaneous, extraordinary sense of acoustic integration with the actual space:

> When one sings in the lower frequency ranges and the chest begins to resound, the church acts as a resonating chamber for the same frequencies. There is at this moment an unusual unity of body and space; song is carried and sustained by the acoustics due to the generous reverberation [...]. (Crunelle, 1993, p.11)

Similarly, the concavity of Pisa Baptistery's cupola (designed by Giovanni Pisano, finished in 1363) creates a long-lasting double echo of more than eight seconds that repeats any sound produced below (Tarabella, 2006). This effect is reinforced by the lack of acoustically absorbent materials in the interior of the building. Research led by Leonello Tarabella (2006) suggests that the acoustics of this building may have been designed intentionally, conceived as an integral element of the architectural plan. Accordingly, this may have conditioned the nature of the liturgical music sung in this space to a considerable extent.

Due to its particular architectural complexities, the Basilica of St Mark in Venice is of capital importance for the study of sonic duplication (including the first documented use of

polychorality). As its acoustic properties intersect with relevant issues related to performative duplication it will be examined in detail in the second half of this historical account (section 2.2.5).

2.1.4) Renaissance

Secular architecture during the Renaissance is rich in examples where the production of echo and sound reflections may have been deliberately devised by architects and builders. Villa Simonetta in Milan (built between the late 15th and early 16th century) is a paradigmatic example of these architectural preoccupations (Crunelle, 1993). The rear court of the villa is seventeen meters wide and thirty-four meters long. In order to produce a clear echo, the source of sound must be placed seventeen meters (or a multiple of this number) from the reflecting wall. Moreover, as Crunelle observes, quoting Radau,

> The echo occurs only once along the axis of the widest side. And yet "from a window in the upper floor, in the left wing of the palace, and overlooking the court, a pistol shot repeats forty to fifty times, [and] the sound of the voice is reproduced from twenty-four to thirty times". (1993, p.8)

Similarly, in the villa Orsini gardens in Bomarzo, built during the 16th century, echo is utilised in a playful, almost humorous manner. In the garden, a set of mythological sculptures is placed among the trees and vegetation (Vercelloni & Vercelloni, 2010). One of these sculptures depicts Orcus, the Roman god of the underworld. Its mouth, large enough to shelter one standing person, produces a remarkable echo that amplifies any sound produced in it, channelling it towards the cavity's exterior (Coty, 2013). The inscription located on the upper lip of Orcus reads, "Lasciate ogni pensiero voi ch'entrate" ("Abandon all thought, ye who enter here"). This sentence ironically paraphrases Dante's famous quote from the Divine Comedy describing the entrance to Hell: "Abandon all hope, ye who enter here" (Coty, 2013). This almost symbolic use of echo points to a mannerist use of architectural effects, more preoccupied with expressiveness than with notions of proportionality and balance (Vercelloni & Vercelloni, 2010).

2.1.5) The Baroque

As a great exponent of the early Baroque intellectual and scientific life, Athanasius Kircher (1602-1680), devoted seventy-one pages to the study of echo in the *Magia Phonocamptica* chapter of his vast treatise *Musurgia Universalis* (Crunelle, 1993). He also wrote an additional book on the subject, the *Phonosophia anacamptica*, integrated in the treatise on acoustics and musical

phenomena entitled *Phonurgia nova* (Tronchin, 2009). Kircher was one of the first intellectuals to think of echo as an effect caused by sound waves reflected by discontinuities in the medium of propagation.

> In the *Phonosophia anacamptica*, Kircher was extensively interested in the prodigious phenomenon of echo, which he considered was founded on sound waves, which, having hit some *obiecta phonocamptica*, or "obstacles", they propagated in the air or in the water and therefore produced reverberation. (Tronchin, 2009, p.11)

Athanasius Kircher studied and tested reverberation in several buildings, notably in the "Villa Simonetta" and in the now-ruined Electoral Palace in Heidelberg (Tronchin, 2009). One of the rooms in the interior of the palace, built according to a circular ground plan and covered with a vaulted ceiling, was characterized by an extraordinary echo. Words spoken in a quiet voice, emitted from a point on the perimeter of the room's circumference, could be heard clearly from equidistant points situated relatively far away on the same perimeter (Tronchin, 2009). In a typically empirical manner, Kircher observed that this echo was caused not only by the circular shape and the vaulted ceiling but also due to the materials from which the actual room was built.

> […] Kircher analysed the floor of the room in particular, presuming the type of material utilised could contribute to the special acoustic effect. At that time, pavement in the so-called "Venetian style became very fashionable and extensively used in many palaces. This type of pavement, which still exists in several ancient palaces, is a mixture of mortar and stones; besides giving a pleasant aesthetic effect, once trampled, produces a singular sonorous effect Kircher emphatically compared to a thundering crowd rushing in threatening pursuit. (Tronchin, 2009, p.13-14)

A contemporary of Kircher, the French theologian and mathematician Marin Mersenne (1588-1648) experimented with the properties of echo in order to calculate the speed of sound. Mersenne's experiments involved standing in front of a large reflecting surface and saying the words *Benedicam Dominum* (Pesic, 2014). He would then measure the time that it took for the words to be echoed with the help a pendulum, repeating the experiment under different weather conditions and using different vocal registers and dynamics. His experiments concluded that the speed at which the syllables were reflected (tested according to the clarity of echo) was not influenced by these factors (Pesic, 2014). In order to carry out his research he accurately measured the distance from the reflecting wall at which the speaker should stand so that a clearly intelligible echo of the words *Benedicam Dominum* was audible. He also indicated the (inconceivably fast) speed in which these words should be spoken for the experiment to work.

> Mersenne's experiments involve using language itself to probe the speed with which the echo is formed: "it is certain that all sorts of echo that repeat seven syllables pronounced in the time of a second must cover the distance of 458 feet," which he compares to the firing range of an arquebus. (Pesic, 2014, p.112)

Mersenne's acoustic experiment is particularly interesting, as the notion of duplication (materialized here as the reflection of one's voice) is exclusively regarded as a tool for scientific research. In effect, Mersenne's empirical measurements resulted in a relatively good estimation of the speed of sound.

> The echoed words had covered a round trip of two times 485 royal feet (a total of 319 metres), allowing Mersenne to deduce that 319 metres per second is the speed of sound. This is remarkably close to the correct value of about 340 metres per second (1,200 kilometres per hour). (Cox, 2014)

Baroque architectural acoustics also dealt with the issue of echo: while it remained a common effect in the interior of large churches and worship spaces it became a matter of concern for the design of new opera theatres where the clarity of vocal articulation and textual intelligibility was prioritised (Ianniello, 2001). Additionally, the degree of visibility between the boxes was of a considerable architectural importance due to the active social interplay ("seeing and being seen") that took place during opera and theatre presentations (Barron, 2010). The typical horseshoe plan of Baroque theatres and their ornate decoration contributed to a good sound diffusion, but this was mostly neutralised by the large acoustic absorption generated by the large number of cavities (boxes) and the plush upholstery and other absorbent materials that covered floors, seats and other surfaces (Ianniello, 2001). This tendency towards the reduction of reverberation was paradoxically counteracted by the creation of "echo effects" on stage, especially in operas (as we shall examine in more detail in section 2.2.6).

2.1.6) 18th century

The late 18th century, as a depositary of the ideas of the Age of Enlightenment and Rationalism, saw the development of neoclassical architecture as a return to the proportionality and spirit of ancient Classical antiquity. A materialization of these architectural ideals and principles is clearly observable in the Paris Panthèon, finished in 1790 (Kleiner, 2010). The crypt of this building is particularly interesting for its acoustic properties, as a long-lasting echo is produced in the concentric layout of the passages and vaults (Gore, 1842). The lack of acoustic absorbent materials, the bareness of the walls, the vaulted ceilings and the elongated shape of the crypt's corridors creates a highly reverberating atmosphere. It is a matter of speculation whether the acoustics of this

space were regarded as an integral element of its original architectural conception or not. Nevertheless, the feeling of geographical dispersion of the original sonic source caused by the sepulchre's complex echoing powers is particularly disorientating:

[...] striking a coat or other item of clothing with a dry blow produces a sound analogous to that of an explosion, and when a coin is dropped on the floor, the resulting noise is strongly amplified and accompanied by multiple echoes. The sound of footsteps is equally amplified and is accompanied by other footfall-noises seeming to come from different directions. (Crunelle, 1993, p.9)

2.1.7) 20th century

The 19th century and the first half of the 20th century do not provide substantial architectural examples in which the acoustic properties of echo are explored. The next substantial example of echo as an architecturally generated phenomenon takes place already in the 1960s in the form of echo chambers. These chambers were primarily used to simulate rich, natural reverberation within the limited space of early recording studios (Huber & Runstein, 2014). Typically, echo chambers were covered entirely in reflective materials such as tile or shellac, which helped to maximize reverberation. The operational procedure was simple: an audio signal from the studio mixing desk would be sent to one of the speakers at one of the extremes of the chamber, then, a number of microphones placed along the width of the chamber would pick up the sound of the speaker and its reflections on the walls (Huber & Runstein, 2014). The location of the microphones was crucial, since the level of echo and reverberation changed according to the distance from the loudspeaker (the farther away, the more echo was produced). The signal from the microphones was then fed back to the mixing desk where it was customarily blended with the original source. The development of these chambers was an innovative, functional mechanism to simulate richly reverberant spaces and to generate artificial echoes in small enclosed rooms. Eventually, their use would be drastically reduced (if not completely abandoned) by the gradual introduction of digital audio processing.

This creation of constructed reverberation chambers marks the culmination in the history of echo as an architecturally generated, functional acoustic phenomenon. A direct link may be established between humans' primeval fascination with the echoing vastness of caves, ridges and physical spaces and the modern emulation of this rich, natural reverberation in artificially designed chambers. An underlying anthropological substratum may have originated from our first, archaic experiences of echo: our voices, our bodily sounds wondrously reflected by the geography of particularly reverberating spaces. The experience of this phenomenon transcended mere physicality,

raising questions about our identity, our interaction with space, our relationship to the unknown and the divine, etc. It is perhaps this latent fascination that has led individuals throughout the centuries to seek and build specific spaces for echo to resonate. This responds to metaphysical reasons (echo as a depository of symbolic meaning), practical acoustic motivations (reflected in architectural designs and scientific research) and/or to particular artistic and aesthetic preferences.

2.2) **The performative realm**

2.2.1) Antiquity

The first historical examples of duplication from a performative perspective were probably related to the notion of antiphony. Antiphony is defined by the alternate or responsive singing and/or declamation by two semi-independent choirs in interaction (Foley & Bangert, 2000). These two choirs typically interact following a call and response structure according to the semantic content of (mostly) liturgical texts. To a certain extent, antiphony recalls, from a rhetorical point of view, the acoustic properties of echo by delineating mirror-like declamatory interactions between the two choirs. The choirs mostly echo each other, adding a spatial dimension—and perhaps a sense of theatricality—to the process of declamation and singing. The first examples of antiphonal structures probably originated in early Israelite and other Middle Eastern liturgical practices. This is already evident in some of the early psalms of the Old Testament (Edelman, 2003). Ancient Hebrew psalms typically present a mirror structure that suggests a responsive performance between the priest and the congregation or/and between two different choirs (Edelman, 2003). Early Hebrew poetry is usually structured around the notion of "rhetorical parallelism": the formulation of the same thought in two or more different ways (Casanowitz, 1906). From a speculative perspective we could regard the spatial division of the choir as a response to these two parallel semantic interpretations of the same concept. This feature is clearly observable in Psalms 121,126 and 128 (Amzallag & Avriel, 2010). These antiphonal responsive structures may have served as tools to emphasize concrete passages and, perhaps, as primitive oratorical mechanisms to dramatize specific sections of the text. Different performing configurations were already known and used by the 6th century B.C., as Smith observes:

A group of late sources shows that methods of responsive performance could also be envisaged as applying to material that exists as plain poetic text […] Five responsive methods are identified:

1. The leader sang the first clause of the first unit of text (for example the first clause of the first verse), then the company repeated this after him and completed the unit of text, and so on with each successive unit of text.

2. The leader sang the first unit of text, then the company repeated it, and so on with each successive unit of text.

3. The company sang the opening words of the first unit of text as a refrain after each unit of text sung by the leader.

4. The leader sang the opening of the first unit of text, then the company completed the unit.
5. The leader sang the complete text, then the company sang it.
(2012, p.98-99)

The different interactive strategies applied to the performance of the psalms reveal a complex use of the space. The second and fifth categories exposed by Smith are closely related to some of the principles that define duplication. There is a clear use of iterative structures not only from a formal and temporal perspective but also from a spatial angle, adding a feeling of physical depth to the psalms by the division of the choir into two mirroring units. This division of the choir may be regarded not only as a narrative tool but as an early, probably accidental, exploration of the acoustic properties of musical duplication.

2.2.2) Ancient Greece

Greek theatre from the 5th century B.C. experienced some of the first staged examples of antiphony due to the development and consolidation of the chorus. The origin of the chorus may have been derived from earlier communal dithyramb singing contests performed in Dionysian festivals (Brown, 1995). The chorus constituted a variable group of 12 to 50 players (Weiner, 1980) whose dramatic function consisted of commenting on the main themes presented by the play, often personifying collective aspects such as memory and wisdom (Greene & Cushman, 2010). The chorus was typically used as a tool to recreate the inner thoughts that were not directly expressed by the actors. In fact, some scholars believe that the chorus operated as a cooperative actor rather than as a collection of individuals (Montgomery, 1942). This follows Aristotle's consideration of the chorus as a single, collective character, as an entity that was integrated dramatically into the play and not as a mere component of the orchestra (Weiner, 1980). Often, the chorus entered into dialogue with the main characters of the play, commenting, interrupting and, in some occasions, delving into their psychological profile. Sometimes the chorus amplified the thoughts of the characters by echoing their voice and replying to it in an antiphonal manner. This was particularly evident in the *kommos,* mourning songs in which the lamentations and consolations are typically split between the mourner and the condolers (Goldhill, 2012). The structure of the *kommos* is typically antiphonal in performance; the lamentations declaimed by the mourner are echoed in expressions of grief and consolation by the chorus while they underline the universality and unavoidability of death and human fate (Goldhill, 2012). These passages consequently enrich the identity of the character, both from psychological, declamatory and sonic perspectives. Notable *kommos* may be found in plays such as Aeschylus' *The Persians* or Sophocles' *Antigone*.

2.2.3) Early Christianity

As discussed before, the architectural dimensions of the first Christian Roman basilicas from the 4th century onwards favoured long reverberation times, which, in turn, implied modifications and adaptations in the liturgical music sung in these spaces. The first monophonic chants of the liturgy adapted efficiently to the nature of these spaces: the simplicity of the first Christian chants (from the post-Constantinian period onwards) favoured vocalization and the intelligibility of the liturgical text to the detriment of rhythmical complexity and heterophony (Lubman & Kiser, 2001). The use of antiphonal models was common in early Christian chant, probably as a direct inheritance of the antiphonal structures of ancient Hebrew prosody and psalmodic chants (Fletcher, 2001). A letter from Pliny to Emperor Trajan from the early 2nd century may contain one of the earliest Roman references to antiphonal singing: "It was the custom of the Christians to sing *by turn among themselves* a *Hymn to Christ as God*" (Forth, 1921).

The antiphonal structures permitted a richer musical stratification by the active alternation of monophonic passages between semichoirs, and engaged the congregation in a more participatory organisation of the liturgy (Crocker, 2000). Socrates of Constantinople (ca. 380–439) believed that the first person to introduce antiphony into Christian liturgical choral music was Ignatius of Antioch (ca. 35–108) after the vision of two angels in heaven singing hymns to God in an alternate manner (Moran, 1986). The use of antiphonal psalmody, common in the Syrian and other Eastern rites, was imported by St. Ambrose (ca. 340–397) to Milan, introducing this practice into Western Europe (Apel, 1969). Ambrosian chant incorporated the antiphonal hymnodic structures of the East and influenced the music of Western liturgical rites to a considerable degree. From a sociological perspective, Forth (1921) suggests that the incorporation of antiphony mirrored the struggle and conflicts of early Christian societies:

> Ambrose realised the spirit of emulation that lay under the method of singing by voice contrast in alternate choirs, for not only did he divide his choir in two, but his congregation also during a time of persecution at Milan; and found this method a valuable asset in keeping up the spirits of his people [...] So noted did the choir trained by St. Ambrose become, that the churches in the West soon began to follow he method of the East. (p. 645)

By the end of the 4th century, antiphonal chanting was a common form of worship, practised even in familiar and private secular contexts. The Emperor Theodosius (347–395) and his sisters were known for reciting antiphonal religious hymns every morning (Forth, 1921).

2.2.4) Middle Ages

The next important milestone in the history of musical duplication is defined by the use of antiphonal chants in Gregorian repertory. The unification of various regional forms of plainchant (mainly the ones related to the Roman and Frankish rites) led to the creation of a uniform plainchant style (Apel, 1958). Although this endeavour is typically attributed to Pope Gregory I (ca. 540–604), the process that led to the crystallization of Gregorian chant spanned a much longer period and responded to a large extent to the aspirations of religious and political unification of the Carolingian monarchs (Treitler, 2003). By the 9th century, Gregorian chant was fully developed, reaching its definitive form (Apel, 1969). Gregorian chant included antiphonal chants such as the Introit, the Offertory and the Communion, characterized by the alternation of two choirs singing verses of psalms (sometimes doxological) and a refrain or "antiphon" respectively (Apel, 1969). In antiphonal psalmody, the iteration of various sections or rondeau-like forms was common, adding some complexity to the formal and spatial interaction between the two semichoirs. More complex forms of antiphony were explored in monastic contexts, such as alternations of solo psalmody with choral antiphony. The use of antiphonal structures was an especially practical procedure for the daily rendition of psalms.

> Monastics applied antiphony enthusiastically […] in addition, since they knew the psalms by heart, they found antiphony especially useful for singing the entire Psalter of 150 psalms every week throughout the year in the monastic Office. […] The purpose of antiphony was to introduce variety and interest into musical performance. (Crocker, 2000, p.145)

The monophonic singing characteristic of plainchant is also a source of particular interest for the notion of duplication. A set of identical melismatic or syllabic passages were sung simultaneously in unison by a congregation of "duplicated" voices. A sense of uniformity was only obtained by the coordinated performance of all the voices and by the acoustic assemblage favoured by the rich reverberation of churches (Lubman & Kiser, 2001). As exposed before, the development of the architectural choir enhanced the performance of antiphonal and responsorial psalms, creating an impression of physical integration between sonic duplication and the inner space of the church.

> Over the centuries standard procedures of antiphony were developed, governing which side should begin, and under what circumstances both sides should sing together. In this way the practice of antiphony became closely linked to the architectural plan, and almost dependent upon it. (Crocker, 2000, p.146)

The advent of polyphonic music during the *Ars antiqua* period did not stop the production of antiphonal music, such as the 14th century British Marian antiphons (Hiley, 1993). The great development of canonical and imitative structures in polyphonic motets and other musical forms, as well as the development of isorhythmic techniques in the *ars nova* period (ca.1320-1390) is, from my point of view, only partially related to the notion of duplication. Contrary to the practice of plainchant (which was configured by the simultaneous iteration of syllabic and melismatic passages), polyphonic forms rely on the interdependence of the voices, generating a feeling of spatial "enclosure" of the materials by the actual stacking of melodic lines. Monophony operates in an opposite way, "disclosing" musical material spatially by the use of antiphonal and responsorial structures. The notion of "disclosure" is intimately associated with duplication, as distance and spatialization are some of its key defining elements (as discussed in chapter one).

2.2.5) Renaissance

The Renaissance is a remarkably fruitful period in the history of musical duplication due to the development of polychoral polyphony. This innovation establishes, in my view, a direct link between the spatial dimension of duplication and the temporal fluidity of polyphonic music. The earliest examples of polychoral polyphony may be traced back to the second half of the 15th century (Reese, 1954). The "Modena codex" (mid-15th century) suggests an Italian origin of polychoral music much earlier than the first examples of the Venetian School. Some of the pieces of the codex require two choirs in polyphonic interaction, singing stanzas of the hymns and the psalms in an alternate manner, as Reese points out:

> Each choir has its own manuscript; two books are needed, each containing only one-half of the composition. We have here the beginnings of polychoral composition, almost a hundred years before Willaert, generally regarded as its inventor, wrote his famous psalms for double chorus. (1954, p.28)

Possibly, the use of polychorality developed as an extension of the antiphonal polyphonic writing of the late 15th century. Although its creation is typically attributed to Adrian Willaert (c.1490-1562) there are several works that prove the use of this technique earlier than the 16th century (Carver, 1981). Ruffino's *Super verbum bonum* Mass for two choirs is another illustrative case of polychoral polyphony previous to Willaert's time as *maestro di capella* in St. Mark's (Carver, 1981). Other composers such as Roussé, Phinot and Crequillon (Reese, 1954) preceded the Venetian school in the exploration of polychoral techniques. The late 15th century and 16th century saw compositional attempts that would ultimately lead to the full development of polychorality:

> […] in fact in the 15th and 16th centuries the application of polyphony to texts associated with antiphonal chants almost invariably resulted in alternatim compositions, in which one choir sings in polyphony, alternating with the other in plainchant, or in settings for a single choir of the whole text, in sections or through-composed (Carver, 1975, p.271)

The Venetian basilica of St. Mark was, however, the unquestionable epicentre for the development of polychoral music. The complex architectural and acoustic features of this large church are fundamental for the proper understanding of the crystallization of the polychoral style. Built in the shape of a Greek cross following the model of the church of the Holy Apostles in Constantinople,[11] the basilica is sheltered by five domes, one over the central area and four smaller ones over the arms of the cross that stem from the centre. Every dome is supported by a set of four large pillars (complemented by arches, which in turn form four smaller piers that support the gallery). The east side of the nave terminates in an apse, which is flanked by two smaller apses. This area is separated from the rest of the nave by a dividing structure, the *iconostasis* (literally an "icon stand", constituted by eight pillars that support fourteen statues). On both sides of the *iconostasis* two elevated pulpits are located: the hexagonal *pulpitum magnum cantorum* (also known as *bigonzo*) and the *pulpitum novum lectionum.* Research conducted by Laura Moretti (2004) concluded that one of the places of singing in the basilica was precisely the *pulpitum magnum cantorum.* Other particular spaces where singing took place, according to Moretti's research, include the *pergoli* (balconies located behind the *iconostasis* at around 2.10m[12] above the floor and about 10m[13] from each other)*,* the two organ lofts flanking the choir (at about 5.60m[14] above floor level) and the floor level where the liturgy takes place (where the singers would possibly stand or sit in the choir). The architectural complexity of this basilica allowed a rich and diverse use of the space according to the particularities of different liturgical practices and state rituals (Smyth, 2012). The placement of singers and performers in the previously described spaces responded to adaptations to the complex acoustic reality of the basilica (Smyth, 2012). The use of individual elevated spaces for singing was particularly convenient for the spatial interaction of multiple choirs and groups of musicians. The effect of insularity was counterbalanced acoustically by the raised position of the vocal and instrumental groups over the floor level.

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[11] This brief description of the basilica of St. Mark's has been formulated according to the architectural facts contained in the following article: Moretti, L. (2004). Architectural spaces for music: Jacopo Sansovino and Adrian Willaert at St Mark's. *Early Music History. 23*(1), 153-184.

[12] This measurement has been extracted from Baumann, D. (2011). *Music and Space: A systematic and historical investigation into the impact of architectural acoustics on performance practice followed by a study of Handel's Messiah.* Bern, Switzerland: Peter Lang Publishing Group. p.9.

[13] Ibid. p.10.

[14] Ibid. p.9.

Musicians knew that the elevated positions in the crossing and in the choir helped cope with acoustic difficulties in this complex space with its five domes and large pillars separating the main nave, side naves and transept. This was certainly one of the reasons why the medieval singer balcony on the south side behind the iconostasis was raised higher in 1536– 37 and why in 1541– 44, just at the time Adrian Willaert wrote his first double-choir compositions, a similar balcony had been built on the north side. […] The *pergoli* provide excellent acoustic conditions for the interplay of two four-voice choirs with one or two singers in each voice and for listeners within the central sacred area, especially for the doge, who sat in the choir, his back to the iconostasis, on a new throne made by Jacopo Sansovino. (Baumann, 2011, p.10)

This particular setup had a direct impact in the compositional strategies followed by the composers of the Venetian school in their polyphonic sacred music, conditioned by both the reverberation times of the basilica and the geographical distribution of the choirs (Roth & Roth Clark, 2014).

The creation of acoustic mirrors between two or more choral groups, sharing the same or almost analogous materials in an antiphonal (echoic) or simultaneous manner is of particular interest for the notion of duplication. Presumably, this would have been easily achieved by the mirroring configuration of the previously described duplicated elevated spaces: the two opposed "pergoli", the two equidistant pulpits and the two organ lofts (Baumann, 2011). This array of possible spatial setups would have had a dramatic effect in the audience's listening experience.

Listeners outside the choir could hear the music as though it were coming from another space, not only because the iconostasis was closed by carpets during ceremonies, but also because sound coming from the *pergoli* reached the areas west of the iconostasis only through wave reflections directed upwards to the side walls and into the cupola [...] If singers faced the main nave, the sound projected directly to the public. If they faced towards the pier's west front [...] sound was reflected backwards to the main nave but also reached the choir, passing through the uppermost, open part of the iconostasis. (Baumann, 2011, p.10)

Willaert's Vesper psalms are particularly efficient in the distribution of musical material between choral groups, paying attention to the declamatory nature of the music (Taruskin & Gibbs, 2013). This is perhaps why Willaert opted for more transparent, less densely polyphonic structures for the *cori spezzati* passages. This allowed clarity in the transition from one vocal force to the other, creating a sense of balance in the sonic alternation and exchange between the choirs.

The compositional technique combines traditional polyphony and native *falsobordone*, a technique that had long been used in northern Italy for multi-voice psalm writing. In spite of the occasional contrapuntal passages, above all at cadences, the prevailing style for the alternating choirs is chordal; moreover, by

intentionally respecting the rigorous antiphonal scheme, Willaert imposes an archaic stamp on his *cori spezzati.* (Moretti, 2004, p.177)

From a broader perspective, one could regard polychorality as a direct extension of polyphonic thinking: the superimposition of voices not only relegated to the horizontality of the temporal realm but projected onto the spatial axis by means of the multiplication of vocal forces. This is clearly materialized by the complex distribution and geographical dispersion of vocal groups within St. Mark's basilica, acting as a three-dimensional framework for the creation of particular structural and sonic relationships.

Willaert's successors developed polychorality to greater degrees of complexity. Andrea Gabrieli expanded the number of choirs in interaction (up to four) and added instrumental parts to the vocal ensembles, thus initiating the *concertato* style (Taruskin & Gibbs, 2013). Andrea's nephew, Giovanni Gabrieli (ca. 1554–1612) investigated the use of specific instrumental groups and singers within the basilica in even more elaborate ways (Taruskin & Gibbs, 2013). His magnum opus, *In Ecclesiis,* is particularly interesting for the use of specifically defined instrumental and vocal groups. This work raises polychoral techniques to an unprecedented level of complexity by the use of four different groups of singers and instrumentalists, constituted by a total of 15 individual parts (Taruskin & Gibbs, 2013). These groups delineate a network of sonic "islands" within the basilica. Musical material is interchanged between the ensembles across the space but their sonorous idiosyncrasy and identity is clearly preserved:

[…] there has been not a single point of imitation. There are motives that pass from voice to voice, all right, especially in the vocal soloists' parts. But never are these motives combined into a continuous interwoven fabric; instead, they are forever being tossed back and forth like sonic projectiles, heightening a sense of agitated contrast rather than one of calm commingling. (Taruskin & Gibbs, 2013, p.215)

The intimate knowledge of the basilica's acoustic features may have had an ulterior effect: the first use of dynamics. Giovanni Gabrieli is often regarded as the first composer to have notated dynamics in a score (Coelho & Polk, 2016). This might, from a purely conjectural perspective, have been influenced by the aural experience of polychoral music, a direct translation of the different degrees of perceived intensity depending on the listener's position within the intricate acoustic geography of the basilica. Ultimately, the polychoral and instrumental innovations commenced by the Gabrielis led to the crystallization of the *concertato* style—especially after Monteverdi's appointment as *maestro di cappella* in Venice—thus establishing one of the fundamental bases for the development of Baroque music (Sadie, 1991).

2.2.6) The Baroque

From a musical perspective, the Baroque era developed polychorality to an even more complex and intricate level. The *Colossal Baroque* style was largely developed in Rome but had resonances all over Southern Europe, Austria and Germany (Roden, Wright & Simms, 2006). With a clear influence from the earlier Venetian polychoral style, the works written in the Colossal Baroque style experienced a considerable expansion in the number of choral and instrumental parts (Buelow, 2004). The Florentine *Intermedii* (theatrical interludes, clear predecessors of the opera) of the late 16th century made use of up to seven vocal ensembles in simultaneous interaction, setting a framework for the further development and expansion of the vocal and instrumental forces (Grout & Williams, 2003). The Council of Trent and the Counter-Reformation imprinted an aura of euphoria and self-confidence onto the Roman Catholic ecclesiastic hierarchy (often referred as *Roma triumphans*), which resulted in the gestation of a new opulent new musical style:

> The triumphalism was reflected not only in the art, but also in the music of the period: there was an increase in the popularity of spectacular large-scale music for many choirs, designed to impress rather than to communicate the text, just as music in a more ornate vocal style for few voices replaced that in the comparatively austere *prima prattica* idiom. (Dixon, 1979, p.120)

A vast number of polychoral sacred works was produced in Rome during the first half of the 17th century, benefiting from the rich acoustics of Rome's innumerable churches, especially that of the newly refurbished and expanded basilica of St. Peter under the papacy of Sixtus V (1585-90), Clement VIII (1592-1605) and Paul V (1605-21) (Haar, 2006). Clearly, the papacy did not skimp on resources to create an impression of musical grandeur.

> It was St Peter's basilica, however, that possessed both the spatial and the financial resources to permit the multiplication of the number of choirs to the extent that one generally associates with the term 'colossal baroque'. A list of organists who received payment in 1629 for the feast of St Peter shows that the music, under the direction of Agostini, was performed by twelve choirs, each with its own organ. (Dixon, 1979, p.121)

The most remarkable work in the Colossal Baroque spirit is perhaps the *Missa Salisburgensis à 53 voci* (1682)*,* typically attributed to Heinrich Ignaz Franz von Biber (1644-1704). Scored for eight choirs (some with voices only, others with voices and instruments and two exclusively for timpani and trumpets), the Mass takes advantage of the internal geography of Salzburg Cathedral, placing the ensembles in different locations (Buelow, 2004). Interestingly, some

of the ensembles remained in invisible positions (Spitzer & Zaslaw, 2004),[15] which may have added a live acousmatic effect to the performance of the work. This would have created an interesting antiphonal outcome in which sonic equivalences were not matched by visual reciprocity. Biber's sacred music typically makes use of instrumental, vocal and mixed unison doublings, which would contribute to the reinforcement of individual melodic lines (Buelow, 2004). This effect is particularly interesting as these doublings may have established auditory bridges between geographically distant instrumental and vocal groups within Salzburg's Cathedral.

> Only six choirs are visible. Two trumpet choirs can be seen in galleries, foreground right and left, but the timpani are hidden. Two more choirs in galleries are seen further back, directly across the transept from the trumpets. The right-hand choir seems to be composed of singers plus three bowed-string players and an organ; the choir in the left gallery includes two trombones and a cornett, as well as singers. The final two choirs are on the floor, just behind the altar rail. On the left are eight singers, six seated and two standing. On the right are an organist (with a boy who pumps the bellows), two violoni, a cornett, a trombone, and at least eight singers. (Spitzer & Zaslaw, 2004, p.59)

Polychoral works were also common among Protestant late Baroque composers. Notable examples include J.S. Bach's use of the double choir in *St. Matthew's Passion* (Melamed, 1995) and Handel's oratorios *Solomon* and *Israel in Egypt* (Burrows, 2009). Instrumental works like Handel's *"Double choir concertos",* for two identical woodwind groups and strings, replicated, to a certain extent, the compositional procedures of double choir writing (Hogwood, 2005). This suggests a link to the *concertato* style that, as discussed before, developed as a corollary of Venetian polychorality (Hogwood, 2005). The generalised use of *ritornello* as an iterative device and a generator of structural coherence in many Baroque works was also a concomitant effect of this development (Taruskin & Gibbs, 2013).

Early Baroque opera is rich in examples where echoes are simulated (Abbate, 2001). This may have originated as a result of the acoustic conditions of opera theatres, whose lack of reverberation generally favoured definition, clarity of speech and musical articulation. This may have had an influence in the composition of numerous artificial echoes (especially in vocal parts) in the music of several composers of the time. Alternatively, the delineation of artificial echoes may have responded to rhetorical aspects present in the texts set to music. The lament in the closing act of Monteverdi's *L'Orfeo* is a paradigmatic example of this: Orfeo, in his final unaccompanied

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[15] The use of invisible musicians and singers is also significant in some of my works, chiefly in *I reached A through the throng through the threshold through the throb* (2011-2012) and *Gyre and Gimble* (2016). In some passages of these two compositions, a choir of invisible singers create antiphonal relationships with the main singers on stage. This generates, as in Biber's *Missa Salisburgensis,* sonic correspondences across the performance space as well as the suggestion of parallel, unobservable acoustic spaces.

soliloquy, hears his words repeated by an offstage singer. These echoes immerse Orfeo in a process of self-recognition (Chua, 2005). The lamentation for the loss of Euridice is coldly reflected by an invisible echo that iterates the last syllables of the sung words, deprived from any instrumental or vocal support. The delay between voice and reflection is artificially elongated, which creates an effective and perceivable iteration of the words being sung. This helps to increase the feeling of distance and, perhaps, the suggestion of an unattainable, parallel space.

> The echo's critical edge is sharpened by its very deliberate speed of execution; not only does the echo objectify the voice with a plainness at variance with the rhetorical content of what is sung, it delivers the message in slow motion. Unlike a real mirror, sonic reflections travel at the speed of sound and not of light. Music takes time. The echo, by measuring the distance between subject and object, simply stretches the point. (Chua, 2005, p.574)

Similar procedures are observable in Cavalieri's *Rappresentatione di anima e di corpo* (1600) where the Portrayal of the Soul asks Heaven for an answer to her questions. The responses are only expressed in an echoic manner, as exact iterations of her question's last syllables (Szweykowska & Szweykowski, 2004). Early operatic conceptions would have probably regarded echo as a means of transmission, as a sort of primeval technology for the propagation of sound within the theatre.

> Echoes, however, also have a more strictly mechanical implication. They can "bring the beyond" downstage. […] speaking unscientifically and subjectively from one's own point of listening, echo could just as well be the sound of one's voice passed on, sent afar [...] Musical power as affective power becomes musical power as mechanical force, in an operatic singer's dream of a voice thrown undiminished across great distances. The dream predates by centuries the technology of the microphone or the loudspeaker. (Abbate, 2001, p.27)

Further examples of the use of artificial echoes as simulators of remoteness and rhetorical pathos are found in works such as Carissimi's oratorio *Jephte* (1650) (where the choir echoes Jehpthah's daughter's lament (Jackson, 2005)) or Purcell's *Dido and Aeneas* (c.1684) (chiefly the antiphonal witch choruses in *In our deep vaulted cell*) (Adams, 1995). In *The Fairy Queen* (1692), Purcell makes use of this resource in one of the trios of the 2nd act, where the "three elves" interact in an explicitly echoic manner. Echo is treated here in a somewhat redundant and ironic way as the sung verses reveal the nature of the phenomenon at its very moment of simulation: "While Eccho shall in sounds remote, repeat each Note, each Note, each Note" (Hollander, 1981).

2.2.7) Classical period

Musical duplication in the Classical period is characterised by an inheritance of Baroque polychoral and echoic techniques, which were adapted to the new aesthetic priorities of the time. Of particular significance is W.A. Mozart's *Notturno for four orchestras* (1776). In this work, Mozart writes for four identical groups of horns and strings (Sadie, 2006). These small orchestras were intended to sit in different locations so that the music could be echoed across the space of performance. In each of the three movements Mozart begins with a single phrase. The end of this phrase is echoed up to three times by the rest of the ensembles. This imitative process is explored in a variety of ways (Sadie, 2006). At the end of the minuet, the echoes become so short that a vertiginous, whirling quadraphonic effect is obtained. This distributes the musical material across the space, creating a constant sonic shift between the ensembles.

Composed echoes were also used by Beethoven. In the first movement of the *Eroica* symphony (1804) the horn motif (bars 294–295) echoes the main theme of the first movement. This is, however, intentionally displaced: a tonic triad superimposed in a dissonant manner over an accompanying dominant chord, as if the motif was desynchronised, temporally unsettled (Chua, 2005). This, however, helps to underline its actual presence by installing it in a harmonically alienating context. This displacement suggests a sense of chronological discontinuity, the echo is not emulated as an inevitably linear phenomenon but reappears, temporally dislocated, as a carrier of structural significance:

> [...] the echo's time lag recycles the past to preempt the reprise, so that it becomes what Adorno pinpoints as the temporal structure of the Beethoven symphony: "a force retroacting in time". (Chua, 2005, p.581)

2.2.8) Romanticism

The incorporation of new instruments and instrumental techniques to orchestral writing throughout the 19th century led to an increasingly sophisticated use of orchestral effects. This coincided with the aesthetic craving for expressiveness and dramatic pathos of the Romantic era. The creation of echo effects within the orchestra was not an uncommon procedure among Romantic composers. This was generally expressed in a naturalistic manner: composed echoes used as an imitation of natural reverberation, typical in symphonic poems, e.g. Grieg's or Sibelius' symbolic representation of the vastness of Scandinavian open spaces by the use of echoic interactions between muted brass instruments (Dawn Goss, 2009). Additionally, echo effects were used as a

mechanism to define and explore spatial perspective within the orchestra—that is, to simulate or intensify a feeling of distance and spaciousness within the orchestral apparatus. The use of this last resource is frequently present in the symphonic works of Anton Bruckner (Tovey, 2015).

A similar effect, but with an explicit programmatic character, is explored by Berlioz in *The Royal Hunt and Storm* (from the opera *Les Troyens* (1858)). This is a clear example of the effective use of echo from an evocative, naturalistic perspective (Northcott, 2009). In this movement, the horns, in their typical recreation of hunting calls, echo each other suggesting a series of changing distances, as if the hunters were moving in the forest before the storm starts (Knight, 2006). In *La Mort d'Orphée* (1827)*,* on the other hand, the brass section is used to create an echo, which explicitly suggests spatial depth without any allegorical connotation. A number of chords are played conventionally by the brass instruments and immediately repeated with the mutes on (Berlioz & MacDonald, 2002). This delineates, in an almost pedagogical way, an artificial sense of distance within the brass section.

In 1839, Richard Wagner embarked on an unexpected sea-crossing trip from Riga to England (allegedly fleeing angry Latvian creditors). The stormy weather forced the ship to find shelter in the fjord of the small Norwegian island of Borøy (Brener, 2014). Apparently, the crew's shouts, echoed by the vast rocks of the fjord, made a strong sonic impression on the composer. These would be later evoked and freely recreated in *The Flying Dutchman*.

> A feeling of indescribable well-being came over me as the granite walls of the cliff echoed the chantings of the crew as they cast anchor and furled the sails. The sharp rhythm of their call stuck with me as an omen of good fortune and soon resolved itself into the theme of the sailors' chorus in my *Der fliegende Holländer.* (Wagner, 1983, p.162)

These echoes resonate, in a figurative way, all along the opening of the opera*,* composed by Wagner approximately a year after the accidental trip to the Norwegian island. The physicality of the aural experience at the fjord is emulated quite literally in the opening of the 1st Act. Daland's sailors, in their effort to shelter their ship from a storm in the calm waters of a fjord, start shouting the word "Hallojo!" This word is echoed repeatedly by the valve and natural horns in the orchestra, recalling the sheer reverberation of the cliffs (Grey, 2000). In this particular case, the use of echo does not just imply the emulation of the natural acoustic behaviour of this phenomenon but also opens up the stage's space, delineating a directional sonic link between the pit and the scene. For me, the reconstruction of an aural recollection may be regarded as a form of duplication, even if it may be filtered by the pathos and dramatically charged connotation of an operatic context.

2.2.9) Early 20th century

The 20th century is particularly fruitful for the development of musical duplication. The experimentation with multiple orchestras, duplicated ensembles and instruments, and the introduction of both gesture and audiovisual means as generators of spatial duplicates create a vast number of examples and potentially illustrative scenarios.

Charles Ives' unfinished *Universe Symphony* (started in 1915) has left a long-lasting legacy of speculation among composers and musicologists, a conundrum inhabiting the limit between music of the idea and practical performance. In his biography of Ives (*Charles Ives and his music* (1955)), Henry Cowell describes the *Universe Symphony* as a work for several orchestras and large choirs of male and female voices that should be located in valleys, on hillsides and mountain tops. Only a few sketches and descriptions survive of this "intentionally unfinished" work (as described by Cowell). The idea of creating a poly-orchestral work, whose instrumental groups are integrated into the landscape of open air and natural spaces, responds to Ives' metaphysical beliefs:

> I started something that I had had in mind for some time: trying out a parallel way of listening to music suggested by looking at a view.
>
>   First, with the eyes toward the sky or tops of the trees, taking the earth or foreground subjectively (that is, not focussing the eye on it), and then
>
>   Second, looking at the earth and land and seeing the sky and the top of the foreground subjectively. In other words, giving a musical piece in two parts, but both played at the same time... the whole played through twice, first when the listener focusses his ears on the lower or Earth music, and the next time on the upper, or Heavens music. (Ives, cited in Cowell, 1955, p.201-202)

Hypothetically, Ives' proposed duality may suggest a performance in which different orchestras—up to eleven according to Lyman (2008)—could perform independently in distinct geographical locations, perhaps echoing each other across the valleys and tops of the Adirondack mountains, some of them performing the Earth's tones and some others the Heavens' (Burkholder, 1996). This extensive, impossible use of the performative space leaves room for imaginative conjectures: distant antiphons between mountain peaks, uncoordinated orchestral groups performing the same passages in visually and aurally disconnected locations, orchestras echoed by the mountain rocks, etc.

A sense of duplication is also present in other works by Ives, notably in the *Three Quarter-Tone Pieces* (1923-1924) for two pianos tuned a quarter-tone apart. In some passages of the first piece (bars 51-53) and the second piece (bars 55-56, 57-60, 61-65, 71-72, 91-92, 121-123 and 135-

137) Ives treats the first and second pianos in an echoic manner; a passage is played on one piano and then performed a quarter-tone lower or higher on the other. However, these small tuning differences do not obliterate a clear feeling of duplication. These passages are similar enough to be perceived as iterations, although a slight impression of instability, distortion and aural discrepancy is created between the two parts. These small sonic divergences are quite close to the effect of echo. This phenomenon is fully dependent on the acoustic conditions of specific spaces, which are able to modify the nature of the original sources and generate small sonic distortions and transformations.

Figure 4: Charles Ives' 2nd Piece (Allegro) from *Three Quarter-Tone Pieces*, bars 135-137.

2.2.10) From 1950 to the present day

In the 1950s and 1960s, a number of notable poly-orchestral works were produced by composers associated with the Darmstadt School. Among the most iconic poly-orchestral works of the time are Karlheinz Stockhausen's *Gruppen* for three orchestras (1955-57) and *Carré* for four orchestras and four choirs (1959-60). Additional significant poly-orchestral works include Iannis Xenakis' *Stratégie* for two orchestras (1959–62) and the often unjustly forgotten Bruno Maderna's *Quadrivium* (1969) for four orchestral groups.

As a milestone in the history of orchestral music, Stockhausen's *Gruppen* extrapolates serial thinking into the space-time domain (Misch, Hentschel & Kohl, 1998). The work is performed by 109 musicians divided into three identical instrumental groups (each led by a separate conductor) and set up around the audience in the form of a horseshoe (Harvey, 1975). Although the work displays an active shift of musical processes from one orchestra to another (generating, in many

cases, directional movements of sound and common musical materials across the space), the spatiality is rather an outward consequence of the compositional techniques and serial organization of the material (Misch et al., 1998). In parallel, *Gruppen* was conceived as a reaction against the limitations of the pointillistic style of the earlier Darmstadt serialism, here favouring sonic directionality, density, speed changes, and timbral and dynamic shifts, in opposition to pointillistic procedures and the localized significance of individual pitches (Misch et al., 1998). As Smalley points out,

> The importance of individual notes and intervals has greatly diminished in *Gruppen* and they only become perceptible in certain sparsely scored and solo passages. So it is no use listening for motives and themes, but rather for sonority, density, speed, dynamics, and direction of movement. (1967, p.795)

The prioritised use of these parameters allows the generation of a large number of sonic duplications that are easily perceivable from the audience's position. The presence of three almost identical orchestras on stage determines the possibility of direct sonic analogies that are generally emphasized by musical ideas embedded in the actual compositional technique. Examples of this may be found in passages throughout the score: in the first section (the work is subdivided into seven main sections consisting of a total of 174 units or "groups" (Harvey, 1975)) a specific passage (a string glissando combined with a staccato trumpet note and a keyboard cluster) is rotated from orchestra to orchestra (Smalley, 1967). In the 6th section, during the first climax of the piece, a quasi-antiphonal exchange of materials from one orchestra to another is displayed in an energetic manner (rapid alternation of loud, densely chromatic chords). Similarly, in the last section of the piece, a set of instrumental interventions (e.g. attacks on the wood-drums, flute flutter-tongues, brass chords, etc.) are rotated between the three orchestras (Smalley, 1967). The use of duplicated and analogous materials between the orchestras creates a feeling of spatial and temporal continuity, a feeling of aural consistency that subverts the individual character of the groups and is intimately linked to Stockhausen's compositional preoccupations at the time.

> Each sound-source is now in a position to let its own time-space be experienced, and the listener finds himself in the midst of several time-spaces which in turn create a new, common time-space. (Stockhausen, cited in Misch, 1998, p.150)

Composers from the early 1950s onwards produced a considerable corpus of works for two or more identical instruments. A large number of significant pieces were composed for multiple pianos since the mid-20th century (Hinson, 1983). This could be somehow regarded as a continuation of the prolific tradition of two piano writing initiated in the 19th century, but with some

substantial differences. From my point of view, 19th century compositions for two or more pianos are still based in a clear division of roles according to musical functionality (usually melody and accompaniment). This resulted in a largely orchestrational conception of the instruments, involving a traditional stratification of their register and timbral characteristics. This conception has been greatly expanded since 1950. Generally, the pianos' roles no longer submit to conventional orchestrational strategies. Instead, other modes of interaction between the instruments are explored. These include the creation of different textures, juxtapositions, antiphonal structures, synchronous and asynchronous passages, use of alternative tuning systems, non-coincident tempi, etc.

Some remarkable works within this category are Stefan Wolpe's *Enactments* for three pianos (1950-53), Pierre Boulez's *Structures I* (1952) and *Structures II* (1961) for two pianos; Henri Pousseur's *Prospection* for three pianos tuned in sixths of a tone (1952–53); John Cage's *Music for Piano 4–19* for any number of pianos (1953), *Winter music* for 1 to 20 pianos (1957) and *One* for one to four pianos (1989); Ivan Wyschnegradsky's *Arc-en-ciel* for 6 pianos in twelfth tones (1956); Morton Feldman's *Piece for Four Pianos* (1957), *Two Pianos* (1957), *Five Pianos* (1957) and *Vertical Thoughts I* for two pianos (1963); Steve Reich's *6 pianos* (1963); Stockhausen's *Mantra* for two pianos and electronics (1970); Salvatore Sciarrino's *Sonata for 2 pianos* (1970); Gyorgy Ligeti's *Monument - Selbstporträt – Bewegung* for two pianos (1976); and James Tenney's *Flocking* for two pianos tuned a quarter-tone apart (1993) and *Ergodos III* for two pianos (1994). More recent works include Matthias Spahlinger's *Farben der Frühe* for seven pianos (1997-2005); Georg Friedrich Haas' *Limited Approximations* for 6 microtonally tuned pianos and orchestra (2010); and Cecilia Arditto's *Gespleten Piano* (2010) for piano, hidden piano and cassette players.

Apart from works for several pianos, a vast array of pieces for other multiplied instruments and voices has been produced since the fifties. This confirms the interest of many composers in the structural, sonic and aesthetic issues related to duplication. This category encompasses, among other relevant works, Pierre Boulez's *Messagesquisse* for solo cello and six cellos (1976); Iannis Xenakis' *Windungen* for 12 cellos (1976); Helmut Lachenmann's *Salut für Caudwell* for two guitars (1977); Georges Aperghis' *Signaux* for quartet of instruments of same range and timbre (1978) and *Totem* for eight cellos (1997); Morton Feldman's *Three voices* (1982); Alvin Lucier's *Kettles* for five timpani and two pure wave oscillators (1987), *Unamuno* (1994) for four equal voices and *Criss-Cross* for two electric guitars (2013); Luigi Nono's *"Hay que caminar" soñando* for 2 violins (1989); Matthias Spahlinger's *Off* for 6 snare drums (1993); Salvatore Sciarrino's *Il cerchio tagliato dei suoni* for four flute soloists and ensemble of 100 flutes (1997); and Pierluigi Billone's *1+1=1* for 2 bass clarinets (2006).

This chapter attempts to give a broad overview of historical approaches to duplication (hence the enumeration or pieces). It would greatly exceed the scope of this text to examine the

presence and role of duplication in each of these works. However, as an illustration, I will focus in some detail on a few individual compositions. These selected pieces have a clear connection to my own work and have been significant, to some extent, in the development of my compositional language.

Morton Feldman's *Piece for four Piano*s (1957) is a paradigmatic example of the synergistic use of sonic, instrumental and gestural duplications. In this work, each pianist begins playing simultaneously, performing identical parts. Each pianist moves at his/her own tempo (typically slow, but undefined) and dynamics (generally soft). The effect of these drifting individual tempi results in the unpredictable iteration of events, which results in the creation of shimmering, reverberating textures during the passages in which events are more densely concentrated. From a metaphorical perspective, the asynchronicity of the pianists operates rather like the movement of circular waves in water.

> The effect rapidly becomes one in which each event is heard once and then with three further repeats - it has been likened to throwing a pebble into a pond and watching the subsequent waves spin out from the center. (Fulkerson, 2002)[16]

Similar or nearly identical sounds arrive to the listener at different times. Sometimes, depending on the speed of the performance, the materials are perceived in an echoic manner as clear iterations. In other cases, secondary relationships between the materials emerge as being more significant than the repetitions themselves. In this work, the musical material is not only duplicated but rendered at different speeds. This temporal disjunction underlines precisely the performative idiosyncrasy of each pianist (Cline, 2016). In my eyes, this dissociation reveals the intrinsic properties of the materials as they are "irradiated" rather than "repeated". The significant role of duplication in this piece is not only defined by the presence of analogous instruments, scores and, to a certain extent, performative gestures but also by the way in which the material propagates. In my opinion, this "pond wave effect" avoids compositionally generated temporal constraints to highlight the complex, inherent properties of sound and the performers' individual temporal perception.

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[16] This "pond-wave effect" may be compared, in spite of the obvious differences, with the bending processes applied to the metal sheets in some of my works (e.g. *Isla y Continente*, *Huella y Horizonte* and *Gyre and Gimble*). The materials transmitted through transducer speakers to the surface of the sheets—and consequently acoustically modified by the bending movements—are often identical. However, in specific passages, the duration and speed of these movements is non-coincident, even if the same levels of curvature are finally obtained. This generates textures in which the iteration of materials is perceived in a quasi echoic manner (if the bending movements take place relatively soon after each other) or as separate events (if the bending movements are performed at very different speeds).

Luigi Nono's last work, *"Hay que caminar" soñando* (*"One must go, dreaming"*[17]), explores duplication from an almost contrary perspective to Feldman's *Piece for four Pianos*. Evoking its title, Nono's score instructs the two violinists to walk on stage, to look for their own path across the space. This is encouraged by the use of several music stands—at least eight—as potential geographical points that the performer may or may not visit during the performance (Esterbauer, 2011). This procedure is not only intended to evoke the image of the performer as a wanderer but to "resound" the space from different locations (Petazzi, 1999).

The use of stands as signposts opens a space for potentiality, an almost infinite number of possible of itineraries across the stage allowing an ever-changing set of relationships and parallelisms between the two violins. In Feldman's piece the events are projected in an echoic manner by means of irradiation from fixed points in the space. In Nono's work, however, these echoic interactions are spatially variable. Feldman's search for individual performative itineraries is temporal while Nono's is fundamentally spatial. In this work, Nono utilizes the *scala enigmatica* of Verdi's *Ave Maria* as pitch material (Sutherland, 1994), filtering it by the subtle exploration of the violin's sonic nuances, creating an ever-changing palette of sounds and techniques of emission, occasionally dissolving into near silence and the limits of audibility. The two violins are so interdependent that it is often hard to distinguish between them, especially during the passages of particular fragility. The use of shared sonorities between the two violins creates mirror-like structures across the stage that are variable in every performance, subject to the musical intuition and the particular spatial itinerary followed by each of the players.[18]

The use of acousmatic means to generate a sense of duplication is an interesting addition to instrumental multiplication, mainly defined by the use of pre-recorded materials as constituting elements of the compositional process. This process suggests, in most cases, the presence of parallel spaces and duplicated identities within the space of performance. A relevant example of this is Luigi Nono's *La lontananza nostalgica utopica futura. Madrigale per più "caminantes" con Gidon Kremer* for violin solo, eight pre-recorded tapes and ten music stands (1988–89)—a work written only a year before *"Hay que caminar" soñando,* with which it shares a considerable number of conceptual and material principles (Esterbauer, 2011).

In this work, the ambulant violinist also wanders freely between the stands, located both on

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[17] The translation of this work's title into English has been found in the following article: Carvalho, Mário Vieira de. (1999). Towards Dialectic Listening: Quotation and Montage in the Work of Luigi Nono. *Contemporary Music Review* *18* (2), 68.

[18] A similar effect occurs in my chamber opera *Gyre and Gimble.* In this work, three singers (soprano, mezzo-soprano and baritone) wander across the stage. The soprano never sings in a conventional sense. She carries a loudspeaker that plays the distorted pre-recorded voices of the rest of the singers on stage. She shapes her mouth and facial expression according to the materials played through the loudspeaker ("fake-singing"). A number of sonic parallelisms and correspondences are established between the pre-recorded materials and the voices of the ambulant singers. For more information see sections 3.1.5 and 4.4.

the stage and among the audience, defining his personal path and forming a possible network of routes across the space of performance. Similarly, the person in charge of the electronics—the "sound-projectionist"—is advised to combine different channels of the recorded materials, delineating a path through the pool of available sonic materials (Sigman, 2010). The sound-projectionist's role is, to a certain extent, analogous to that of the violinist: a navigator of sound and space. In this work the sound of the violin merges with the pre-recorded sounds, appearing from and disappearing into the electronics in a process that blurs the sonorous identity of the instrument. The use of pre-recorded materials suggests the presence of invisible violins, located in unattainable, parallel spaces. The sonic materials echo and reflect each other but the visual correspondence of this process is neglected, being exclusively materialised in the loudspeakers.[19]

The exploration of gestural duplication as a compositional element has been largely influenced by the development of music theatre and the assimilation and incorporation of theatrical elements into the musical discourse of a considerable number of composers. A compelling example of the use of gesture as an emancipated, independent musical object, and also directly related to duplication, is the already discussed family of pieces *Next to Beside Besides* (2005–2006).[20] These works by Simon Steen-Andersen are especially interesting from an audio-visual perspective. A feeling of sonic and visual duplication is generated by the execution of identical performative movements on different instruments, generating coincident or comparable sonic results.[21] This set of pieces is a paradigmatic example of the syncretistic use of gestural and sonic duplication, enriched even further by the incorporation of live video recordings and projections in *Self-reflecting Next To Beside Besides.*

The use of gesture as a catalyst for the generation of duplicated audiovisual identities marks the end of this section. This historical report highlights the significance of duplication throughout music history, revealing the abundance of examples in which this phenomenon is a key aspect. Its presence is constant through the ages, and it has been conditioned and utilised according to the aesthetic tendencies and the technical developments of each specific period. This section constitutes, from a broad perspective, the first attempt to classify and group together works and musical examples according to duplication. In spite of the clear stylistic and technical differences between these examples, the effect of duplication operates as a common thread, generating related

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[19] Multiple acousmatic sources (defined by the use of transducer loudspeakers fixed to different instruments and sound boxes) are also used in *Gyre and Gimble*. These loudspeakers usually play pre-recorded fragments of the singers' voices. This creates sonic equivalences between the wandering vocalists and the acousmatic sources (see pages 84 and 85).

[20] See page 15.

[21] Similar examples in which gestural and sonic duplications are directly related may be observed in some of my works. In passages from *Huella y Horizonte* and *Isla y Continente* (see sections 3.1.2 and 3.1.3), the performative gestures simultaneously applied to two or more metal sheets are often coincident. The sheets are usually bent to the same positions, producing identical sonic outcomes.

and comparable compositional and/or performative strategies and approaches. In this respect, my recent compositions may be regarded as a modest contribution to this specific corpus of works.

Chapter three: doubles in the spatial realm

I saw all the mirrors on earth and none of them reflected me. (Borges, 1978, p.27)

This chapter will examine the role of duplication in my own music from a spatial perspective. Here I will focus on several fields of study: instruments, objects, stage setups and performers. These will be regarded in light of spatiality, avoiding as much as possible the implications of the temporal and sonic domains. The role of the performers will be analysed from a static perspective, regarding them as carriers and/or depositaries of spatial significance within specific musical setups.

A clear interest in setups in which the instruments, objects and performers are duplicated is present in my work since 2010. This stems from a long-lasting fascination for the visual reproducibility and the sense of spatial parallelism generated by mirrors. This interest has been materialized in my own work by the creation of setups in which instruments and performers mirror each other, both from spatial and performative perspectives. The use of duplicated instruments and objects may determine a process of visual and sonic equivalences and associations within the space of performance. However, this audio-visual symmetry may be challenged by the usage of dissimilar sonic materials (as we shall investigate in the next chapter). This possible contradiction may alter or reformulate the mirrored relationships established between two or more identical instruments, delineating a fragile equilibrium between the aural and visual realms. Metaphorically, from a viewpoint of musical duplication, we could regard the spatial domain—the conjunction of duplicated instruments, objects and performers—as the frame of a mirror. In turn, the reflective surface of this hypothetical mirror would be constituted by the sonic domain, completing in such a way the audio-visual contract.

The Borges quote above is particularly appropriate when extrapolated into this particular context: mirrors do not always imply an expected reflection, a causal effect. They are rather conceived as frames of potentiality, as indicators of a possible duplication that may be either confirmed or shattered by the nature of their reflecting surface.

Evidently, the separation between space, gesture and sound proposed in my analysis is somewhat artificial and may contradict, to some extent, the way in which the works are perceived by the listener. This division is, however, necessary to shed light on the different aspects that constitute and define the phenomenon of duplication in my music. This somehow paradoxical segmentation is also observable in chapter four. An attempt has been made to focus as much as

possible on the main issues of discussion but inevitably, in some sections, alluding to other fields of study has been necessary for the sake of clarity and intelligibility.

3.1)   <u>Instruments, objects and stage setups</u>

In *Of Other Spaces* (1967), Michel Foucault distinguishes between "utopias" and "heterotopias" as spatial realities that, even if in direct relation with real spaces, reverse, counterbalance and annul the set of relations they embody and/or reflect. Utopias are spaces without a real place, illusory sites "that have a general relation of direct or inverted analogy with the real space of Society" (1986, p.24). Heterotopias, on the other hand, could be defined as the reversal to utopias: existing places in which the rest of real places are "simultaneously represented, contested and inverted" (1986, p.24). An illustrative example of this is the theatre. During a play, there is usually a representation of unrelated, alternative spaces—e.g. a battleground, a church, a café, etc.—in the circumscribed realm of the stage. In this regard, the theatre, as a heterotopian space, brings together seemingly disconnected and incompatible places and locations.

Interestingly, Foucault describes an intermediate state in which heterotopias and utopias are indissolubly intertwined: the mirror. Mirrors may be regarded as utopias as they create an impression of virtual spatiality, a feeling of displacement, of a place without a place. We find ourselves duplicated behind the surface, our corporeal identity virtually dislocated, transferred to an unreachable location. Simultaneously, mirrors may also be considered heterotopian devices as they are concrete objects that exist in reality. They mark a limit between the virtual space and the real, allowing us to reconfigure our original sense of place in the process of mirroring. This feeling of displacement is paradoxically counterbalanced by our reflected image, our vision oriented towards ourselves from the other side of the glass, permitting us to reconstruct our original sense of space and identity. As Foucault observes,

> The mirror functions as a heterotopia in this respect: it makes this place that I occupy at the moment when I look at myself in the glass at once absolutely real, connected with all the space that surrounds it, and absolutely unreal, since in order to be perceived it has to pass through this virtual point which is over there. (1986, p.24)

The creation of musical situations in which the utopian and heterotopian realms are suggested is present in a considerable number of my compositions. In order to recreate an ambiguous and fluctuating alternation between the two realities, mirror-like setups and symmetrical spatial layouts have often been devised in my work. A feeling of heterotopia is suggested by the use of duplicated instruments, often mirroring their counterparts from a sonic and performative perspective. The heterotopian character is confirmed by means of visibility: a duplicated instrument refers back to the original source by its observable presence and by means of performative and

sonic iteration. A global sense is constructed upon the relationship between the original source and its duplicates, in many cases obliterating the identity of the original by the delineation of ambiguous processes of imitation and sonic exchange. This often prevents the listener from distinguishing between the original and its copy, between the inside and the outside of the mirror.

The utopian aspect is often alluded to by the use of acousmatic sources (speakers and transducer speakers). These suggest parallel, unreachable places in the space of performance by creating unobservable aural duplications. The use of recordings is particularly important in the delineation of utopian parallelisms: the sound of an instrument or a voice is echoed in an inaccessible location, impeding the source's visual identification. The subject of sonic duplication will be thoroughly addressed in the next chapter.

The order in which the works are presented in this chapter is strictly chronological (from the earliest to the latest). Not all the works composed over the course of this PhD have been included in this chapter but just those in which spatial issues are central to their identity.

3.1.1) *I reached A through the throng through the threshold through the throb:* initial experiments with duplication

In my early work *I reached A through the throng through the threshold through the throb* (2011-2012) the relationship between the heterotopian and utopian realms is metaphorically explored by the design of a staged "still life". This work constitutes my first attempt to suggest a clear impression of duplication on the stage and operates as a predecessor of all the works and the research carried out in the course of my PhD. Due to its significance for the development of my later compositions it will be addressed and referred to on a number of occasions, even if it is not strictly part of the PhD's corpus of works.

In this piece, the stage is divided into two halves: on the right side there is an ensemble of 10 performers while the opposite side is populated by a collection of instruments and objects. This accumulation of instruments mirrors exactly the opposite ensemble's setup: each instrument is duplicated (see Figure 5). These non-played instruments are sonically animated either by the use of transducer speakers fixed to their surface (especially those with resonating boxes: piano, percussion, strings) or by small conventional loudspeakers placed behind the instruments (winds). Additionally, some percussion instruments and the piano strings are activated by the use of miniature motors fixed to their surface. The materials played through these speakers consist of individual recordings of the ensemble's instrumentalists. Each unperformed instrument is associated with the sound of its played counterpart. A singer is placed among this still life of instruments but she only operates as an automaton, as a replica of the soprano on the other side. She carries a loudspeaker among her clothes that projects the voice of the other singer. Meanwhile, she silently shapes her mouth and facial expression according to the nature of the materials played through the loudspeaker. Short fragments from Lewis Carroll's *Through the Looking-Glass* define the textual materials spoken/sung by the soprano. Fittingly, these texts address the issues of parallel spaces, mirrors and duplicated identities.

The role of visibility is particularly relevant in this work as the relationship between the "inanimate" collection of instruments on the left side of the stage and their "animated" replica on the right side is mainly confirmed by sight. The sonic equivalences, the materialization of the actual musical mirroring between the two sides of the stage is only truly identifiable by the visual observation of the setup's symmetrical configuration. In this respect, the specific topos, the particular location in which every object/instrument is placed on the stage is of crucial importance.

Figure 5 : setup of *I reached A through the throng through the threshold through the throb* (graph by the composer)
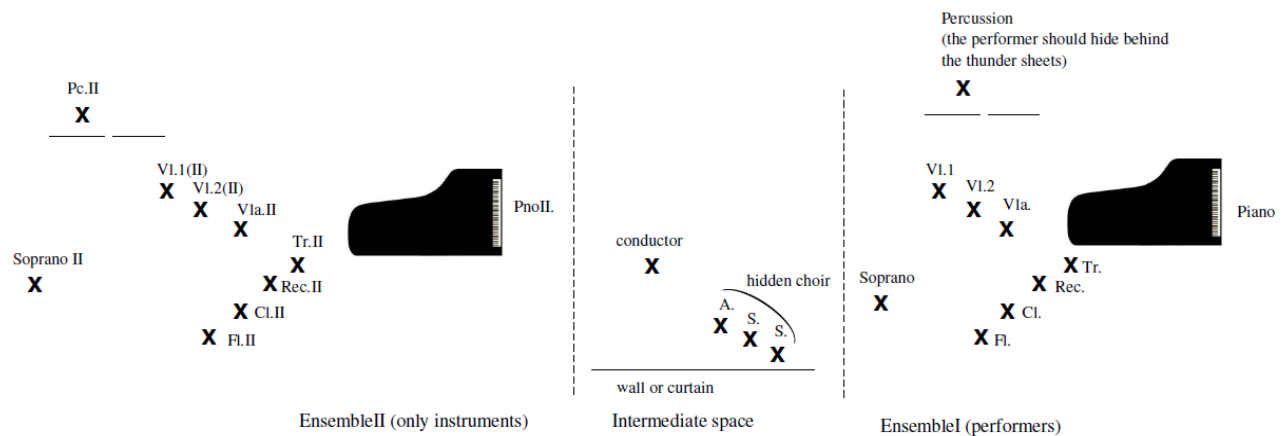
Visual bridges are suggested on the stage by the mere duplicated position of identical instruments. However, these are also linked to each other by means of light. The musicians on the right side of the stage press small switches that activate individual light bulbs located next to their unplayed instrumental counterparts, on the opposite side of the stage. The use of light underlines the visual correspondence and also enhances the aural identification of related sonic sources. The distribution of individual light bulbs implies a considerable number of electrical cables. These cross the stage and operate as observable geographical links between the pairs of identical instruments and objects. Lights become independent instruments in their own right at some points, abandoning their illuminating function in favour of a more autonomous role. They emancipate themselves from the process of synchronicity and generating more complex audiovisual relationships between instruments, loudspeakers and performers.

As discussed in chapter one, Overlie's *Theory of Viewpoints* (Bogart & Landau, 2005) is particularly efficient in describing the levels of spatial interaction between the objects, people and architectural features on the stage. In this particular case, Overlie's "spatial relationship" category —which focuses on the distance between objects on stage; of one object in relation to another, to a group, etc.—would be defined by the physical separation established between the two rooms. This separation is needed so that these rooms are perceived as independent, yet interrelated, spatial entities. Concurrently, the duplication of individual instruments, central to the conceptual backbone of the piece, requires an organized mapping of the stage so that an observable replication is suggested. This is determined by a set of carefully arranged distances between each pair of instruments. Additionally, Overlie's "shape" category—the contour of bodies/objects in space; the shape of an object in itself or in relation to other bodies, etc.—is particularly useful for the analysis and practical realization of this work. The use of identical percussion instruments on the two sides

of the stage, the choice of physically similar singers, even the orientation of the unplayed instruments (which should match that of their played counterparts) should create a visual context in which a sense of symmetry and parallelism is clearly observable.

3.1.2) *Huella y Horizonte*: mirror displacements

A more recent work, *Huella y Horizonte* (2014-2015), investigates the utopian/heterotopian nature of mirrors to a perhaps more literal and evident degree. This work, scored for tenor saxophone and five flexible steel sheets of different sizes, explores the creation of sonic and architectural mirrors on the stage. The pre-recorded sound of the saxophone is projected onto the metal sheets through transducers speakers fixed to their surface. The metal sheets are manipulated in several ways: bending them to various levels of curvature, applying different beaters and resonators to their surface, etc. The sound produced by the transducer speakers is modulated by the acoustic properties of the metal sheets. These could be regarded as sonic screens and/or distorting mirrors capable of substantially altering the nature of the original audio samples. Ultimately, a process of hybridisation between the sound of the saxophone and that of the steel sheets is suggested. Throughout the entire performance of this work, the saxophone player is situated with his back to the audience, directing the instrument's sound toward the rear of the stage. The metal sheets are placed in a semicircle around him, facing the audience. In such a way, an almost parabolic configuration is outlined. This creates an illusory effect by which the sound of the saxophone is perceived as being reflected by the sheets.

Figure 6: first performance of *Huella y Horizonte* during the Bernaola Festival, Spain, 11/11/2015 (photograph by the composer)

Figure 7: spatial setup of *Huella y Horizonte* (graph by the composer)
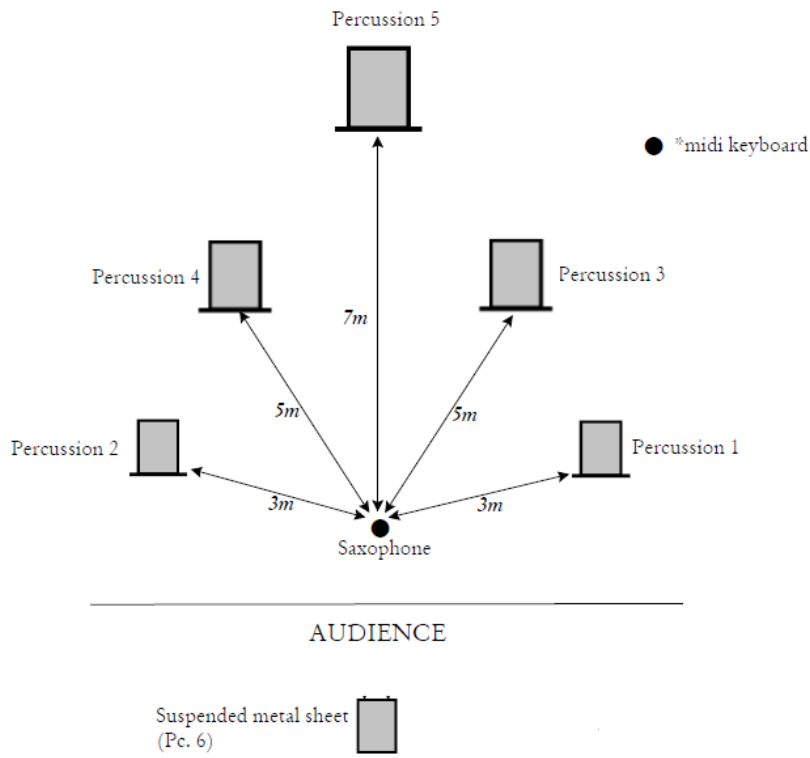
The visual content of this work is particularly significant as the different bending processes applied to the sheets imply the creation of a complex architecture of planes, curves, arches and parabolas. This context of changing configurations is often intended to generate visual analogies and mirroring structures on stage. The simplicity and malleability of the metal sheets allow a direct and observable imprint of physical gestures onto their surfaces and the consequent crystallisation of different shapes and bending degrees. The structure of this work is based on 63 different spatial configurations, each of them involving a different combination of instruments (in fact, mathematically, 63 is the total number of possible combinations). Each specific spatial setup operates as a quasi-independent scene within the piece, characterised by the exploration of different techniques, sound materials and architectural relationships. This work is completely symmetrical from a structural and spatial perspective. The second half of the piece mirrors the spatial configuration of the first half, although the combination of materials and the specific sound world of the first sections do not always coincide with that of the mirroring sections. As previously discussed, the materials played through the transducers are mostly defined by pre-recorded samples of the saxophone's sound. These samples are largely coincident with the materials performed on stage by the saxophone player, determining a set of references and distorted sonic reflections between the instrument and the metal sheets. In this context, Foucault's notion of the mirror as a

territory in between utopia and heterotopia seems again particularly appropriate. The metal sheets become distorting mirrors: objects at the limit between concrete spaces (defined by the actual presence and sonic identity of the sheets) and unattainable spaces (defined by the process of projection, distortion and reformulation of foreign materials). This process suggests the simultaneous coexistence of various unrelated sonic and spatial universes in the same object. The actual metal sheets are observable exponents of a concrete topos on the stage while the pre-recorded materials, projected onto their surface through transducer speakers, are reminiscent of virtual, inaccessible places. Appropriately, Foucault describes this phenomenon in *Of Other Spaces*:

> The heterotopia is capable of juxtaposing in a single real place several spaces, several sites that are in themselves incompatible. Thus it is that the theater brings onto the rectangle of the stage, one after the other, a whole series of places that are foreign to one another (1986, p.25)

In the same vein, apart from the sound of the saxophone, a number of recited texts were added to the list of pre-recorded materials of *Huella y Horizonte*. These operate as quasi-unintelligible internal messages within the structure of the work. These texts were extracted from Amundsen's *South Pole Expedition diary*, Copernicus' *De revolutionibus orbium coelestium* and Melville's *Moby Dick*. They address the problems of geographical awareness and impossible cartographies, the difficulties in locating and ascertaining concrete spots on a territory and the inability to discern between real and fictional places. These subjects are, in fact, clearly related to the paradoxical nature of the mirror: an object of the in-betweens, in the interstice between utopias and heterotopias.

Individually, each individual sheet physically resembles a mirror, and all of them, in spite of their different sizes, look like each other. Not only do the metal sheets have evocative or associative implications, but they operate as veritable non-static, flexible sonic mirrors able to reflect, warp and reformulate the materials played through the transducer speakers. On many occasions, the processes of bending are identical between the metal sheets, both in synchronous or asynchronous temporal contexts. This creates visible symmetries on the stage: mirroring arches and contours determined by the different processes of manipulation. This is also easily observable in the actual score due to the graphic notation utilized to transcribe the different bending positions and the different techniques applied to the metal sheets.

Figure 8: *Huella y Horizonte* (bar 297). Symmetrical bending positions of all the metal sheets
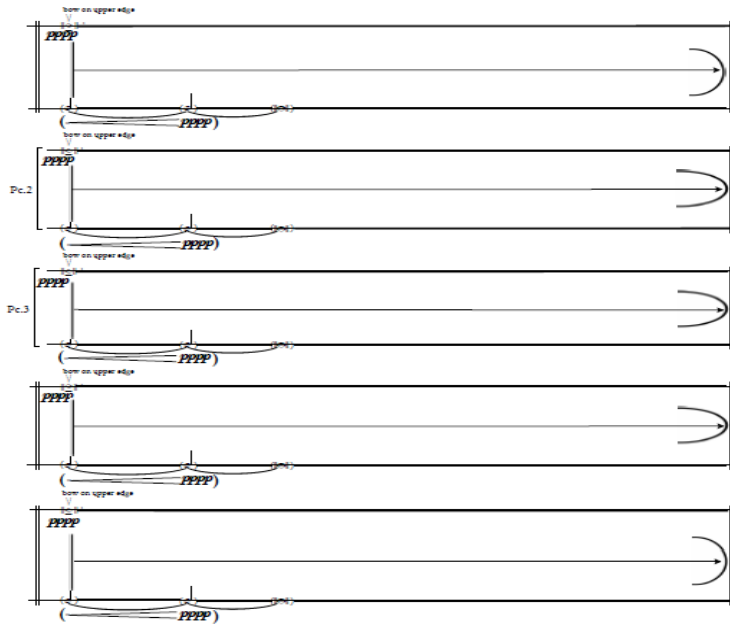
Figure 9: *Huella y Horizonte* (bars 52-59): use of identical sheet bending positions in a non-strictly synchronized way.

Specific configurations of curves and planes delineate the visible architecture of each of the 63 sections of the piece. As exposed before, the processes of curvature applied to the metal sheets are organised in a symmetrical manner within each of the piece's sections. This outlines visible correspondences between two or more metal sheets in the space of performance. While these local processes are mostly dynamic (the metal sheets are always physically manipulated) and their arrangement responded exclusively to intuitive decisions carried out during the process of

composition, a global plan of the specific spatial combinations and interactions between the metal sheets was devised before the process of composition started. This particular plan determined, in a cartographic way, all the possible combinations between the metal sheets and the saxophone. These combinations were later arranged in such a way that the global structure of the work would be entirely symmetrical from a spatial point of view. Consequently, this involved a pre-compositional segmentation of the work's temporal structure, which resulted in an equally symmetrical organisation of the sectional durations. The decision to explore all the possible spatial combinations responds, among other things, to the degree of sameness of the metal sheets. Even if their size is considerably different (the smallest sheet has an area of 0.5x1m while the largest has an area of 0.75x1.75m) they are visually analogous due to their identical rectangular shape. The material they all are made of (non-galvanised steel) adds an additional layer of shared consistency to their texture and visual appearance.

Figure 10: Pre-compositional sketch of *Huella y Horizonte*, indicating the set of 63 possible instrumental combinations and the order in which they appear in the score (sketch by the composer)
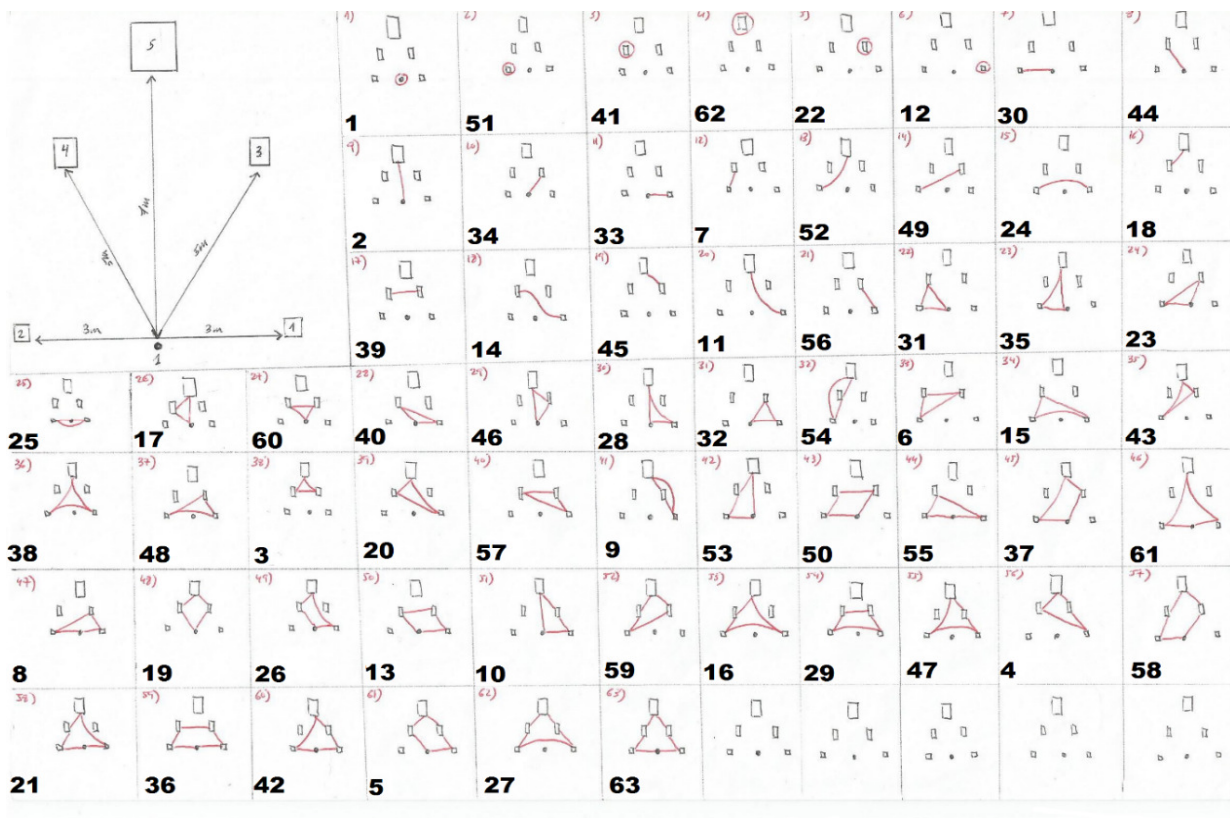
Additionally, the distribution of the metal sheets on the stage is arranged according to perspective. The smaller sheets are placed on the front side of the stage while the larger ones are on the back, determining a somewhat uniform visual perception of the object's size from the audience's position. It is precisely this sense of uniformity (both from a visual and sonic perspective) that

motivated the design of an ever-changing array of spatial relationships between the saxophone and the metal sheets. This constant change of spatial relationships creates an impression of diversity in the musical discourse. Different areas of the stage are sonically excited by similar or identical objects; a feeling of variation is thus built upon a combinatory process in which each metal sheet becomes the signifier of a concrete space, of a specific region within the stage.

During this work's composition process I was particularly interested in Robert Smithson's *Yucatan Mirror Displacements (1-9)* (1969). This artistic project was characterised by the placement of 12-inch square mirrors in different sites of the Yucatan peninsula (the same project would be later replicated in other parts of the world with differently sized mirrors). These sites included a quarry, a field of ashes, a beach, mangrove trees, a river island, etc. The projects were short-lived as the setup of mirrors would immediately be dismantled after they were photographed. The mirrors reflected the surrounding objects and the environmental elements, altering and displacing the form and consistency of the sites on which they were placed. They break the spatial continuum by inserting—displacing—bits of reflected landscape into the landscape itself. This process of spatial displacement is a temporal one as the succession of reflected images is a consequence of the passage of time. However, both the mirror and the photograph are outside temporality: the mirror functions as a timeless object that frames the process of reflections while the photograph itself suspends time. Smithson captures this idea in the description of his *third mirror of displacement*.

> In the side of a heap of crushed limestone the twelve mirrors were cantilevered in the midst of large clusters of butterflies. For brief moments flying butterflies were reflected: they seemed to fly through a sky of gravel. Shadows cast by the mirrors contrasted with those seconds of color. A scale in terms of "time" rather than "space" took place. The mirror itself is not subject to duration, because it is an ongoing abstraction that is always available and timeless. The reflections, on the other hand, are fleeting instances that evade measure. Space is the remains, or corpse, of time, it has dimensions. (1996, p.122)

Smithson's notion of the mirror as a place of displacement is remarkably close to the function of the metal sheets in *Huella y Horizonte.* These objects reflect the sound of the saxophone, which could be metaphorically regarded as a prominent sonic signifier within the hall's specific soundscape. The saxophonist plays with the back to the audience, projecting his/her sound towards the back of the stage. This is, in turn, reflected by the hall's rear walls. This acoustic process—sound travelling from the front towards the rear of the stage and then being thrown back in the opposite direction—is fractured by the presence and activity of the metal sheets.

Figure 11: Smithson, R. (n.d.): *Mirror Displacement (Vertical on rocky bank).* [Photograph]. Retrieved from: https://www.robertsmithson.com/photoworks/mirror-vertical.htm. Coincidentally, this particular configuration of mirrors looks similar to the spatial setup of *Huella y Horizonte*.

The sheets are always positioned facing the audience. As opposed to the saxophone, their sound is aimed towards the public. The metal sheets, as already discussed, could be regarded as mirrors onto which the sound of the instrument is projected. This process displaces the saxophone's sound to other parts of the stage and, simultaneously, breaks the instrument's unidirectional process of sonic projection. To a certain extent, the metal sheets operate as Smithson's mirrors as they insert or transfer bits of the reflected materials (recordings of the saxophone) into the work's general soundscape, generating a sense of discontinuity. The metal sheets are also, from a comparative point of view, non-durational objects that frame time-based reflections, even if their non-static nature— due to the percussionists' manipulation processes—adds a supplementary layer of complexity to their role in the piece.

Smithson's notion of enantiomorphs was particularly inspiring for the composition of *Huella y Horizonte* and some other works. In science, enantiomorphs are described as each of the two crystal forms of a substance that are mirror images of each other. Smithson applied this particular notion to the layout of objects and materials in several of his works for the purpose of disrupting traditional models of perception. By creating two identical objects, the vanishing point, the illusion of oneness towards which the binocular focus of our eyes converge, is split in two. This enhances a stereoscopic perception of the work or, as Smithson would put it: an "enantiomorphic vision" (1996, p.359). This phenomenon could be described in more simple words as "seeing double".

Figure 12: Smithson, R. (n.d.): *Enantiomorphic Chambers 1965/2003*. [Photograph]. Retrieved from: https://www.robertsmithson.com/sculpture/4.htm
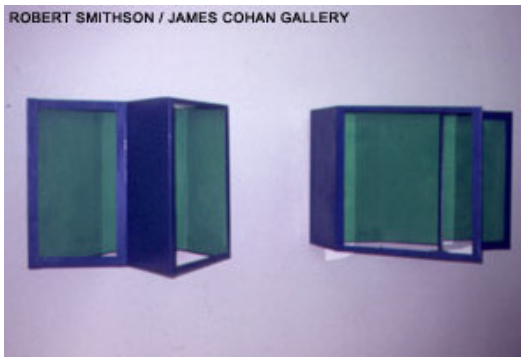
The division of *Huella y Horizonte*'s setup operates in a similar way. The setup is split into two symmetrical halves. The metal sheets on the right side are identical in size to their counterparts on the left (1=2 and 3=4, see figure 7). Similarly, the distance from the central axis is identical between these pairs of metal sheets. This particular symmetry produces a comparable effect to that of Smithson's enantiomorphic works, suggesting a stereoscopic visual perception of the piece's spatial organisation.

Figure 13: setup sketches of *Huella y Horizonte,* indicating the distances between the lateral metal sheets (sketches by the composer)
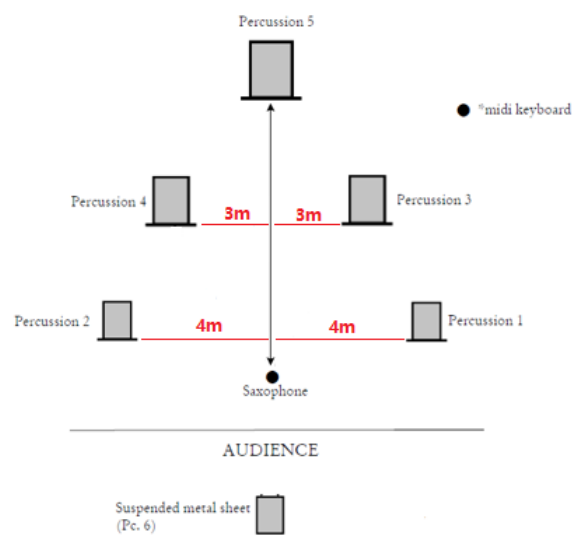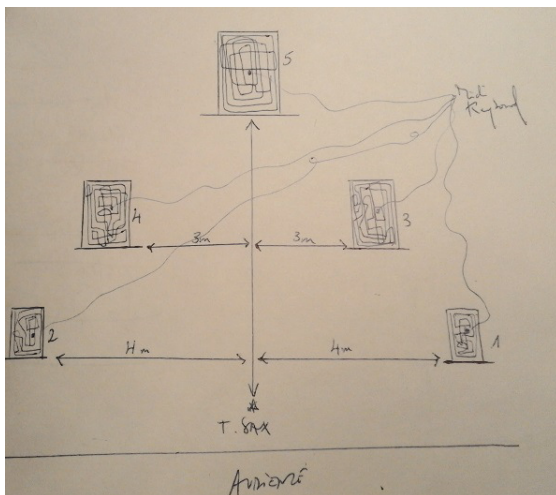
This is especially obvious in passages where the lateral metal sheets (the ones located on the right and left sides of the setup's triangle) interact with their identical counterparts on the opposite side, or when the four lateral sheets are manipulated at the same time. This usually coincides with a simultaneous process of stereophony, which is created by the use of identical audio samples played through transducers speakers fixed to the sheets' surfaces. The concurrent use of stereophonic and stereoscopic effects is particularly effective in creating a feeling of duplication. This convergence

helps to create mirror-like relationships on the stage and obliterates a feeling of visual and aural centrality. Additionally, the potential number of observable vanishing points increases, generating an impression of multiplicity and displacement. On some occasions, the bending actions applied to the lateral metal sheets are coincident (see figure 14), enhancing an even clearer feeling of stereoscopy and a concomitant stereophonic result. In other cases (see figure 15), the bending processes between the metal sheets are slightly different, allowing microscopic differences in the sonic outcome and the observable structure of changing arches generated by the performers' actions. Nevertheless, their identification as doubles is emphasized by the use of identical audio files and the imitative, quasi-canonic treatment of the bending movements.

Figure 14: bars 394-397, percussion3 & percussion4
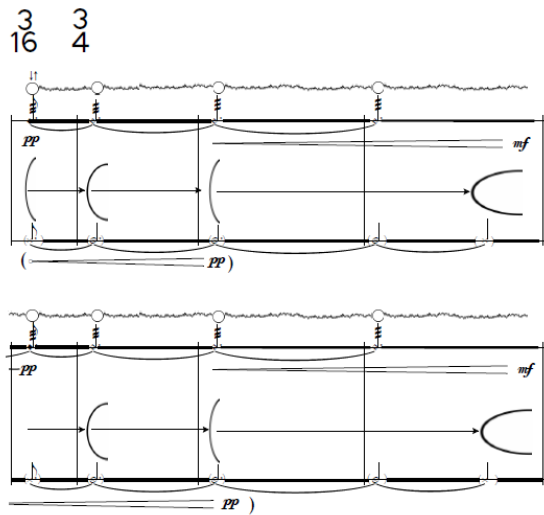
Figure 15: bars 274-279
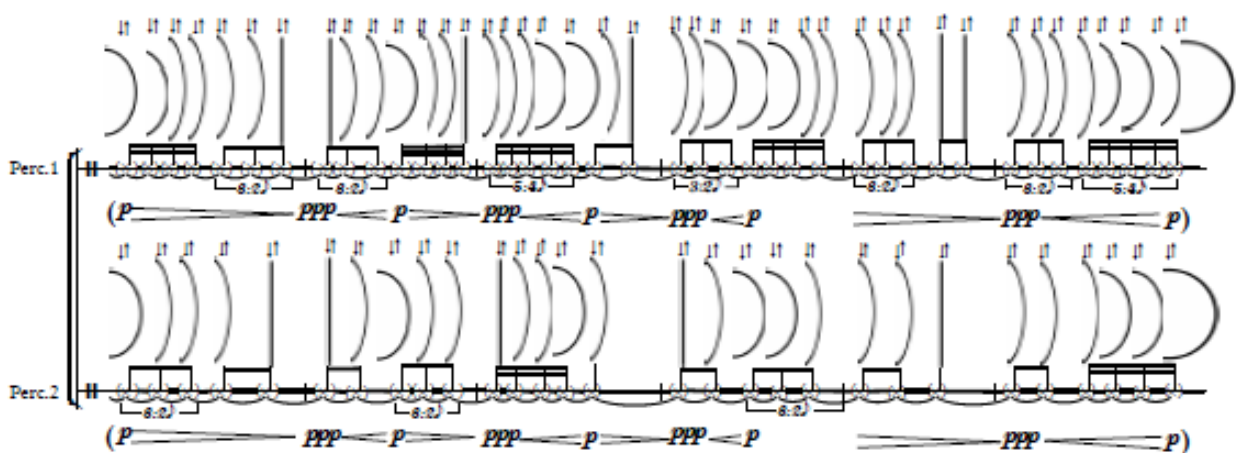
From a visual perspective, the role of the saxophonist in this work is defined by a sense of disconnection and disengagement from the audience. Due to his/her position with their back to the audience, his/her performative gestures and expressive features are never clearly observable. This

produces an explicit visual and communicational detachment from the listener. This is also corroborated by the instrument's sound projection, always oriented towards the rear of the hall. The saxophonist's position is also conditioned by the semi-elliptical metal-sheet-setup, which "reflects" the instrument's sound and directs it towards the audience. The lack of visibility of the instrumentalist's face and actions creates an impression of depersonalisation. The performer is dissociated from any clear gestural or interpretative connotations; he/she is somehow objectified. This allows the audience to concentrate almost exclusively on the instrument's sonic identity.

Additionally, and returning to Smithson's *Mirror Displacements,* the saxophone's sound operates as a tool for suggesting spatial displacements. The pre-recorded materials are sonically transferred to the surface of the metal sheets and, as a consequence, distributed across the performance space. This outlines a network of sonic reflections, which is rarely confirmed by the visible presence of the actual instrument. The sound of the saxophone also becomes the generator of an auditory framework that is often discontinued and interrupted by the action of the metal sheets. In fact, the work's title, *Huella y Horizonte* (literally *Footprint & Horizon*), makes reference to the notion of spatial and sonic discontinuity often explored in the piece. The horizon could be metaphorically associated with the role of the saxophone (its sound projected towards the rear, towards the "horizon line" of the stage) while the metal sheets operate, from an allegorical point of view, as footprints on the landscape, as visual and aural discontinuities within the performance space.

3.1.3) *Isla y Continente*: **portals, imperceptible asymmetries and Tarkovsky's** *Mirror*

My work *Isla y Continente* (2015) addresses, to a considerable extent, similar issues to those explored in *Huella y Horizonte.* This work, scored for two large metal sheets with transducers fixed to their surface, explores architectural, gestural and acoustic duplication by the use of an extremely austere instrumental setup. The metal sheets are handled in several ways: bending them to various levels of curvature, applying different beaters and resonators to their surface, etc. The sound produced by the transducers is conditioned, modulated by the acoustic properties of the metal sheets once they are manipulated. Again, these operate as sonic screens, as distorting surfaces capable of altering the nature of the original materials played through the transducers to a considerable extent.

A single common audio sample is played simultaneously by the two transducers. This sample consists of a 13-minute long sine wave that slowly delineates a melodic line (an unrecognisable, greatly stretched quotation from Guillaume de Machaut's ballade *Tres douce dame que j'aour*). This melodic line is also recreated by the use of 10 bowed microtonally tuned tuning forks, fixed to the upper side of the sheets. These are also acoustically conditioned by the different bending positions applied to the metal sheets. In this particular work, the issue of mirroring is challenged by the absence of a referential instrument, a sonic "signifier" such as the saxophone in *Huella y Horizonte*. The materials projected onto the metal sheets are not identifiable; there are no references to an observable instrument or concrete source. The single audio file—transmitted simultaneously to the two sheets' surfaces—is perceived as a somewhat extraneous acousmatic source.

The simplicity of this work's setup is, however, particularly effective for the observation of the different bending positions applied to the sheets. This often implies the creation of mirror-like architectural relationships: concurrent (or quasi-concurrent) delineation of duplicated curves, planes and arches.

Figure 16: *Isla y Continente*'s setup (sketch by the composer)
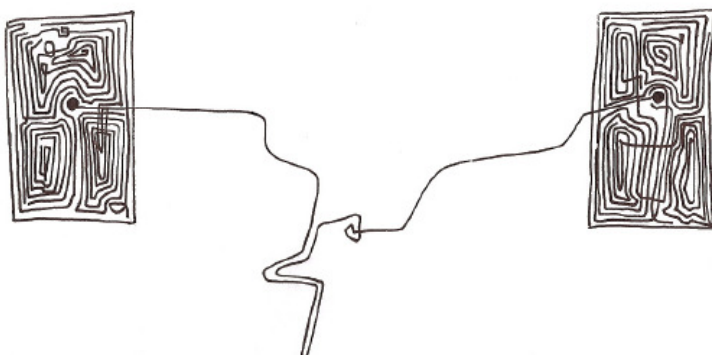
This context of changing configurations is often intended to create visual analogies and mirrored structures on the stage. The malleability of the metal sheets allows a direct and observable imprint of physical gestures onto their surface. As a result, these gestures have a direct effect on the alteration and modulation of the sound produced by the transducers. This particular setup suggests, in a much more evident way than *Huella y Horizonte*, a conjunction between stereoscopic and stereophonic effects, which is also easily observable in the score due to the graphic notation used to symbolize the specific degrees of curvature and other techniques.

Figure 17: *Isla y Continente,* bars *27-32*. Simultaneous and imitative bending processes applied to the metal sheets.

In this work, the issue of distance and visibility is particularly important. Ideally, the piece should be "seen"—experienced live or as a video recording—to fully appreciate the spatial and sonic interactions established between the two metal sheets. These should be placed as far as possible from each other, but allowing visual communication between the performers. The distance between the sheets is consequently variable, depending on the specific conditions and features of the space in which the work is performed. As a result, the amount of separation left between the metal sheets (and the position of the audience in relation to the stage) conditions, to a large extent, the visual experience and general reception of the piece. Either an "enantiomorphic" vision of the two metal sheets is suggested or, if these are greatly separated (in such a way that a general view of the setup becomes impossible), a more focalized yet potentially shifting process of observation is naturally expected. This visual shift from one metal sheet to the other implies a certain disruption in the work's general perception: the sense of symmetry generated by identical and simultaneous (and/or slightly desynchronized) bending processes is only comprehensible if both metal sheets are observed at the same time. This phenomenon, however, is contested by the stereophonic nature of the piece (the transducer speakers always play the same audio file even if the techniques or bending

positions applied to the sheets are not always entirely coincident). As such, the listening process consolidates the general experience of the piece, while the absence of a simultaneous visual "confirmation" of the two sheets may generate a feeling of discontinuity. Thus, the audio-visual experience of the piece is entirely dependent upon the (potentially mutable) distance established between the two metal sheets.

Hypothetically, this issue could be counteracted by the use of video during the work's performance. If the image of each of the two players were recorded and simultaneously projected onto the same screen, the sense of physical distance would immediately disappear. In such a way, the process of gestural duplication would be visually highlighted while the impression of acoustic spatialisation would remain intact. This possibility will certainly be explored in future performances.

In *Isla y Continente*, the absence of an observable object of reflection reformulates the sheets' mirroring function. They no longer operate as mere reflecting surfaces, as distorting sonic mirrors, but rather as portals or windows to an alternative space and sonic realm. The sound projected on the metal sheets (an undulating sine wave) exists as an unattainable object, which is only accessible through the sheets' flexible and modulating surfaces. In a Foucaultian sense, the two metal sheets operate as heterotopian devices, as openings or orifices in the continuum of space. In this regard, I was particularly interested in Andrei Tarkovsky's usage of mirrors and reflections in some of his films. In *Mirror* (1975), this object can be regarded as a gateway to alternative spaces and times, occasionally related to the characters' existential dimension. Mirrors operate as access points to one's inner space, dreams and memories. Usually, they are used to produce an impression of fragmentation and spatial/temporal discontinuity in the film's narrative. They become objects of spatio-temporal dislocation. As Skakov observes:

> […] mirrors and reflections do not perform the function of spatio-temporal 'stabilizers' in *Mirror*. On the contrary, they seem to displace, disorientate and confuse the notions of space and time. (2012, p.104)

The use of metal sheets in my work responds to somewhat analogous principles. The audio file played by the transducer speakers suggests an alternative, parallel sonic realm. In this regard, the quotation of Machaut's ballade is not literal but responds to my personal recollection of the melody (the original score was never consulted for the elaboration of this sine wave). Memory operates as a filter of the original material, which in turn is filtered by the acoustic properties of the metal sheets. The metal sheets operate as gateways, as distorting points of access to the underlying melodic material.

Interestingly, in *Mirror,* Tarkovsky utilizes different kinds of mirrors, defined by various sizes and degrees of definition, reflectivity and convexity. These produce reflections of different qualities, operating as filters of the mirrored images.

> There are multiple mirrors that produce different types of reflection with different textures […] In some scenes, mirroring surfaces are not crystal-clear, and the reflected images they produce are blurred or distorted […] Water, dust or refractions of light undermine the linearity of reflections, and the characters must confront slightly disfigured versions of their own appearance. In other scenes, the camera reveals the presence of a mirror in a shot (either by focusing on its surface instead of on a mirrored image or by showing a mirror with the boundaries of its frame); but then the reflected images start to dominate the screen and appear not to be reflections but fragments of filmed reality (the camera changes its focus from the mirror's surface to the image, or it zooms in and 'hides' the mirror's frame). (Skakov, 2012, p.104-105)

Similarly, in *Isla y Continente*, the different techniques and degrees of bending applied to the metal sheets operate as filters of the materials played through the transducer speakers. Different resonators (bows, superballs, coffee cups) are applied to the surface of the sheets, generating unconventional effects that will be thoroughly examined in section 4.2. The bending processes, however, are particularly significant for the delineation of architectural relationships between the two metal sheets. Several degrees of concavity/convexity are explored in this piece, all of them producing different acoustic effects (distinct overtones are excited depending on the level of curvature of the sheets and the specific pitch played through the transducer speakers). These observable bending levels also appear in other pieces where the metal sheets are utilized (e.g. *Huella y Horizonte* and/or *Gyre & Gimble*).

As Skakov mentions in the last lines of the previous citation, Tarkovsky's process of zooming in and out of the mirror is used to create a feeling of ambiguity between reality and reflected reality, between real and parallel spaces. Tarkovsky deliberately plays with the presence or absence of the mirror's frame to generate an impression of uncertainty between the inside and the outside. Simultaneously, the process of zooming in on a particular thing often results in a less recognizable version of the thing itself, depending on the angle of the camera and the distance from the object (a technique often utilized by Tarkovsky to reformulate or decontextualize the function and appearance of particular objects). The process of zooming in and out may be compared to the actual bending movements applied to the metal sheets. The vertical position signifies a framed mirror: the sonic materials projected through the transducers are hardly acoustically modified by the actual sheet. In this case, the sheet's role is purely reflective. However, once the degree of bending increases, the metal sheet's overtone structure becomes gradually more compressed. This produces an increasing distorting effect on the materials projected through the transducer speakers, which are

filtered through a progressively narrower overtone spectrum. Occasionally, the original materials are hardly recognisable as a result of the high degree of curvature applied to the metal sheets. This bending motion could be compared to the gradual process of zooming in with a camera, to the point at which the object of focus is no longer recognizable due to the process of optical magnification. An additional property of the metal sheets is their reversibility: they can be bent forwards and backwards with regard to the vertical axis. This implies that all of the possible positions and curvature degrees applicable to the sheet in one direction can be equally performed in the opposite direction. This increases the number of possible interactions and spatial relationships between the two metal sheets.

Figure 18: notation of metal sheet bending degrees (with the metal sheet's vertex pointing away from the performer)

= straight (180°) = small curvature (around 160°) = moderate (around 130°) = large (around 100°) = extreme (less than 90°)
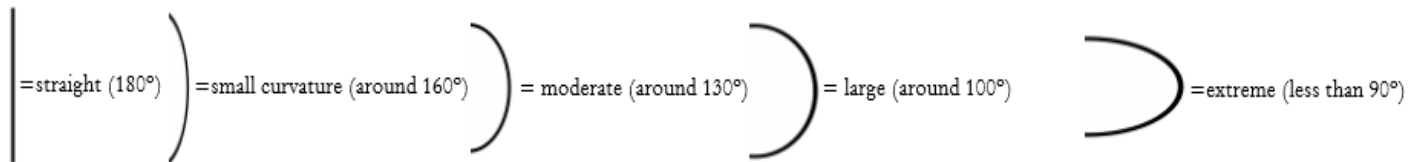
Figure 19: notation of metal sheet bending degrees (with the metal sheet's vertex pointing towards the performer)

Three different bending strategies are used to generate mirror-like, symmetrical and asymmetrical structures between the metal sheets. The first is based on a purely imitative process (the metal sheets are curved to the same degrees following a canonic or successive structure). The second strategy is also based on imitative processes (the sheets reach identical curvature degrees) but these are performed in opposite directions, either towards the performer or away from him/her. This outlines symmetrical, reverse spatial relationships. The third possibility is defined by the use of non-coincident bending positions, creating a sense of asymmetry between the two metal sheets.

Figure 20: *Isla y Continente*, bars 1-7. Contrary bending motion.

Figure 21: *Isla y Continente*, bars 104-112. Asymmetrical configuration of bending positions

The processes of bending applied to the metal sheets are often organised according to imitational or quasi-canonic procedures. With the exception of the passages in which completely asymmetrical relationships are delineated, the rest of the work explores symmetrical structures in a slightly temporally desynchronised fashion, implementing minimal temporal gaps between the crystallisation of identical positions. This lack of simultaneity aims to create a feeling of deviation from a perfect form of symmetry, a certain misalignment that breaks the linearity of the mirror-like processes. The lack of simultaneity between the parallel bending motions generates an impression of imperfect symmetry, a certain irregularity in the outline of mirrored arches and planes. In this regard, Morton Feldman's description of Anatolian rugs is particularly appropriate: the configuration of symmetries is neither exact nor predictable. Small irregularities in the rug's patterns create observable variations that do not obliterate the general perception of symmetry.

In Anatolian village and nomadic rugs there appear to be considerably less concern with the exact accuracy of the mirror image than in most other rug-producing areas. The detail of an Anatolian symmetrical image was never mechanical, as I had expected, but idiomatically drawn. Even the classical Turkish carpet was not as particular with perfect border solutions as was its Persian counterpart. (Feldman, 2000, p.134)

From a comparative point of view, the way in which symmetry is produced in these rugs is similar to the configuration of mirror-like structures in *Isla y Continente*. The two halves of the rugs may be symmetrical in shape but not in colour or texture, depending on the particular process of weaving and pattern design. Likewise, in my work, the processes in which identical shapes are reached by the two metal sheets are often slightly divergent, unaligned and desynchronised. A general impression of symmetry is, however, always preserved. This may be explained by our sense of peripheral vision when applied to bilateral symmetry. As Cucker points out:

1. We rarely notice minor deviations from symmetry.
2. There are a number of elementary feelings associated with the various forms of symmetry which are perceived by the observer even in the presence of deviations, as long as these are noticed as such.
3. Artists made (and still make) use of the fact that these feelings are perceived by the observer even in the presence of noticeable deviations from strict symmetry to convey them without fully subjecting to the boredom of an excessive order.
(2013, p.129)

From a perceptual point of view, a sense of symmetry is also generally imposed onto non-symmetrical patterns. Perhaps this is a result of acquired tendencies related to the observation of the surrounding environment.

There are still many mysteries of right and left, on the large scale of the structure of the universe, on the small scale of elementary particles, and at all levels in between. Rotational symmetry is found almost everywhere, often combined harmoniously with reflection. We find it in snowflakes, domes, flowers, stained glass windows and pottery. This relation between symmetry and art is more than just pleasing to the eye: it reinforces our tendency to look for symmetry, and even to find it, where it does not belong and may not exist. (Hargittai, 1989, p.4)

Interestingly, the use of asymmetrical bending processes in my work responds to this apparent paradox: the artificial construction of a sense of symmetry in contexts where it does not really happen. In this respect, *Isla y Continente* fluctuates between the clear suggestion of mirroring structures (even if slightly unaligned and non-synchronised) and passages where asymmetrical structures take shape but symmetry is artificially constructed by our own perceptual mechanisms.

Thus, due to their ductility and flexibility, the metal sheets are particularly appropriate devices for the observation of these bending processes. The issue of distance between the two metal sheets, as mentioned before, adds a supplementary layer of complexity to the piece's spatial domain, determining an either global or more confined visual reception of the work.

3.1.4) *Piel y Distancia*: still lifes, presences and absences

My work *Piel y Distancia* (2015-2016) explores the issue of duplication from a different angle. This piece is, to a certain extent, more closely related to some of the aspects investigated in *I reached A through the throng through the threshold through the throb.* This composition operates as a reformulation of a string quartet, exploring different levels of interaction between standard playing and the use of acousmatic and mixed media.

Figure 22: setup of *Piel y Distancia* (graph by the composer)
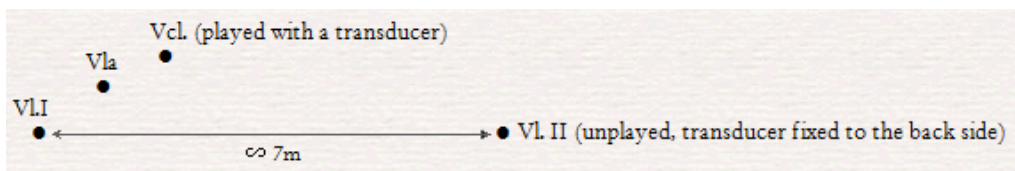
This unorthodox string quartet attempts to investigate all the transitional degrees between standard performance and an installation. In this regard, the first violinist and the violist perform their instruments in a conventional way while the cellist substitutes the bow for a small transducer throughout the entire piece. This transducer plays audio samples based on recordings of the violoncello's sound, which are triggered from an invisible MIDI controller keyboard during the performance. These audio samples, transmitted through the transducer onto the violoncello's strings and sound board, are acoustically modified by the friction and the directionality of the rubbing motions carried out by the cellist. As a consequence, the violoncello is reinvented by the saturation of its own sonic identity. This instrument operates as a distorting self-referential mirror: its sound is reflected and transformed by its own strings and acoustic physiognomy. The second violin, however, is only utilised as a sound box and as a visual object (it is never played). A medium-sized transducer speaker is fixed to its back side. The specific acoustic features of the second violin's body shape the projection and propagation of the sonic materials played through the transducer. These materials consist exclusively of recordings of the 1st violin. Consequently, an impression of parallelism (both sonic and visual) is created between the first and the second violins, establishing auditory bridges between the original source and its "installational" counterpart.

Figure 23: *Piel y Distancia* (sketch by the composer)
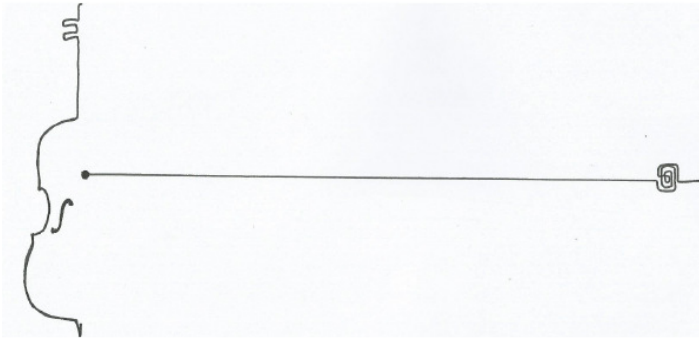
In general, the unplayed violin operates as a "still life version" of the first violin. It is only sonically excited at the end of the piece (from measure 215 until the very end). The use of this violin as a static sound box marks the end point of the gradual transition established between the first violin's and the viola's idiomatic universe and a fully installational realm (the violoncello operates as an intermediate instrument between the two domains). However, the role of this violin throughout the piece is fundamentally visual. Its presence underlines and puts a spotlight on the sense of instrumental duplication characteristic of a typical string quartet configuration. Thus, the establishment of visual and sonic analogies between the played violin and its unplayed counterpart reformulates the role of the instrument within the quartet and, as a consequence, interrogates the instrumentalist's function in this particular context. In this respect, the function of the unplayed violin is twofold: it operates as a sonic mirror and becomes a static double, a depersonalized version of its played counterpart.

The idea of creating "still life versions" of played instruments is not only related to the establishment of visual parallelisms and doubles on stage but also responds to a fascination for representation per se. Still lifes operate as representations of everyday objects that incorporate particular symbolic connotations but are usually free from any specific narrative. Interestingly, most historical pictorial still lifes depict objects that imply a segmented temporality (they operate as snapshots of a particular instant). This is expressed by the depiction of seasonal and perishable goods: specific flowers, fruits, game and fish. In Renaissance and Baroque still lifes, however, the continuity of time is often symbolized by musical instruments. Typically, the transient nature of music was allegorically associated with a linear flow of time.

In times when there was no method to store acoustically (not in the written form of a score) a musical performance, music would also exemplify something that dissolves in time without leaving behind any tangible trace of its existence [...] It should therefore not appear surprising to see the insertion of musical instruments in compositions of edible goods and flowers, as all these things together collaborate in creating a complex and multilayered description of the nature of time. (Marcolli, 2012, p.11)

Figure 24: Claesz, P. (1623). *Still Life with Musical Instruments* [Oil on canvas]. Retrieved from:
https://www.wikiart.org/en/pieter-claesz/still-life-with-musical-instruments-1623

From a metaphorical point of view, in *Piel y Distancia* the unplayed violin operates as a representation of its played counterpart, as an observable, frozen snapshot of its dynamic equivalent. Its role is not that of a symbolic signifier of time's fluidity. Contrarily, it operates as an indicator of material immanence in opposition to the transient character of music. The static quality of the violin acts as a counterpoint to performative dynamism and emphasizes the instrument's intrinsic visual and acoustic materiality.

Another interesting aspect of still lifes is defined by their relationship to the observer. Since still lifes are usually devoid of human figures and specific narrative connotations, they allow particularly flexible and unconditioned interpretations from the spectator.

> The viewer of still life enters a peculiar realm – possibly invited to take an intimate glimpse at the interior life of an imagined other, or even to become a welcomed subject within the liminality of the work itself. (Lynn Haggart, 2010, p.4)

In this sense, the function of still lifes is to "present" an object rather than to "represent" it (Bryson, 1990, p.79). This presupposes a lesser degree of mimesis (as implied by representation) and increases the number of potential possible interpretations from the observer's position. Since still lifes lack any concrete narrative and/or anthropocentric subject matters, their interpretation is less conditioned, suggesting a great number of possible meaning ramifications.

From a metaphorical point of view, *Piel y Distancia* displays a similar phenomenon. The unplayed violin becomes the subject of multiple potential interpretations. This is particularly evident when it comes to its functionality: does it operate as a mirror, as a resonant body, as a visual reference, as the signifier of an absent performer, as a joke? This multiplicity of possible readings is, however, absent in the case of the played violin. The musician resignifies the role of the violin, transforming it into a conventional musical instrument. This is obviously conditioned by all the historical, gestural and musical connotations embedded in standard performance practice. As in the case of still lifes, the absence or presence of human activity completely conditions the functionality

and possible interpretation of everyday objects. Hence, when they are placed within an anthropocentric context, they are immediately reified and acquire a specific signification and functionality. To a certain extent, *Piel y Distancia* explores the tension between these two realms: still lifes and performative contexts, installations and music execution.

As in *Isla y Continente*, the issue of distance is particularly relevant for the spatial configuration of *Piel y Distancia*. In a descriptive fashion, the work's title (literally *Skin and Distance*) makes reference to two different aspects of the piece's nature. The word *skin* alludes to the process of friction established between the transducer speaker and the violoncello's strings and sound board. This instrument is regarded as a skin, as a surface that is sonically activated through a process of friction. The transducer speaker is used to explore the geography of the instrument through a process that resembles the tactile process of palpating and rubbing the skin. The word *distance* refers both to the physical separation established between the second violin (non-played) and the rest of the ensemble and, more conceptually, to the gap created between an eminently performative universe and an installational realm. Tangentially, it also alludes to the sense of sonic displacement that is established between the two violins, a process of reflections based on the first violin's pre-recorded sound.

In this work, the distance established between the two violins operates in a different manner. In *Isla y Continente* the separation between the two metal sheets set the limits of a general versus a more localized reception of the process of duplication. This creates different levels of perception depending on the particular distance established between the sheets. Thus, the observability of the simultaneous actions and the coincident bending changes is fully conditioned by the sheets' separation. In *Piel y Distancia* the issue of gesture, of changing observable positions is irrelevant due to the static nature of the non-played violin. Therefore, the visual reference established between the two violins is not dynamic—it is not based on a symmetrical and corresponding set of gestures but on the mere presence of the actual instruments. In this particular case, the feeling of simultaneity (which was achieved through the coordinated manipulation of the metal sheets, by the parallel display of arches and planes in *Isla y Continente*) is only suggested by sound, by the concurrence of identical played and pre-recorded materials. Interestingly, in most cases, the issue of simultaneity is inherently related to distance. Unavoidably, the identification of two independent events requires a degree of separation, a spatial interval. Otherwise, these two events would be perceived as one, as a single occurrence:

We shall distinguish between the *simultaneity at the same place* and *the simultaneity of spatially separated events.* Only the latter contains the actual problem of simultaneity; the first is strictly speaking not a simultaneity of time points, but an *identity.* Such a concurrence of events at the same place and at the same

time is called a *coincidence.* In a strict coincidence there is actually no comparison of space or time since position and time are identical for both events. Practically speaking, such an identity never occurs since we could no longer distinguish the two events. But an approximate coincidence can be realized […] (Reichenbach, 2003, p.124)

This impression of simultaneity transcends the actual presence of identical instruments. The lack of observable gestural correspondences requires the presence of sonic analogies in order to reinforce the sense of simultaneity and spatial duplication. Additionally, as already insinuated in the description of still lifes, the feeling of distance underlines the insular character of the non-played violin. This instrument operates as an inanimate representation of its played counterpart and, concurrently, as the ensemble's immobile satellite or appendix. Consequently, this insularity stresses the absence of a performer: the instrument acquires a new signification, a new functionality as a static, yet representative object. Additionally, from an alternative point of view, it may be argued that the presence of a "virtual" or a "ghostly" performer is constantly (and unavoidably) suggested by the violin's own historical and interpretative implications, by its association to a functional context of performance and a tradition of musical practice. In other words, the performer's presence is somehow suggested by his/her very absence. This borderline feeling between presence and absence may respond to an anthropocentric perception of the surrounding space, of the objects that define and describe it, their connotation, functionality and relationship to human experience.

Things are not outside of us, in measurable external space, like neutral objects (ob-jecta) of use and exchange; rather, they open to us the original place solely from which the experience of measurable external space becomes possible. They are therefore held and comprehended from the outset in the *topos outopos* (placeless place, no-place place) in which our experience of being-in-the-world is situated. The question "where is the thing", is inseparable from the question "where is the human?" (Agamben, 1993, p.59)

In contemporary theatre and performance, the absence of the performer often responds to a critique of anthropocentrism, usually inspired by posthumanist theories. For me, the disappearance of the performer induces, in a self-contradictory and enigmatic way, his/her metaphorical presence, a ghostly, invisible manifestation. The use of the unplayed violin in my piece is not conceived in any way as a critical reaction towards anthropocentric interpretations but stems from a fascination for the ambiguous relationship between presence and absence. Accordingly, this work demarcates the tension between these two states in a rather straightforward manner: by the delineation of a clearly observable distance between the performative realm (1st violin, viola and violoncello) and the static domain (unplayed violin). These two opposite universes are only occasionally linked by the use of sound reflections. This process adds more complexity to the interaction between levels of human presence and absence in my work.

Interestingly, from a perspective of language, Derrida questions the general view of an absolute presence and an absolute absence. In fact, absent things may leave "traces" of their presence, and things may be present while partially absent. For Derrida, the term *trace* indicates the mark of the "absence of a presence, an always already absent presence" (Derrida & Spivak, 1976). Similarly, in my work, the setup's actual configuration is particularly indicative of these *traces,* these non-present presences. This work was originally conceived and written for a string quartet (not a string trio with an additional resonant violin). Thus, the presence of only three instrumentalists inevitably implies the absence of the second violinist, necessary to complete the quartet's standard setup. This absence is somewhat counteracted by the presence of the unplayed violin in a distant location, functioning as an almost symbolic object. This instrument implies once more, the *trace* of a non-present performer, which is suggested by its own process of objectification, static/depersonalized nature and by the use of pre-recorded materials. In general, a sense of incompleteness and sonic displacement prevails throughout the piece, which adds to this particular tension between presence and absence.

3.1.5) *Gyre and Gimble:* displacements through the looking glass

My large music theatre work *Gyre and Gimble* (2016) investigates, once again, the delineation of acoustic and visual mirrors on the stage as well as the creation of hybrid acoustic realms. This work is composed for a large ensemble of singers (four soloists plus a small choir), four percussionists, strings and a number of small installations defined by a number of prepared air fans and unplayed instruments: tam-tam, various metal sheets, grand piano and several membraphones. These instruments are always sonically excited by transducer speakers. *Gyre and Gimble* explores, in a perhaps more comprehensive and multifaceted way than the previous examples, the Foucaultian sense of confluence between utopian and heterotopian realms; the creation of sonic mirrors that reflect and displace the identity of the singers' voices (transferred through transducer speakers to the surface of different instruments and objects).

Figure 25: sketch of *Gyre and Gimble* (drawing by the composer)
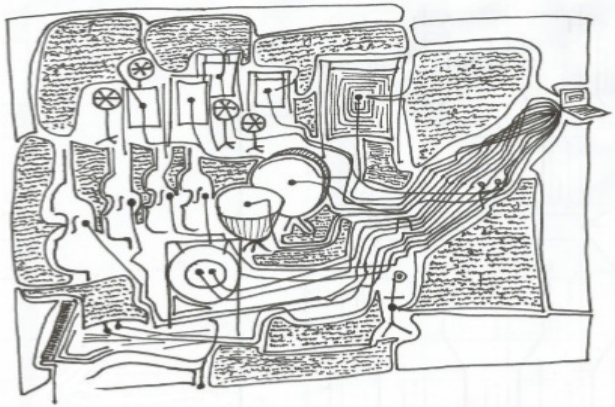
This work is inspired by one of the first scenes of Lewis Carroll's *Through the Looking-Glass*. The providential moment in which Alice crosses the mirror is re-enacted in this piece by the assignment of four differentiated musical, spatial and psychological profiles to the main vocal soloists. These singers operate as metaphorical "Alices", observing and commenting on the contexts and situations they are involved in. This particular passage of Lewis Carroll's book was particularly inspiring for the spatial configuration of *Gyre and Gimble.* Alice does not only cross the looking glass but notices that

> [...] what could be seen from the old room was quite common and uninteresting, but that all the rest was as different as possible (Carroll, 2015, p.106)

This little observation implies a feeling of broken symmetry. The interior of the mirror reflects the room that Alice has just left. Gradually, however, the observable analogies, the original impression of spatial parallelism starts to fade, determining an alternative universe with a different set of rules and logic. For the conception of *Gyre and Gimble* I was particularly interested in Alice's initial moment of spatial awareness. The mirror becomes a fluid membrane, a place that can be accessed and exited, blurring the limits between the reflecting surface and the reflected object. In this regard, the mirror does not only become an object for visual multiplication but it is transformed into a multidirectional gateway, a flexible surface that impedes a clear sense of location and orientation. This is beautifully described by Deleuze in the *Logic of Sense*:

> Alice, from her height, apprehends the mirror as pure surface, a continuity of the outside and the inside, of above and below, of reverse and right sides" (2004, p.272)

In this piece, I decided to create four versions of Alice according to her position in relation to a virtual mirror. Each of the singers (soprano, mezzo-soprano, tenor and baritone) inhabits a particular region of the stage (or moves between them). These regions are located on either side of this metaphorical looking glass and have an effect in the singing techniques and particular psychological profile of the different versions of Alice. Along these lines, the soprano embarks on a long journey into the mirror, crossing the entire stage and stopping in several islands along the way (the journey lasts for the entire duration of the piece). This singer almost never sings. She operates as a "voice thief": a loudspeaker hidden among her clothes plays the distorted recordings of her fellow singers while she silently emulates their speech and singing articulation. Eventually, at the very end of her journey across the stage, she finds her voice and indulges in about 12 seconds of solo singing. The mezzo-soprano inhabits both the outside and the inside of the mirror. She constantly crosses the invisible membrane that separates the two realms. This is represented by a change in the treatment of her voice: inside the mirror she sings/speaks into a bowl of water through a long plastic tube but she returns to standard singing/speaking once she goes back to the other side. This singer is constantly assessing the fragility of memory, represented by the time inversions and discontinuities that take place inside the looking glass. The tenor remains permanently outside the mirror, pondering what the other side would look like. He typically sings into a corrugated plastic tube that ends in the interior of a wedged grand piano (thus benefiting from the natural resonance of the instrument and creating an artificial feeling of acoustic dislocation). This corrugated tube, wrapped around his body, prevents him from reaching the other side of the mirror. Like the mezzo, he also occasionally sings/speaks into a bowl with water through a long plastic tube. Contrarily, the baritone inhabits the space inside the looking glass, examining the paradoxical differences between

the exterior and interior of the mirror. He is located among a "garden" of objects, an installation consisting of prepared air fans and several percussion instruments with transducer speakers fixed to their surface.

Figure 26: setup of *Gyre and Gimble* (graph by the composer)
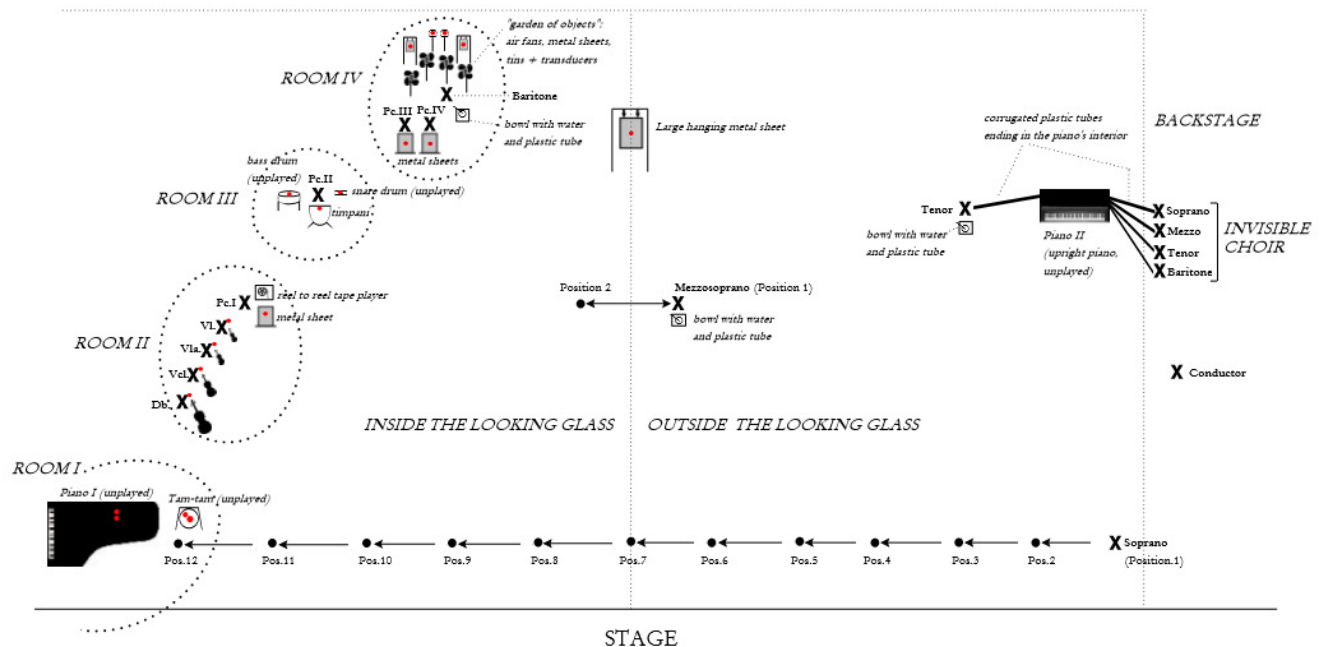
The space located behind the hypothetical looking glass is divided into four rooms. Each of these rooms is defined by different installations and small ensembles of musicians. Each room relates directly to the voice of each singer. These voices are projected onto the surfaces and sound boxes of the instruments through transducer speakers.

Room I is defined by the presence of an unplayed piano (with transducers fixed to the lower strings) and a large tam-tam (with a transducer fixed to its surface). This parallel room "reflects" the voice of all the singers and signals the soprano's final destination.

Room II is characterised by a small ensemble of string players (mostly performing with transducers instead of bows) and a percussion player (using a metal sheet with an affixed transducer and a reel-to-reel tape player). This room is associated with the voice of the mezzo-soprano. Sonic hybrids are determined between her voice and the acoustic identity of the instruments of the ensemble.

Room III, associated with the tenor's voice, is defined by a small collection of membraphones (snare drum, bass drum, timpani) with transducers fixed to their drumheads. One large timpani (C1-A1) is performed by a single percussionist; its pedal used as a filter or modulator for the materials projected through the transducer.

Room IV, related to the baritone, consists of a small garden of objects (metal tins and plates with attached transducers, prepared air fans) and a couple of percussionists playing metal sheets (also with affixed transducers). All the audio samples, which consist exclusively of recordings of the main singers speaking and singing, are triggered from an invisible MIDI controller keyboard. Additionally, a lateral choir (mirroring the main cast of singers on the stage) operates as a utopian, unreachable collective voice. Like the tenor, the singers of this choir sing into long corrugated tubes that end in the piano's interior.

The design of four different rooms responds, to a certain extent, to the initial scene of *Through the Looking-Glass.* Each singer, embodying a different version of Alice, is associated with a potential room behind the mirror. Here, as opposed to some of the previous works, the sense of reflection is not based on the creation of identical setups (still life-like representations) but it is mainly suggested by sound. The singers' pre-recorded voices are reflected on the specific instruments of each particular room. These are sonically excited by the pre-recorded vocal materials, which simultaneously define the specific sonic nature of each room and demarcate a particular acoustic territory. Metaphorically, in *Gyre and Gimble,* the object of reflection is no longer a drawing room but the singers' own voices. By extension, one could argue that it is in fact their vocal identity that activates and signifies each particular space. Additionally, the objects within each room operate as filters and modifiers of the projected voices, distorting to different degrees their original sonic nature. This may be compared with Alice's initial description of the room behind the mirror: a space in which the reflected elements start to lose their original aspect and identity, and in which irregularities and discontinuities start to alter the impression of similarity and correspondence between the two parallel rooms.

> For instance, the pictures on the wall next the fire seemed to be all alive and the very clock on the chimney-piece (you know you can only see the back of it in the Looking-glass) had got the face of a little old man. (Carroll, 2015, p.106)

Throughout the piece, the singers constantly look for their identity, for their genuine voice (which is often filtered, displaced and altered to an unrecognizable level). They often behave as lost, disoriented and perplexed individuals, unaware of their position in relation to the mirror: are they outside, inside or exactly on the line of demarcation between two sides of the looking glass? This is particularly evident in the case of the two singers who roam between different positions (soprano & mezzo soprano), suggesting, in an ambiguous way, different potential crossing points between the two sides of this virtual mirror, different gateways through this figurative dividing membrane. These "Alices" may be regarded as stage wanderers, as erratic explorers of the surrounding

territory. This sense of geographical unawareness, disorientation and displacement is observable everywhere in *Through the Looking-Glass*. Alice is not only the subject of drastic geographical dislocation, perspective shifts and size alterations. She simultaneously becomes a signifier of the spaces she goes through, of their specific behaviours and characteristics. In other words: she defines the nature of space itself.

> [...] Alice progressively conquers surfaces. She rises or returns to the surface. She creates surfaces. Movements of penetration and burying give way to light lateral movements of sliding. (Deleuze, 1998, p.21)

As discussed above, each specific room on the stage is sonically related to the voice of an individual singer. Ideally, these rooms should function as independent, self-contained units within the stage, creating a certain feeling of discontinuity in the spatial realm. These rooms are also characterized by the families of instruments and objects that populate them: membraphones, metal instruments, strings, resonating piano and tam-tam, etc. Apart from the sonic duplication established between the singers' voices and their corresponding rooms, there are a set of instruments that create particular symmetries and parallels between the extremes of the stage as well as within the specific rooms.

Figure 27: staging of *Gyre and Gimble*'s first performance. Ferienkurse für neue Musik Darmstadt (Staatstheater Darmstadt, 31-07-2016) (photograph by the composer)

The two grand pianos on the left and right sides of the stage create an impression of symmetry on the stage. In addition to establishing a visual analogy, these pianos play similar musical roles: they are conceived as amplifiers for the voice of the singers. This is achieved by utilizing the instruments' particular resonating properties (the sustain pedal is always kept down with a wooden wedge) and their internal geography (strings and metal plate). The piano situated on

the left of the stage amplifies the recordings projected onto its low strings through a couple of transducer speakers. The piano on the right side of the stage, however, amplifies the voices of several singers, "poured" into the circular holes of the internal metal plate through long corrugated tubes. The pianos become specific sonic containers in their own right, places of sonic displacement that often engage in quasi-antiphonal processes of sonic exchange. From a metaphorical point of view, they could also be considered mirrors. They reflect the voice of the main singers and the choir in different ways: acousmatically—through the use of transducers speakers—or by the direct physical projection of the singers' voices. They also add a sense of symmetry to the configuration of the stage. These instruments are particularly effective in creating a feeling of sonic dislocation and deterritorialization. There is a clear impression of topological displacement between the original sources and the pianos. These become "destination points" to which the voice of the singers is transported. This is particularly evident in the case of the piano on the right side of the stage: the corrugated tubes create an intricate network, a number of observable channels through which the voice is transmitted. This form of dislocation has resonance, to some degree, with Walter Benjamin's well-known notions of reproducibility of the work of art:

> Even the most perfect reproduction of a work of art is lacking in one element: its presence in time and space, its unique existence at the place where it happens to be […] the here and now of the original is the prerequisite to the concept of authenticity. (Benjamin, 2013, p.220)

In this context, the "original" (the singer's voice) is simultaneously present and displaced. Its source (the singer) is observable but the sonic result is transported, delocalized. In this respect, the pianos operate as apparatus of sonic dislocation. However, the work as a whole suggests a more ambiguous realm, where the relationship between the "original" (the voice of the singer) and its "reproducibility" (the process of sonic displacement and projections) is mostly explored in a simultaneous, concurrent fashion.

In this piece, some of the instruments (the two grand pianos, some of the drums, the tam-tam and the hanging metal sheets) function as installations, as inert objects sonically activated by transducer speakers. These installations, however, are not necessarily perceived as mere reproducers of the singers' voice. In fact, they operate as middle-ground, intermediate objects: they evidently display a referential character but, at the same time, create unique sonic and visual environments. In such a way, the different installations on the stage, even if they belong to a theatrical context, may be experienced as unique signifiers of space and time. This, returning to Benjamin, contradicts the notion of reproducibility, which is based on the possibility of iteration and the nullification of

"aura", the unique spatio-temporal presence of an artwork. In this sense, a parallelism could be drawn between these staged installations and other kinds of installational works.

> Installation art […] operates as a reversal of reproduction. The installation takes a copy out of an allegedly unmarked, open space of anonymous circulation and puts it –even if only temporarily-in a fixed, stable, closed context of a topologically well-defined "here and now" […] Artworks in an installation are originals for one simple topological reason: it is necessary to go to the installation to see them. (Enwezor, Condee & Smith, 2009, p.74)

One of these stage installations, situated in Room IV, consists of a large number of differently sized hanging metal sheets that, together with a set of prepared air fans, constitute a small garden of metallic objects. All of these sheets are individually excited by transducer speakers fixed to their surfaces. Three of the four percussionists physically manipulate metal sheets, which may be perceived as active prolongations of the actual installation. The manipulation of these metal sheets operates in a similar manner as in *Huella y Horizonte* and in *Piel y Distancia.* The percussionists outline parallel bending processes, generating symmetrical arches and planes. Simultaneously, a significant number of techniques are performed on the sheets' surface (bowing, rubbing different objects, etc.). Correspondingly, during the process of bending, the pre-recorded voices played through the transducer speakers are acoustically modified. The particular bending processes applied to the metal sheets are mirrored between the two percussionists in Room IV and the percussionist in Room II. This generates an immediate feeling of parallelism and visual correspondence between these two geographical points.

Figure 28: *Gyre and Gimble* (bars 223-228). Simultaneous and identical bending positions between metal sheets.
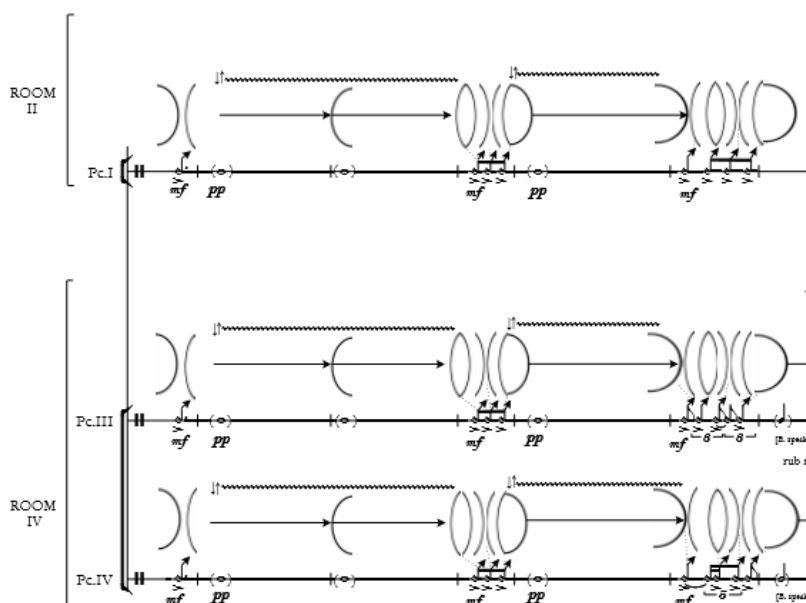
In room IV, the metal sheets are used both as static and as malleable objects. The played metal sheets engage in an imitational bending process while the hanging sheets remain immobile for the whole duration of the piece. Once again, the metal sheets operate as sonic mirrors: both as static and as flexible reflecting surfaces. The audio files played through the transducer speakers—mainly consisting of recordings of the baritone's voice—are identical between all the metal sheets and are, invariably, triggered simultaneously.

Returning to Lewis Carroll and to a more metaphorical realm, these metal sheets could be regarded as mirrors within the mirror, as potential gateways to a multiplicity of parallel spaces. Alternatively, since this collection of "mirrors" is intended to surround the baritone, they could be interpreted as corporeal extensions of the singer himself. In my original conception of the piece, both the baritone and the metal sheets were considered integral elements of the same indivisible installation. The singer's voice would be transmitted to the metal sheets demarcating a particular area, a particular territory on the stage. In this manner, the sheets could be regarded as continuations of the baritone's physiognomy, as extensions of his bodily presence and sonic identity.

The conception of this particular installation was influenced to a considerable extent, by Francis Bacon's pictorial representation of mirrors. Bacon utilizes mirrors as containers of figures and bodies. Mirrors do not always have a clear reflecting function—in fact many of them are intentionally non-reflecting. However, they are often used to encompass or enclose the body, either in its entirety or parts of it (face, limbs). In this respect, Bacon conceives mirrors as holders of matter rather than as reflecting surfaces. Occasionally, they operate as extenders of the body itself, generating an impression of material continuity between the body and its supposed reflection. The figures are simultaneously inside and outside the mirror; there is no physical distance, no material separation between figure and reflection: they are one and the same.

Figure 29: Bacon, F. (1976). *Figure writing reflected in mirror.* [Oil on canvas]. Retrieved from: http://andipa.com/artist/francis-bacon/figure-writing-reflected-mirror

Deleuze describes Bacon's mirrors as permeable spaces, as potential containers of figures

and bodies:

> Bacon's mirrors can be anything you like—except a reflecting surface. The mirror is an opaque and sometimes black thickness. Bacon does not experience the mirror in the same way as Lewis Carroll. The body enters the mirror and lodges itself inside it, itself and its shadows. Hence the fascination: nothing is behind the mirror, everything is inside it. (Deleuze, 2003, p.13)

In *Gyre and Gimble*, the role of the installation of metal sheets is clearly related to the encapsulating and corporeal nature of Bacon's mirrors. These metal sheets operate, in my eyes, as prolongations of the baritone's sonic and physical identity. They do not function as mere reflecting surfaces but as spaces of enclosure, as particular demarcations of the baritone's sonic identity. This feeling of physical interdependence and correlation between this singer and the surrounding installation is precisely generated by a sense of proximity, by the physical integration of the baritone within this specific realm.

A certain impression of duplication is also established in rooms II and III, in this case by the use of instruments from the same family (strings, drums). Room II is characterized by the presence of a string quartet (violin, viola, violoncello, double bass) and a percussionist. The string instruments are mostly played and sonically excited with transducer speakers. The transducers replace the bows and are rubbed on the strings and other areas of the instruments, determining, through the process of friction, sonic hybrids between the pre-recorded materials and the instruments. These recordings consist mainly of the mezzo-soprano's voice. Here, spatial duplication is suggested, not only by the physical similarities of the string instruments (in spite of the obvious difference in sizes) but also by the use of often imitative and coincident transducer-rubbing processes. This outlines similar, parallel trajectories and movements of the transducers on the fingerboards and bodies of the instruments (see figure 30). In this work, the geography of the string instruments (fingerboard, bridge, body) is conceived as a map, as a diagram on which the transducers are positioned. The transducers become signifiers of particular geographical points, which are sonically excited by the transmission of pre-recorded materials. When rubbed, these speakers move between concrete points of the instrument's geography, delineating routes and trajectories—e.g. linear movements between specific spots on individual strings, left-to-right and right-to-left rubbing motions on the bridge's wood, etc.

Figure 30: *Gyre and Gimble* (measures 95-105). Identical rubbing movements applied to different string instruments.

Interestingly, in some sections of the piece these rubbing motions are mirrored between the instruments, producing a feeling of symmetry and parallelism. These correlative rubbing processes produce quite distinct acoustic effects due to the instruments' differences in size and materials (string lengths, textures, densities, etc.). Nevertheless, the same gesture is often replicated and reproduced simultaneously by all the performers (this is once more related to Walter Benjamin's notion of "gesture quotability", see page 15). Thus, these string instruments do not only "reflect" the voice of the mezzo-soprano from an acoustic perspective but often engage in processes of gestural mirroring. The magnitude and intensity of this gesture increases according to the size of the instrument. In such a way, the double bass implies a much larger amount of spatial displacements, with larger distances between specific positions than the violin or the viola. This could be metaphorically regarded as a succession of magnifying mirrors, all of them displaying a progressively larger version of the same gestural structure. Subsequently, this effect of gradual magnification is enhanced by the position of the musicians on the stage: the double-bassist is located closer to the audience, then followed by the cellist, violist and, eventually, by the violinist. This generates a sense of gestural duplication "in perspective", as if the diminutive gestures applied to the violin's fingerboard and body were amplified by a series of consecutive magnifying lenses or mirrors.

Generally, from a perspective of linguistics, "quotable gestures" are directly associated with specific meanings. Quoted gestures are regarded as conveyors of a particular semantic content that is universally understood by the receptor (e.g. nodding and shaking our head, particular hand gestures, etc.)

In both their forms and their meanings, quotable gestures are as conventional as words and they can convey referential meanings that are as well defined as words. (Burlings, 2007, p.42)

Benjamin describes the phenomenon of gestural quotability in relation to epic theatre. For Benjamin, a sense of interruption is generated by the act of quoting as the context of a particular text is altered once it is displaced. Benjamin maintains that this is a particular feature of epic theatre and it is equally applicable to gesture. These gestures do not necessarily imply a particular symbolism or have universally understandable connotations but may refer to any specific scene or moment within the play. This adds structural cohesion to the actual play by means of repetition.

‘Making gestures quotable’ is one of the essential achievements of epic theatre. The actor must be able to space his gestures as the compositor produces spaced type. This effect can be achieved, for instance, by the actor on stage quoting a gesture of his own. (Benjamin, 1998, p.19)

In my work, this process of gestural quotation is related to the impression of visual perspective. The performative gesture is magnified the closer it gets to the audience (and so does the size of the instruments). Here, the use of gestural quotations is not temporal but spatial. The "compositor's spaced type" could be metaphorically compared to the feeling of distance established between the instrumentalists of my piece and the suggestion of spatial depth. An impression of gestural transferability is generated by this somewhat artificial delineation of perspective. Gestures are perceived as being transferred from one instrument to the next, being simultaneously "enlarged" or "reduced" depending on our point of observation.

Room III is characterised by a collection of membraphones (timpani, bass drum and snare drum). A form of visual duplication is somewhat suggested by the use of a set of instruments from the same family. These are sonically excited by transducer speakers placed on their respective membranes. The bass and snare drums remain unperformed while the individual timpani is utilized as a modulator for the materials played through the transducers. This is carried out by gradual pedal changes and different techniques applied to the timpani's head. Due to the simplicity of their sound boards, the drums operate as particularly clear, crystalline sonic reflectors. The pre-recorded voice of the tenor (who is typically associated with this particular room), is transmitted to the drums simultaneously; the three instruments are sonically activated at the same time.

As with *Isla y Continente*, during the process of composition of *Gyre and Gimble*, I was again thinking of the role of mirrors in Tarkovsky's *Zerkalo (Mirror)*. Tarkovsky's reflecting surfaces are always different. They create diverse degrees of clarity, opacity, blurriness and distortion; different textures that condition the nature and identity of the reflected images. Similarly, in my piece, the instruments operate as unique sonic mirrors. They generate particular levels of

distortion and alteration in the audio materials projected onto their respective surfaces and sounding boards. More interestingly, in Tarkovsky's film the functionality of the mirrors is manifold. They operate as gateways to different spaces and times, as physical frames for specific scenes, as membranes between dreams and reality, as creators of distortion or asymmetries between the reflected image and the original, as mere image reflectors, etc. In general lines, Tarkovsky's mirrors function as observable discontinuities, as fractures of the spatio-temporal continuum.

> The looking glass, as an object, is one of the most resonant aesthetic devices, able to overcome the imposed homogeneity of space as perceived by the human eye. It is a natural means of displacing spatial categories. Even a straightforward reflection reverses, at the very least, the right-left axis—a mirror always reflects distortion back to the subject. In addition, the point of view in relation to the mirror […] inevitably tilts the reflected object; the resulting image is bound to misrepresent its physical source. (Skakov, 2012, p.103)

The use of audio-visual mirrors in *Gyre and Gimble* is comparable in many respects. The role of the instruments may also be interpreted in a multiplicity of ways: as pure sonic reflectors, as modulators and filters, as sonic containers, as visual duplicates, as prolongations of the sonic and physical presence of specific singers, as indicators of potential parallel spaces, as creators of a sense of displacement, and more generally as generators of discontinuities and intermittences in the audio-visual continuum.

Figure 31: staging of *Gyre and Gimble's* first performance at the Staatstheater Darmstadt (photograph by the composer)
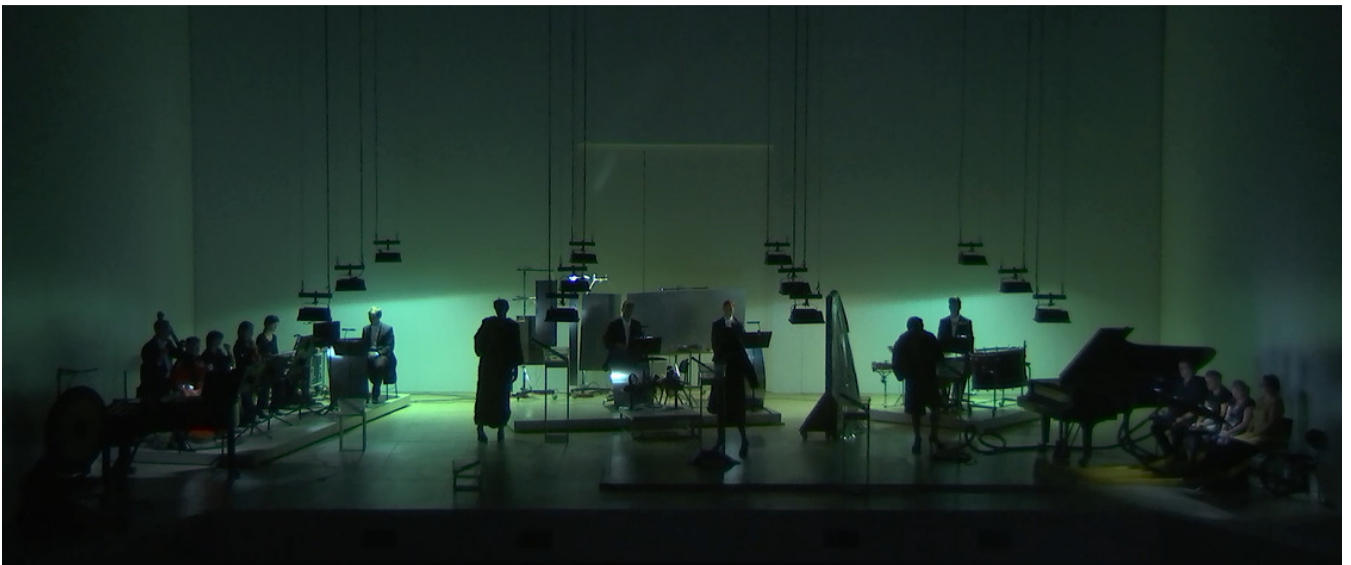
3.2) <u>Performers</u>

The previous section analysed the role of objects and instruments in a context of spatial duplication. The function of the performers in this sense is much harder to elucidate. In my works there is a tendency to depersonalise the performer, to consider him a mere activator of instruments and objects. In my music, the visual emphasis is generally put in the presence of particular instruments (in their particular shapes, location, behaviours and movements) rather than on the presence of the actual musician. From a viewpoint of duplication, the performer is generally regarded as a catalyst for particular gestures and movements, which are transferred to specific instruments, delineating observable symmetries and parallelisms (e.g. coincident bending processes applied to metal sheets, parallel rubbing gestures on string instruments, etc.). In this respect, the performers are somewhat "objectified" so that the actual presence of the instrument is highlighted, accentuated. In general, my works tend to create, to a certain extent, non-anthropocentric contexts. This is particularly evident in the pieces where "still lifes" are outlined. The performers are often absent, but paradoxically this very absence suggests their unattainable manifestation, a trace of their potential and inherent presence.

In my large music theatre works, however, there are cases in which the role of specific performers is crucial to establish a sense of observable duplication on the stage. In *I reached A through the throng through the threshold through the throb* the two main singers mirror each other. In fact, the singer located on the left-hand side of the stage operates as a representation of her counterpart on the right side. As already discussed, this parallel singer inhabits a still life of objects and instruments that mirror the setup of the ensemble on the opposite side of the stage. Her role is utterly static, but she participates in some imitational processes (mainly when she fakes vocalization). In fact, this soprano never sings or speaks but shapes her mouth according to the materials played through a small loudspeaker hidden among her clothes. This loudspeaker always plays recordings of the other soprano's voice, which creates an acoustic parallelism between the two singers. Both sopranos are rather static throughout the piece, but during the rehearsals the silent soprano was persuaded to emulate her counterpart's particular microscopic universe of gesticulation when singing and speaking. Additionally, in the concert they wore identical dresses, had similar hairstyles, same makeup and were illuminated with the same kind of spotlights. This set of elements produced a clear impression of duplication. In this case, I was interested in the transformation of one of the singers into an automaton, a sort of active, "still life-like" version of her counterpart. During the process of composition, I was inspired by literary and philosophical theories on the issue

of the double, of the *doppelgänger.* In this respect, I was particularly interested in the work of Jean Baudrillard and Jorge Luis Borges. Their writings were influential for the general conception of this piece and, more specifically, for the delineation of a feeling of duplication between the two main singers of the piece.

In *Simulacra and Simulation,* Baudrillard draws a parallel between biological cloning and the unreal nature of duplication. He considers that the illusory force, the mixture between uncaninness (paraphrasing Freud) and innermost subjectivity produced by the double is based in its insubstantiality, in its immaterialness. The double is regarded as a fantasy, as an illusion. We can dream of a perfect doppelganger of ourselves, but this delusion is shattered by reality. Doubles are therefore mental images, mirages, projections of our imagination.

> The double […] is an imaginary figure, which, just like the soul, the shadow, the mirror image, haunts the subject like his other, which makes it so that the subject is simultaneously itself and never resembles itself again, which haunts the subject like a subtle and always averted death. […] The imaginary power and wealth of the double –the one in which the strangeness and at the same time the intimacy of the subject to itself are played out *(heimlich/unheimlich)* –rests on its immateriality, on the fact that it is and remains a phantasm. (Baudrillard, 1994, p.95)

A parallel could be drawn between Baudrillard's notion of unreality and the establishment of a living doppelganger in my work. The silent soprano could be regarded as a mental projection of her counterpart, as her imaginary, dreamed duplicate. Consequently, in order to generate this illusory feeling, the process of emulation between the silent singer and her counterpart is always accurately coordinated. Also, the process of fake-singing ought to be executed as precisely as possible. The recordings played through the loudspeaker are mostly coincident with the passages being simultaneously vocalized by the soprano on the opposite side of the stage. However, this phantasmagorical sense of immateriality, of a dream-like state, is shattered at the very end of the piece when the silent soprano suddenly begins to sing a high tone. This reverses for a few seconds the operational dynamics of the piece. This inversion could be compared with Baudrillard's notion by which the illusory impression created by doubles is immediately obliterated when projected or extrapolated into the real world. The real voice of this soprano appears as a confirmation of her concrete identity and materiality, breaking the already established process of duplication and simulation.

> Everyone can dream, and must have dreamed his whole life, of a perfect duplication or multiplication of his being, but such copies only have the power of dreams, and are destroyed when one attempts to force the dream into the real. (Baudrillard, 1994, p.95)

In Borges' *The Other* (2001), the notion of duplication is addressed from a more existential perspective. In this short story, a mature Borges encounters a younger version of himself. Both doubles engage in a conversation in which their political, ethical and aesthetic differences are apparent. The old Borges attempts to convince the young Borges that the person speaking to him is an older version of himself by providing facts about literature, family and historical events. The younger Borges remains sceptical but the older Borges, in order to prove he is not a product of his younger version's imagination, hands him a banknote with the year 1974 written on it. Interestingly, the older Borges concludes that this event is real for him, but a dream for the younger. In my eyes, this short story utilizes the idea of the double as a metaphor for the fallibility and fragility of memory. This unreliability of memory is also related to the notion of an illusory nature of existence: our recollections may be subject to alterations and discontinuities that determine the essence of our present identity. This echoes Berkley's idealism, which defines human identity as a construct of the mind, as an illusion. As Percoco states,

> "El otro" is an attempt by Borges to portray man's eternal yearning to understand the meaning of his existence [...] Borges believes that man can only experience a sense of individuality in the infinite present. Due to the process of memory loss, man can never reconcile his past and present personality. (2003, p.120)

In *I reached A through the throng through the threshold through the throb* there is a constant shift of materials between the two singers, between the actual voice of the soprano and her pre-recorded version (embodied and re-enacted by the silent soprano). These pre-recorded materials are often coincident with the live singing of the main soprano. Occasionally, however, the pre-recorded materials are repeated and displaced in time, altering the sonic and gestural continuum established between the two singers. These recordings could be potentially interpreted as memories, as the soprano's intermittent set of recollections. Additionally, on some occasions, these pre-recorded materials are intentionally distorted and filtered. Consequently, they may be experienced as somewhat vague, inexact, blurred reminiscences. By extension, and returning to Borges' text, the silent soprano—her entire persona—could potentially be considered a signifier of remembrance, of memory itself.

Both in the case of Baudillard (dreams) and Borges (memories), the double is regarded as the product of an illusion, as a figment of the imagination. In my work, I attempt to recreate the illusory nature of the double by delineating a clear sense of distance between the singers, by dividing the stage into two independent regions. The area that circumscribes the silent singer—the allegorical doppelganger—is populated by a still life of instruments and objects. This collection of unplayed instruments (each of which is individually lit by a single light bulb) creates a feeling of

depersonalization. The evident and deliberate absence of the performers is particularly successful in emphasizing the presence of the silent singer as she constitutes the only human or anthropomorphic manifestation in this part of the stage. Her chiefly mimetic role and the artificial process by which the pre-recorded materials are transmitted through the loudspeaker hidden in her dress transform her into a semi-installational character. She explores the borderline between live performance and automatism. The established sense of subtle artificiality may ideally provide an illusory character to the nature of this singer, as if she were the product of a dream or a slightly distorted recollection, as a projection of the main soprano's psyche.

Figure 32: silent soprano in *I reached A through the throng through the threshold through the throb*. 1st performance during the Münchener Biennale 2012 (photograph by the composer)

As previously mentioned, in many of my works the performer is often regarded as an executer of gestures and movements that are transmitted to specific instruments and objects. In this sense, my works *Isla y Continente* and *Huella y Horizonte* are particularly evident examples. The performers' actions have an immediate and easily observable effect on the particular bending configurations of the metal sheets. The malleability of these objects makes them extremely sensitive to any particular movement or action carried out by the percussionists. These objects function rather like visible outliners or materialisers of the performer's gestural processes. Thus, even if the visibility of the performers is not particularly relevant for the delineation of observable symmetrical and coincident bending structures, the processes of manipulation and the gestures applied to the metal sheets need to be coordinated in an almost choreographic manner.

During the rehearsal process for both of these works, particular emphasis was given to the exact execution of the indicated bending gestures so that the performative actions between the percussionists were as similar as possible. This gestural consensus allowed the materialization of symmetries and observable duplications between the sheets. In this particular context, the

coordination and unification of gestures and actions, even if only visible to a certain extent (the actions and movements are usually small but are greatly magnified by the metal sheets), reinforces the impression of performative duplication. The metal sheets could also be regarded extensions of the performers' physicality, as objects that enlarge and transform the players' gestural universe, as particular visual signifiers of their actions. Hence, even if the presence of the performers does not determine a feeling of duplication per se, their coordinated actions, their application of correlative gestures is crucial in establishing an observable impression of parallelism. In some way, the metal sheets operate as gestural screens, as surfaces in which gestures are "imprinted" and simultaneously displayed. A sense of duplication is then achieved by the imprint of coincident bending gestures onto the metal sheets (determining concomitant degrees of curvature and bending directionalities).

In *Gyre and Gimble* all the singers operate as different versions or models of the same character (Lewis Carroll's *Alice*). In spite of differences in gender, age, visual appearance, voice type and theatrical role, during the scenic rehearsals and performances of the piece there was an effort to equalize as much as possible the singers' physical appearance and particular ways of moving on the stage. Their costumes and small accessories were designed in an identical fashion, which suggested visual uniformity during the performance.

The notion of various actors representing the same character was also explored by Samuel Beckett in some of his works (chiefly in *Ohio Impromptu* (1980) and *Film* (1965)). In *Ohio Impromptu,* the main characters of the play operate as doppelgangers. The exact role of these characters—the *Listener* and the *Reader*—is hard to elucidate: they may be regarded as alter egos, as the embodiment of a divided self or, perhaps, as ghostly apparitions (the *Reader* being a projection of the *Listener*'s mind). Generally speaking, *Ohio Impromptu* addresses the issue of solitude and nostalgia at old age and the impossibility of communicating those feelings to anybody but oneself. Hence, the split of the main character into two identical interlocutors may be regarded as a symbolic representation of loss and loneliness. In this play, the actors must resemble each other as much as possible: the two old men are characterised by possessing the same long white hair and wear identical, long black coats. Both characters sit beside the same table in an almost symmetrical fashion. The *Listener* faces the audience with his head bowed and his head hidden. The *Reader* displays the same posture but looking at an open book in front of him. This determines an almost mirror-like configuration of the play's setting.

It is the first Beckett play to present a Doppelgänger on stage, another Beckett pair, but this time seen as mirror images; it belongs to Beckett's ghost period, where phantoms that echo the haunting quality of memory and nostalgia in his work are seen or described on stage. (Calder, 1989, p.219)

In my eyes, Beckett's usage of doubles is similar, to a certain extent, to the multiplication of "Alices" in *Gyre and Gimble.* The two doppelgangers in *Ohio Impromptu* play different roles, each of them exploring or signifying different angles of the main character's personality and inner conflicts. This sense of identity split is precisely suggested by the analogous appearance of the two actors, clearly embodying or representing the same character. An analogous process takes place in *Gyre and Gimble,* where the duplicated versions of Alice display different aspects of her personality and her position with regard to the mirror. There is a representation, a simultaneous exhibition of the multiple layers of Alice's psyche. In both Beckett's play and in my work the aspect of simultaneity is important. The multiple versions of the same character are always present on the stage, interacting and displaying a number of specific personality traits at the same time. In such a way, the characters' function is not merely reflective, they are not only meant to resemble each other but are descriptive or illustrative of certain sides of their identity and their particular relationship to the space they inhabit. As Coates argues,

> Defining 'doubling' can be problematic, as the operation that confronts characters with exact reproductions of their physical appearance may be conflated with one giving them very different features, to reveal the underside of a personality or character-type. Ironically yet appropriately, the term itself breathes unacknowledged duality. (2015, p.13)

Similar usages of the double are particular common in cinema. Classical films such as Wegener's *Student of Prague* (1913), Hitchcock's *Vertigo* (1958), Bergman's *Persona* (1966), Fassbinder's *Despair* (1978), Kurosawa's *Kagemusha* (1980) and Kieslowski's *The Double Life of Véronique* (1991) utilize the issue of the double as a central motive. *The Double Life of Véronique* seems particularly close to the usage of doppelgangers in *Gyre and Gimble* and *I reached A through the throng through the threshold through the throb.* In this film, Kieslowski shows the parallel lives of two physically identical, coetaneous women in two different cities: Véronique, a French music teacher, and Weronika, a Polish singer. Both roles are performed by the same actress (Irène Jacob). In the film, the two women never meet physically but Weronika sees Véronique in the distance at Kraków's Market square. Inexplicably, Véronique senses Weronika's death later in the film and goes through a number of isolated experiences and apparently trivial occurrences that mirror events of Weronika's life. Eventually Véronique discovers a photograph of Weronika, taken during her trip to Kraków, confirming the corporeal, genuine presence of her double. In this film, the issue of the double is not utilized to generate a process of direct interaction or confrontation between the characters (with all the potential implications of uncanniness, identity-split, etc). Instead, the film aims at establishing a number of enigmatic allusions, unexplainable resonances and parallelisms

between the two women by locating them in completely different cities and environments. This spatial displacement creates a feeling of digression, the doppelgangers are connected in a purely tangential manner, yet the intimacy of the subtle, inexplicable allusions established between the two is remarkably evocative. Weronika and Véronique operate as autonomous persons connected only by seemingly casual and coincidental events. These, however, underline a much richer universe of dream-like, illusory and unexplainable reciprocal relationships.

> The Double Life of Véronique typifies stories of doubling, whose very premises 'break the frame' separating inner and other, here and there, removing the self beyond its own unattainable horizon […] The image of the double is indeed dreamlike in its enigmatic fusion of distance and proximity. (Coates, p.74-75)

A similar process takes place in *Gyre and Gimble.* The singers personifying different versions of *Alice* do not interact on stage but rather encounter each other in their particular journey across the stage (with the exception of the singers that remain static). These doppelgangers rarely react to each other even when they are face to face, as if they were unable to communicate with each other. They are, to a certain extent, disengaged and disconnected from their fellow doubles. The spaces they inhabit are relatively independent and their random interactions respond to their trajectories or positions on the stage. Each version of Alice lives in a personal and alternative realm, which occasionally intersects with the others' particular territory. Even if the impression of proximity and interplay seems to take place in the performance of the work it is a product of the spatial displacements rather than of a specific narrative. The doubles "sense" each other rather than engaging in a clear process of identification. This is also sometimes corroborated by the occasional displacement of a particular singer's pre-recorded voice into the territory of another (played through transducer loudspeakers). This suggests a somewhat intrusive presence and, simultaneously, a concealed, almost unnoticeable network of connections between the different versions of Alice.

Chapter four: doubles in the sonic realm

The sound must seem an echo to the sense. (Pope, 1998, p.10)

This chapter examines the role of duplication in my works from a sonic perspective. Here I focus on the implications of particular materials and compositional strategies in the design and creation of duplicated sonic sources. The delineation of audible correspondences, of artificial echoes between two or more instruments, is also a recurring procedure in my music. This places my compositions, as discussed in chapter two, within a specific historical lineage of works.

Generally, the suggestion of echoic structures is achieved through the use of transducer speakers playing the same materials (transmitting them to the surface of specific instruments/objects) and/or by the performance of coincident techniques by identical or similar instruments. The role of the transducers as generators of echoic interactions is fundamental in my music. These devices are electronically activated. Therefore, from a sonic perspective, they are able to excite distantly located objects, instruments and/or sound boards in a simultaneous manner. They are capable of distributing the same sonic materials in space and transforming any resonant body into a potential loudspeaker. They operate as intermediate devices that transform electrical impulses into mechanical energy and eventually, once the surfaces on which they are placed vibrate, into acoustic energy. Even if the sonic results are conditioned by the acoustic characteristics of each specific resonant body, a sense of sonic parallelism, of echoic interrelation, is easily suggested when identical sonic materials are transmitted onto a number of different instruments and/or objects.

Alexander Pope's slightly alliterative quote is particularly revealing. The verb "must seem" (as opposed to "is") suggests a process of emulation; an imitation of the phenomenon of echo as a poetic mechanism, as a tool for suggesting sonic correspondences within the same stanza. Analogously, in my music there is usually a process of emulation of echo as an aesthetic device, recalling its physical effect in an artificial and evocative manner. Nevertheless, reducing the issue of sonic duplication to the properties of echo would be rather simplistic. This phenomenon always implies a certain displacement in time between the sonic source and its reflection, a feeling of asynchronicity. However, in my music there are often passages in which sonic duplication is explored in an entirely simultaneous way. This determines a different kind of auditory experience in which duplicated events may be perceived as perfect concurrences. Synchronicity is particularly effective in the demarcation of particular acoustic territories as the duplicated sonic sources operate

as concomitant and directly related spatial signifiers. The interrelated relationship between space and the perception of synchronous events was accurately described by Carl Jung:

> Synchronicity in space can equally well be conceived as perception in time, but remarkably enough it is not so easy to understand synchronicity in time as spatial, for we cannot image any space in which future events are objectively present and could be experienced as such through a reduction of this spatial distance (2006, p.41-42)

In my music there is often an alternation between these two usages of sonic duplication: echoic structures and exact synchronicity. Sometimes there is a gradual shift between these two states, determining an often-ambiguous process of transitions and transformations. This often brings the distinction between the two states to a microscopic and almost imperceptible level. In the next pages I will examine the use of sonic duplication in the works composed throughout the past three years, mainly focusing on the use of sonic materials and some related notational strategies. As in chapter three, the order in which the works are presented is strictly chronological (from the earliest to the latest).

4.1)   *Huella y Horizonte*: distorting mirrors, hidden messages and sonic palimpsests

As discussed in section 3.1.2, in *Huella y Horizonte* the saxophone is surrounded by five differently sized metal sheets, distributed in a semi-elliptical manner. Most of the sonic materials that define the piece are derived from the saxophone's sonic universe. Its pre-recorded sound defines the material substratum of the majority of audio samples, which are then projected onto the metal sheets through transducer loudspeakers (each sample is triggered by the specific key of a MIDI controller keyboard and distributed in space by a Reaper patch). Of the total of 72 different samples played through the transducers, 59 are exclusively based on recordings of the saxophone. The 13 remaining samples are defined by a mixture of speech (see page 60) and discreet underlying saxophone tones. The 59 instrumental recordings can be grouped into different categories: multiphonics (50 recordings), high "teeth-on-reed" tones (6 recordings) and key clicks with air tones (3 recordings). These recordings were carried out during the process of composition and later reworked and readapted for the configuration of each individual sample. In general, the audio samples are organized according to the work's specific pitch distribution. The piece is based on a symmetrical, progressively descending and ascending microtonal scale framing an interval of a minor 10th (F4-D3-F4). Each of the piece's 63 sections centres on a specific pitch (or on a group of 2, 3 or 4 consecutive pitches).

Figure 33: pitch structure of *Huella y Horizonte*. Each section focuses on a specific pitch or on a number of consecutively ordered pitches. Each particular rectangular box indicates the pitch(es) utilised in a specific section. These rectangles intersect, indicating the number of shared pitches between sections—a maximum of 3 and a minimum of 1, except for the 1st and last section, which are independent. Sketch by the composer.
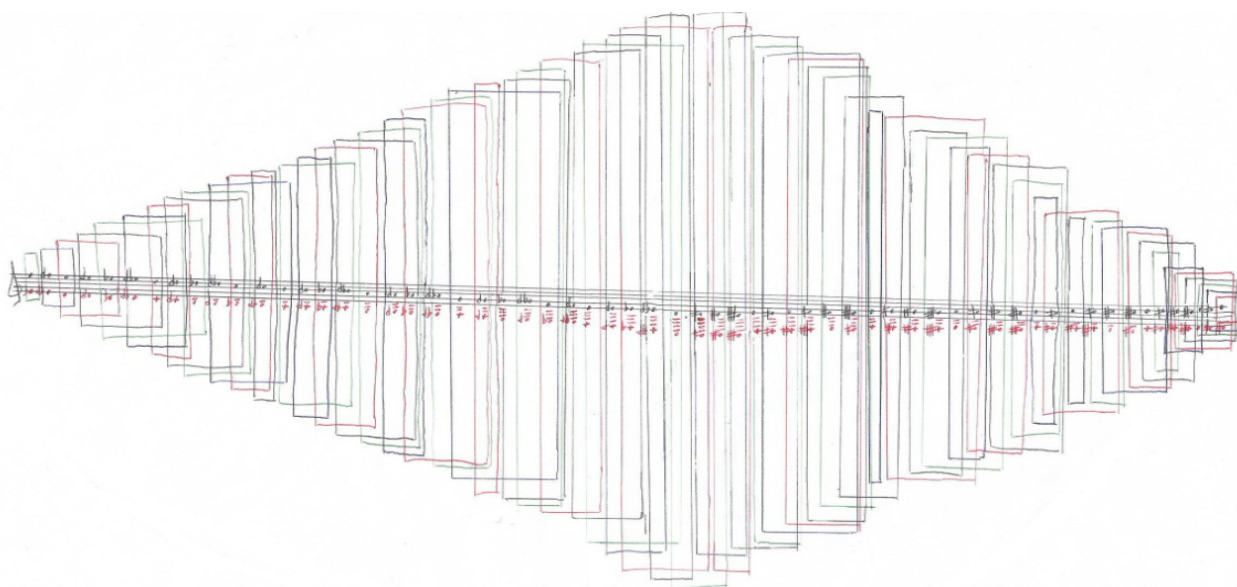
The palindromic nature of this scale also coincides with a somewhat parallel distribution of materials throughout the work. In general, the sections that share the same pitch(es) also display similar materials and character, outlining, to a certain extent, a mirror-like general structure. This also coincides, as seen in the previous chapter, with a symmetrical distribution of setup configurations throughout the piece.

The metal sheets operate as true distorting mirrors. Due to the malleability and the flexibility of steel, the materials transmitted through the transducer speakers (metaphorically reflected on the metal surfaces) are acoustically modified when the sheets' levels of curvature are altered. This is generated by the sheet's overtone structure, which is compressed and expanded according to the bending movements. Therefore, and to a large extent, the sonic role of each metal sheet is that of a modulator, shaping the nature of the projected sounds by effecting changes in their concavity and convexity levels. However, the metal sheets are capable of producing a number of sonic effects regardless of the materials projected through the transducers. These can be divided into two categories: sounds generated by the actual motion of the sheets (e.g. thunder-like effects, swishing noises produced by rapid bending movements, etc.) and sounds produced by applying and rubbing different beaters and objects onto their surface (e.g. superballs, porcelain mugs, corrugated plastic tubes, bows, etc.). Eventually, the final sonic results can be defined as a hybridisation between the pre-recorded materials and steel's sonic identity.

During the process of composition I was particularly interested in the use of mirrors by different artists, chiefly Robert Smithson—as discussed in chapter three—and Anish Kapoor. Kapoor's distorting mirrors have a comparable effect, from a visual perspective, to the warped sonic outcome of my metal sheets. Kapoor's large mirroring surfaces reshape the figure of the spectator dramatically and, simultaneously, insert it into the sculpture itself (the observer becomes part of the artwork). Additionally, these mirroring sculptures appropriate the surrounding space. In *Huella y Horizonte* an analogous process takes place. The saxophone could be compared to the spectator in Kapoor's sculptures as it is sonically reflected and misshapen by the changing positions of the metal sheets. The occasional techniques performed on the sheets' surfaces could be metaphorically related to the unavoidable reflection caused by the surrounding space in Kapoor's mirrors. These spaces generate particular visual contexts, specific backgrounds onto which the viewer's reflected image is projected. The extended techniques performed onto the metal sheets create a similar effect: sonic frameworks onto which the pre-recorded sound of the saxophone is superimposed.

Figure 34: Kapoor, H. (2006). *Vertigo* [Stainless steel]. Retrieved from:
https://artmirrorsart.wordpress.com/2015/02/02/mirror-sculptures-by-anish-kapoor/

To a certain extent, these processes of distortion could also be compared to the technique of anamorphosis. In painting, anamorphosis refers to the particular technique by which certain images are represented according to a distorted projection so that the viewer must utilize special devices and/or be positioned at a particular vantage point to reconstruct the image. The bending processes applied to the metal sheets could be allegorically compared to this particular technique; the level of curvature operates rather like perspective. In this sense, a straight metal sheet—causing no or almost no sonic alteration in the original samples played through the transducers—could be compared with the exact vantage point from which an anamorphic image should be observed. An increasing curvature creates a growing distortion in the sound, just as the aspect of an anamorphic image becomes more and more deformed once the viewer moves away from the vantage point.

Figure 35: Holbein, H. (1533). Anamorphic skull from *The Ambassadors* [Oil on canvas]. Retrieved from:
http://employees.oneonta.edu/farberas/arth/Images/Ambassadors/amb_floor_large.jpg

In *Huella y Horizonte,* this metaphorical process of anamorphosis is particularly evident in passages where there is a clear transition between a vertical position of the sheets and other levels of bending. Once the sheets are curved, the pre-recorded sound of the saxophone becomes somewhat warped and distorted. Sometimes, the level of distortion created by the process of bending is such that the nature of the original recording is almost impossible to identify. This anamorphic treatment of the pre-recorded materials creates an oblique link with the original source. In most cases, the materials played through the transducer speakers are coincident with those played by the saxophonist. However, the bending processes determine new relationships with the original, new displacements and extensions of its sonic identity. This is comparable to the role of the anamorphic image in relation to the particular position of the viewer:

> Unlike perspective, anamorphosis does not reduce forms to their visible outline. Rather, it distorts them through a process that projects them outside themselves […] It implies a displacement of the subject and its reinscription according to a trajectory of obliqueness. Anamorphosis supplants the frontality of the visible, since the position of the viewing subject is now constituted outside the parameters that define visual semblance. (Levin, 1993, p.67)

In *Huella y Horizonte*, the use of specific techniques and processes of bending and sonic distortion is often outlined in a parallel, mirror-like manner. As previously discussed, these events are organised either in an imitative, echoic manner or in a perfectly synchronised way. The pre-recorded materials played through the transducers usually coincide with the materials played by the saxophone. This creates a feeling of sonic duplication between the centre of the ensemble and its surrounding satellites.

The shift between simultaneous and imitative bending/distorting processes and other techniques determines different experiential approaches to sonic duplication. In some passages there is a constant process of transfer between these different states, creating an impression of ambiguity in the listener's perception. Interestingly, the discernment between simultaneity and non-simultaneity involves different time intervals in the aural and visual domains. This may perhaps add a layer of complexity to the audio-visual processes in which both gesture and sound are apparently concomitant.

> We perceive audio signals as non-simultaneous if they are separated by an interval of roughly 6 milliseconds. If that separating interval is shorter, we perceive audio signals as being simultaneous. Visual impressions which are separated by an interval of 20 to 30 milliseconds are experienced as non-simultaneous. (Vrobel, Rössler & Marks-Tarlow, 2008, p.8)

Figure 36: bars 33-37 & 49-51. The first image shows synchronised bending/distorting processes in which there is a coincident use of identical pre-recorded materials (saxophone multiphonics) and equal techniques (irregular tapping with the fingers). The second image displays imitative ("echoic") bending/distortion processes and the usage of identical pre-recorded materials (saxophone multiphonics)
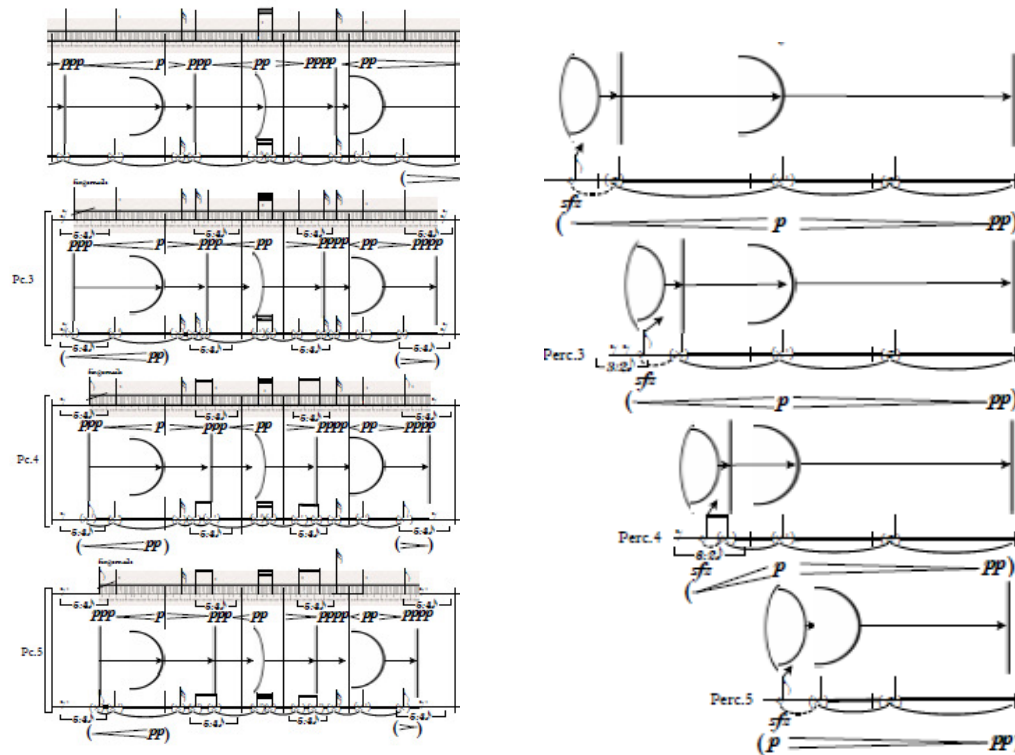
The graphic on page shows all the different setup combinations utilised throughout the work. Each of the piece's sections displays a particular combination of instruments and establishes different spatial relationships. The sonic materials explored in each individual section are usually identical between the metal sheets; the transduced materials coincide and so do the particular effects performed on their surfaces. This creates a number of auditory bridges between the sheets themselves and between them and the saxophone. The sense of sonic correspondence is consistent throughout the score, determining a variable network of echoic structures and acoustic mirrors in the space of performance.

Interestingly, the notion of acoustic mirrors is of particular relevance in some psychoanalytical theories. For Guy Rosolato, the voice operates as an acoustic mirror in between body and language, essential for the development of the subject's personality. In this regard, the voice can be articulated and heard simultaneously, being impossible to ascertain whether it is "outside" or "inside" of ourselves. This has a similar effect to the reflection of an individual in a mirror; his/her image is both in the reflecting surface and outside of it. As Rosolato states,

The voice [has the property] of being at the same time emitted and heard, sent and received, and by the subject himself, as if, in comparison with the look, an "acoustic" mirror were always in effect. Thus the images of entry and departure relative to the body are narrowly articulated. They can come to be confounded, inverted, to prevail one over the other. (quoted in Silverman, 1988, p.78)

In *Huella y Horizonte,* the function of the saxophone's sound—both acoustic and pre-recorded—is somewhat similar to that of the voice in Rosolato's observation. On many occasions, the saxophone executes a sound that is simultaneously heard in the surrounding metal sheets. This often suggests a feeling of sonic continuum between the instrument and its oblong metallic satellites. At times, this sonic continuity impedes the auditory distinction between the original source and its pre-recorded versions, generating a feeling of ambiguity and possible auditory misidentifications.

This feeling of uncertainty is often semantically encompassed by the textual materials that constitute some of the work's pre-recorded samples. These recited texts are utilized both as sonic materials (treating speech as a uniform sonic substratum) and/or as almost unintelligible hidden messages within the work's sonic framework. These fragmentary texts (extracted from Amundsen's *South Pole Expedition diary*, Copernicus' *De revolutionibus orbium coelestium* and Melville's *Moby Dick*) focus on issues such as disorientation, the inability of identifying specific geographical spots and discerning between real and imaginary places.

We reckoned now that we were at the Pole. Of course, every one of us knew that we were not standing on the absolute spot; it would be an impossibility with the time and the instruments at our disposal to ascertain the exact spot. (Amundsen, 2010, p.302)

The sonic alteration of the pre-recorded sources caused by the bending process applied to the metal sheets may be metaphorically compared to the impossibility of locating concrete geographical points in a territory. The exact aural identification of a pre-recorded material and, by extension, its accurate amplification, is challenged by the distortion levels produced by the different bending degrees. Reaching this ideal reproduction is often an evasive task, a process challenged by the dynamic alternation of shapes, positions and external effects performed on the metal sheets. In this regard, the intelligibility of the textual materials is variable. Depending on the level of distortion, the extent to which the texts may be comprehended fluctuates. These particular quotations may be interpreted as concealed messages that occasionally emerge from the sonic framework of the piece. Additionally, in some cases, the accumulation of different speech layers is utilized to create a uniform sonic stratum. This may be perceived as a collection of distant, incomprehensible commentators that, simultaneously, generate a relatively static sonic layer. This is

projected onto the surface of the metal sheets, delineating once more a sense of common materiality and acoustic duplication.

On some occasions, the sonic nature of speech is emulated by the techniques performed on the metal sheets, particularly in passages where superballs and bows are utilised. These techniques produce effects that are similar to speech in articulation and character. Usually, these techniques are performed when the speech recordings are simultaneously played through the transducers. Somehow, this could be interpreted as a particular "sonic palimpsest"; speech-like sounds "imprinted" onto a surface, which in turn is sonically excited by pre-recorded speech. Ironically, the application of these techniques obliterates to a large extent the comprehension of the underlying words played through the speakers. This process of effacement is inextricably related to the nature of palimpsests. However, in these particular passages, there are sometimes noticeable emanations from the pre-recorded stratum. These may be perceived as sonic traces or remnants.

> Acoustic palimpsests often involve sounds that we weren't supposed to hear: sounds related to the body, to technological mediation, to the neutral background, to the inaudible politics that undergird all sonic situations. The palimpsest metaphor encourages us to listen for the quietest of sounds, and to imagine erased sounds stubbornly pushing back through the threshold of audibility as well. (Daughtry, 2017, p.78)

The levels of sonic distortion generated by the different metal sheets are often configured in a coincident or correlative manner. This evidently coincides with the symmetrical degrees of curvature applied to the metal sheets. Only minor sonic deviations and dissimilarities may be perceivable due to the metal sheets' size differences (the ones located at the front of the setup are smaller than the ones in the back and middle positions). The cases in which coordinated sonic distortion processes coincide with a parallel configuration of the sheets' bending degrees fulfil the audio-visual contract in a particularly apparent manner. This emphasizes the predominant sense of symmetry and audio-visual duplication suggested throughout the piece.

Figure 37: bars 102-107. "Sonic palimpsests": combination of pre-recorded speech (played through transducers speakers) and speech-emulating effects (superball rubbing motions)

Figure 38: bars 222-230. Coincident levels of sonic distortion achieved through identical bending processes and the use of the same techniques.

4.2)   *Isla y Continente:* **doubles and non-concrete sources**

Isla y Continente and *Huella y Horizonte* share a number of common aspects in terms of instrumentation and the use of similar techniques and effects. *Isla y Continente*'s most relevant element of differentiation is, in my view, the use of non-concrete sonic sources. In *Huella y Horizonte,* all the pre-recorded materials allude to specific, identifiable sources (either the sound of the saxophone or speech recordings). In *Isla y Continente*, however, the materials played through the transducers are defined by a sine wave, which outlines a long uninterrupted melodic line.[22] As already mentioned in section 3.1.3, this sine wave is based on an extremely elongated and microtonally compressed quotation from Machaut's ballade *Très douce dame que j'aour.* This melodic line is hardly recognizable but defines, to a certain extent, the structural framework of the piece. In *Isla y Continente,* the metal sheets do not operate as true sonic mirrors since the materials played through the transducers are not associated to any particular identifiable instrument or external source (e.g. speech). The use of a sine wave as the common material for the two metal sheets aims at determining a certain sense of neutrality, a sonic substratum that is free from any clear associative connotations. In this respect, this relatively uniform sine wave is utilised to highlight and explore the actual acoustic properties and identity of the metal sheets. From an allegorical perspective, it could be compared to a sonar wave that propagates underwater in search of discontinuities and specific geographical features.

In chapter three, I drew a parallel between the role of the metal sheets in this work and Tarkovsky's usage of mirrors in *Mirror*. In the film, these objects operated as gateways to an alternative spatiotemporal context. Similarly, during the process of composition of *Isla y Continente*, I regarded the sheets as metaphorical accesses to a parallel sonic realm. In fact, the neutral character of this sine wave, its lack of identification with any recognizable external source, suggested this particular conception. The sheets do not operate as real mirrors since there are no concrete, identifiable sonic objects to be reflected. Rather, they behave as allegorical portals, as malleable entries to an alternative sound world. This breaks, to a certain extent, the aural continuum by insinuating two perforations, two discontinuities in the auditory realm.

As in *Huella y Horizonte*, the different bending degrees applied to the metal sheets produce several acoustic effects. The configuration of the overtones changes according to the sheet's curvature, modifying the nature of the transduced materials. In this piece, however, there is no feeling of anamorphosis due to the lack of referential and identifiable sonic objects that may be

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[22] This sine wave can be heard here: www.goo.gl/g3uvED

acoustically deformed by the process of bending. Nevertheless, an impression of disclosure is created by this underlying sine wave as it reveals the inner acoustic properties of the metal sheets throughout the processes of bending and manipulation. In fact, this sine wave could be regarded as a twofold exploratory tool used, on the one hand, to sonically excite the metal sheets and, on the other hand, to unravel their particular acoustic characteristics. Additionally, it operates as a generator of duplicated identities. Since the transducers fixed to the metal sheets play the same sine wave simultaneously, a general underlying stereophonic effect is created. This sometimes coincides with the concurrent use of identical bending movements although imitational, slightly asynchronous processes (asymmetrical bending configurations, as exposed in section 3.1.3) tend to predominate. In this work, a number of additional techniques other than the bending processes are investigated. These techniques are always applied to the two metal sheets during the same passages. This suggests a further layer of aural duplication even if the articulation and rhythmic structures performed on each sheet may differ. This organization of the materials is consistent throughout the work, avoiding as much as possible the overlap of multiple techniques in the same section.

The most significant of these techniques is defined by bowing on which could be regarded as "physical extensions" of the metal sheets. These consist of a number of specifically tuned tuning forks fixed to the sheets' upper edge. Once they are bowed, their sound is transmitted to the metal sheet's body and further modified/distorted by the bending processes.

Figure 39: tuning forks' specific pitches
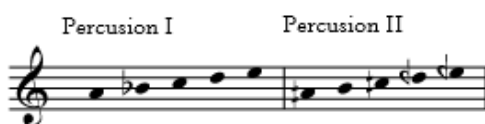
The microtonal disparities in pitch between the tuning forks are possibly the only differentiating elements in terms of tone production between the two metal sheets. These microscopic divergences are sometimes utilized to create an aural fissure between the two sheets. This is particularly evident in the passages where there is a superimposition of two tones pitched at a distance of a quarter tone. This generates a number of perceivable beatings and slight tuning deviations between the two sheets. Additionally, the tuning forks interfere with the particular sine wave played through the transducers. The 10 pitches produced by the tuning forks coincide with the tones utilized in the delineation of this sine wave. These pitches are, in turn, derived from the microtonal compression of Machaut's *Tres douce dame que j'aour*. In this sinusoidal wave, the shift between the different pitches is carried out by the use of glissandi, always keeping a sense of linearity. The tuning forks usually generate microtonal beatings against this melodic line. These

beatings are obviously different between the two sheets, depending on the specific tuning forks at hand.

Figure 40: *Isla y Continente* (bars 201-208): rhythmically coordinated tuning-fork bowing passages. The bending movements are also symmetrically organised.


Other techniques utilised throughout the score include shaking (grabbing the metal sheets from the lateral sides or from the upper edge) and bowing and rubbing different objects (e.g. small plastic boxes and coffee mugs) on the sheets' surfaces. These techniques are usually performed simultaneously on the two metal sheets, generating an impression of sonic duplication in each section of the piece. Among these techniques, perhaps the most interesting one is defined by the rotational movement of coffee mugs on the sheets' upper corners. The mug's cavity is placed on the sheet's vertex. The metallic corner creates friction against the porcelain once the mug is rotated. This friction produces a number of high, relatively unpredictable overtones. The sheet's vertex could be regarded as a turntable needle capable of triggering different harmonics throughout the turning processes. These rotational movements are also coordinated with the sheets' bending actions, determining mixed acoustic scenarios. Naturally, the friction caused by the mug is also transmitted to the metal surface, generating a reciprocal process of sonic exchange. In this particular context, I find the stylus metaphor significant: the coffee mug becomes a sort of manual turntable that, depending on the turning speed, determines different acoustic effects and levels of friction and resistance. Fittingly, Adorno observed the metaphorical parallelism between pottery and gramophones. Clay is shaped by turning the potter's wheel just as sound is conditioned by the gramophone's gyre.

> The turntable of the talking machines is comparable to the potter's wheel: a tone-mass *[Ton-Masse]* is formed upon them both, and for each the material is preexisting. But the finished tone/clay container that is produced

in this manner remains empty. It is only filled by the hearer. (Adorno, 2002, p.275)

In my work there is a similar process of material shaping. The "tone-mass" is a pre-existing element, defined by the sine-wave transmitted to the surface of the sheets. The process of turning, however, determines the definitive outline of the sound, which is ultimately received and processed by the listener. The mug-turning processes established between the two metal sheets are usually non-coincident from a rhythmic point of view. However, they are always performed during the same sections so that an overall feeling of sonic consubstantiality is generated. The particular rhythmic structure of each of the piece's sections is based on different versions, distinct "readings" of Machaut's ballade. The original rhythmic structure of this ballade's melodic line is compressed elongated, retrograded and rendered in different speeds according to tuplet denominators 3, 5 and 7.

Figure 41: *Isla y Continente* (bars 120-125): coffee mug rotations on the sheets' upper corners. The rhythmical structures are derived from Machaut's *Tres douce dame que j'aour*.
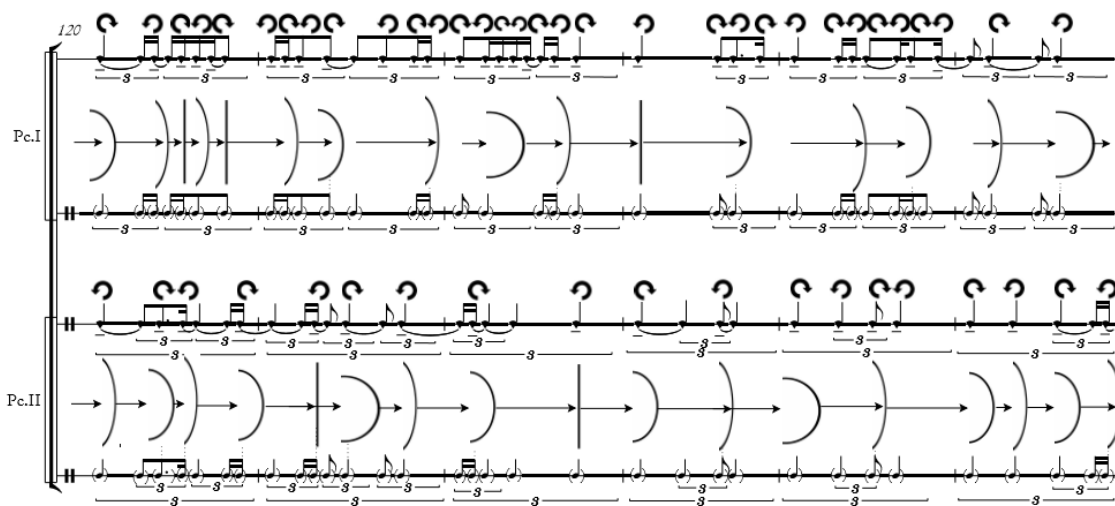
For the most part, there is a general feeling of sonic duplication throughout *Isla y Continente*. Nevertheless, this sense of acoustic parallelism is sometimes challenged by small dissimilarities in bending and in the articulation of the different materials. These divergences in rhythm and articulation are usually organised according to the ballade's rhythmically derived structures. These small differences suggest a bifurcation from the general feeling of sonic correspondence that prevails throughout the piece. In fact, they create a certain tension in the listening experience, a fracture in the auditory continuum that never ends by completely shattering or disrupting the global impression of duplication.

From a metaphorical perspective, the different techniques applied to the metal sheets (especially those involving small objects and resonators) could also be regarded as erosive sonic devices. The sound of the underlying sine wave—a sort of unifying common thread between the

sheets—is transformed, warped and sometimes acoustically masked by the rubbing and bowing actions. Allegorically, these processes of sonic erosion may be compared to the corrosion of steel and other metals in open spaces. The general shape of these materials remains largely unaltered. However, their surface's physiognomy may wear down and change significantly throughout time depending on the surrounding environmental conditions. In this regard, some of Richard Serra's sculptures bear resemblance with my metal sheets, both visually and from a perspective of material erosion. Among these sculptures, *East-West/West-East*—a collection of large (12cm thick and 16m high[23]) rectangular steel plates located in the middle of the Qatari desert— is particularly revealing. The harsh desert conditions—sand storms, temperature changes, etc.—progressively erode and rust the surface of the sculptures, leading to a slow process of appearance alteration. This process is similar, from a comparative point of view, to the sonic distortion operations carried out through the bending movements and the effects performed on the metal sheets' surfaces.

Figure 42: Serra, R. (2006). *East-West/West-East* [steel plates]. Retrieved from: http://www.goo.gl/hGyhib and www.goo.gl/8i1msd respectively.

These "erosive processes" are executed in such a way that a global feeling of sonic duplication is preserved. In *Isla y Continente*, the small sonic and articulation divergences established between the metal sheets operate as the corrosion patches in Serra's sculpture; small areas of differentiation that only condition the steel plate's overall shape and physiognomy to a minor degree.

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[23] Nilsson, 2016, p.146-147.

4.3)   *Piel y Distancia:* **string mirrors**

As discussed in section <u>3.1.4</u>, this sui generis string quartet explores the grey area between an installation and a live performance. To a certain extent, and from a sonic perspective, this work is also characterised by the use of pre-recorded materials. These recordings are mainly derived from the cello's and the violin's sonic universe: long tones, harmonics and short iterative passages. These materials are transmitted to the body of the second violin and cello through transducer speakers.

The use of these speakers is, however, radically different in both cases. The second violin operates as a static sound box, sonically excited by the transducer fixed to its back side. The cellist, on the other hand, shows a fully performative character by rubbing the transducer on the strings and different surfaces of the instrument. In spite of the differences, both the violin and the cello could be regarded as sonic mirrors. These mirrors are self-referential as the instruments' own sounds are projected onto their respective bodies and sound boxes. The second violin amplifies the pre-recorded materials in a clear and transparent manner. Its sound board is particularly effective in propagating the materials played through the transducer. These pre-recorded materials often coincide with those played by the first violin in several passages of the piece. This often creates a sense of sonic link and aural identification between the two instruments. The cello, on the other hand, is used as a complex surface on which the transducer speaker is placed, rubbed and/or rhythmically tapped. The transducer replaces the bow, which is never utilised throughout the piece. The different actions performed with the transducers determine a hybrid sonic realm, a mixture between the pre-recorded materials (cello sounds) and the effects produced by the speaker's friction against the strings and different parts of the instrument.

This combination of elements creates a somewhat tautological result; the cello's pre-recorded sound is transmitted to the body of the instrument, which in turn produces its own sonorities through the process of rubbing/tapping. This could be regarded as a different form of duplication: the instrument operates as an acoustic mirror of itself and at the same time generates a new sonic materiality. Several techniques are utilised to explore the cello's acoustic geography. The most common one is defined by rubbing the transducer on individual strings. The process of friction generates residual tones—glissando-like effects—while the sound played through the transducer is conditioned by the rubbing speed (the quicker the more distorted) and by the specific position of the speaker on the string. These transduced materials generate particular acoustic responses from the strings, exciting distinct overtones by sympathetic vibration. This is especially noticeable in passages where the pre-recorded materials are defined by long static tones.

The notation of these techniques is fundamentally graphic. The fingerboard clef signifies the instrument's geography, indicating the specific place where the actions should take place. The beam position shows the location of the transducer in relation to the fingerboard clef while the graph above the stave indicates the speed variation applied to the actions. The Roman numeral on top of the fingerboard clef signifies the specific string where the actions should be performed.

Figure 43: *Piel y Distancia*, notation of linear rubbing passages.
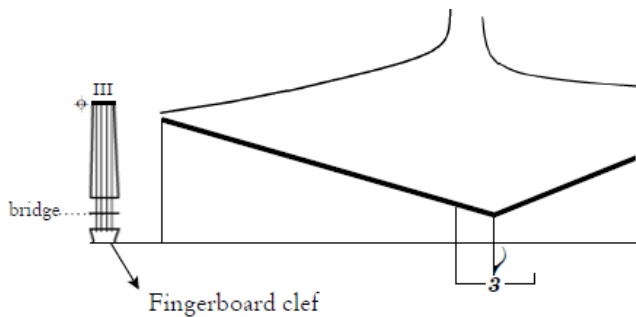
The pre-recorded materials are modulated and sonically transformed by the gradual transitions between different positions and by the fluctuations in the rubbing speed. In this case, the nature of the pre-recorded materials is not always aurally recognizable as it is masked by the effects produced in the rubbing process. From a metaphorical perspective, the cello strings may be regarded as elongated, slightly ductile distorting mirrors, capable of altering the identity of the reflected materials. The speed of friction also determines the amount of residual noise that is generated throughout the course of the performance.

These linear rubbing gestures find a certain lineage in the history of performance practice. The lengthwise displacement of the bow on the strings (as opposed to a typical transversal bowing motion) is observable in many of Helmut Lachenmann's works for strings, chiefly in *Pression* (1969) for solo cellist or the string quartets *Gran Torso* (1971/72) and *Reigen seliger Geister* (1989). Even if the nature of my music is very remote aesthetically from that of Lachenmann, the cello part is occasionally reminiscent of his particular gestural universe. The transducer replaces the bow in order to determine a hybrid instrument, and consequently, a new sonic syncretism. The gestural content is, however, embedded within a specific gestural and performative tradition. From a notational point of view, the cello part is also indebted to Lachenmann. This is displayed by the usage of *prescriptive* notation as opposed to *descriptive* (or traditional) notation. Prescriptive notation is defined by "means of execution rather than resultant configurations of pitch and rhythm" (Kanno, 2007, p.231). Most of Lachenmann's scores display a mixture of prescriptive and descriptive notational strategies, which is also the case in most of my works. The usage of fingerboard clefs, which appeared for the first time in Lachenmann's *Pression*, is particularly

evident in *Piel y Distancia*. These clefs operate as maps, as representations of the instrument's body that indicate a precise location, a specific topos for each of the individual actions carried out on the instrument. In this regard, all the actions performed on the fingerboard are conditioned by the particular resistance and consistency of its materials (the texture of strings, wooden surfaces, etc.). The ultimate sonic product is also defined by the specific velocity of the gestures and the amount of friction generated against the different surfaces. The cello part is not defined by traditional notational parameters but by oblique lines indicating the trajectories and displacements of the transducer on the fingerboard. This notational procedure signifies hybrid sonic events that are the result of a mixture between gesture (movement) and the contact of the transducer with the strings and other parts of the instrument. Tangentially, and even if the nature of my cello part is fundamentally crossbred (a mixture between acousmatic and acoustic effects), the process of sound production finds some resonance in Lachenmann's early notion of *musique concrète instrumentale*.

> In this sort of piece it is common for sound phenomena to be so refined and organised that they are not so much the results of musical experiences as of their own acoustic attributes. Timbres, dynamics and so on arise not of their own volition but as components of a concrete situation characterised by texture, consistency, energy, and resistance. (Lachenmann, 1970)

My approach to the physical manipulation of the transducers may indeed be related to the gestural paradigms of *musique concrète instrumentale*. However, the hybrid nature of the sonic results, the unfamiliar sense of in-betweenness created by the transducers contrasts strongly (and perhaps ironically) with the expectations derived from an idiomatic gestural universe. Additionally, the application of these specific rubbing motions underlines the cello's intrinsic instrumental role. This prevents the listener from identifying this instrument as a mere static sound box or as a resonator for the transducer's amplification.

Apart from the already discussed linear displacements, in *Piel y Distancia* there are a number of different transducer-rubbing motions that generate alternative effects. One of the most common effects is defined by circular movements on individual strings. The transducer's vibrational surface excites the strings by following a circular motion. This generates a somewhat rotational acoustic effect that alters the linearity of the gestures utilised until then. The materials played by the transducer in these passages are defined by recordings of circular bowing on the cello strings. This produces again an impression of redundancy: the circular nature of the pre-recorded sounds coincides with the rotational rubbing motion applied to the transducer. In this respect, this technique could somehow be regarded as a sonic/gestural palimpsest. Circularity constitutes the main articulating feature for both the underlying substratum (pre-recorded sounds) and the

superimposing layer (transducer rotation). In these passages, the first violin and viola also make use of circular bowing as a means of determining a sense of gestural and sonic linkage with the cello part.

Figure 44: circular rubbing on the strings. The first graph indicates one circle per rhythmic figure on the indicated string spot. The second graph symbolizes rubbing the transducer in as-fast-as-possible circles, following the overall direction indicated by the oblique line arising from the top of the stem.
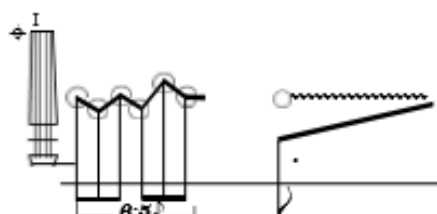
Figure 45: Piel y Distancia (bars 72-76). Circular transducer rubbing (cello) & circular bowing (violin I and viola)

Other techniques performed on the strings include a sort of "transducer tremolo" (rubbing the speaker on the string(s) as fast as possible with a discreet brushing-like, up-down movement) and a "transducer spiccato" (gently tapping the transducer along the indicated string). These two techniques create two distinct effects respectively: a granular, oscillating texture and a percussive, fragmentary, "ricochet-like" sound quality. The latter of these techniques implies, for the first time, listening to the sound of the transducer's actual vibration in the air. This is produced by the brief instants of separation from the string left after each consecutive percussive attack. This reveals, for a few seconds, the transducer's operating mechanism, its true vibrational nature.

Figure 46: tremolo-like rubbing on the strings & transducer spiccato.
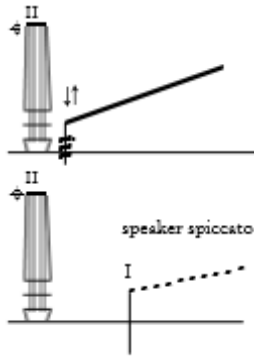
A number of supplementary instrumental areas are utilised for the transducer's placement and rubbing processes. The bridge is particularly effective in transmitting the sound played through the transducer onto the cello's sound board. There, the pre-recorded materials are amplified in a particularly effective and crystalline manner. Several techniques are performed on the wood of the bridge: static positioning of the transducer on different sections of the bridge (usually on the position of each individual string), tremolo-like rubbing (discreet up-down, brushing-like movements), circular rubbing and spiccato-like movements (left-to-right or right-to-left tapping displacements). Additionally, the transducer is used as a sort of inverted stethoscope. The speaker is placed on different spots on the cello's sound board, transmitting the pre-recorded materials to different areas of the instrument and generating different acoustic responses. The nature of these responses varies depending on the thickness of the wood and the proximity to the instrument's openings (f-holes).

Figure 47: different transducer techniques performed on the bridge and on the instrument's body.
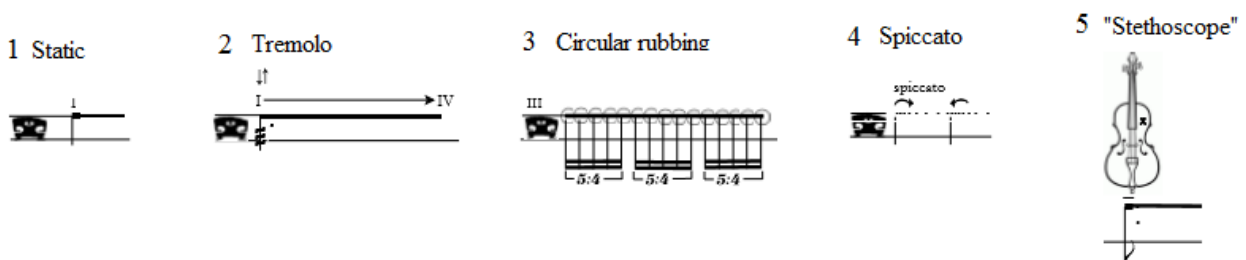
Foucault describes the operational mechanism of the stethoscope, which is remarkably similar to the transducer's mode of functioning. This medical device also involves a sense of sonic displacement and the direct physical contact with a specific surface.

> The stethoscope, solidified distance, transmits profound and invisible events along a semi-tactile, semi-auditory axis. (Foucault, 1973, p.164)

From an allegorical point of view, and as specified before, the cello could be regarded as a sonic reflector. Its body represents the totality of a mirror's surface that encompasses and projects, in a variety of ways, its own pre-recorded sound. Simultaneously, the cello functions as a soundboard that amplifies the residual sounds produced by the transducer's friction. The cello's mirror-like character is therefore based on redundancy, on the concurrent superimposition of several layers of its own sonic identity. The conception of the cello's body as a general, hyper-extended sonic mirror could be compared to Derrida's notion of ontological mirrors, devices able to encompass and appropriate the elements that define reality, not only to reflect them:

> Imagine that mirrors would not be in the world but that things "present", on the contrary, would be in them. Imagine that mirrors (shadows, reflections, "phantasms," etc.) would no longer be *comprehended* within the structure of ontology […] but would rather envelop it in its entirety. (Derrida, 1981, p.324)

In my view, the cello operates in an analogous manner. Its surface encapsulates, reflects, distorts and projects its own pre-recorded sound. The instrument's body becomes a sort of infinity mirror in which different layers of reflection and resignification interact simultaneously.

From a broader perspective, this work generally displays an echoic treatment of the materials, establishing auditory bridges between acoustic instruments (1st violin, viola) and hybrid instruments (2nd violin and cello). This is carried out by the sonic correspondences established between idiomatically performed sounds and pre-recorded materials.

4.4)   *Gyre & Gimble:* the voice and its double

As discussed in section [3.1.5](#), in *Gyre & Gimble* the voice of specific singers is utilised to excite different instruments and objects through transducer speakers. Each of the four rooms that constitute the work's setup is associated with the voice of an individual singer.[24] Therefore, each room's sonic identity is not only defined by these singers' particular vocal features but also by the acoustic qualities of the instruments populating these demarcated spaces.

During the process of composition, a vast number of recordings (more than one hundred) were carried out. These generally involved long tones and speech fragments sung and spoken by the mezzo-soprano, the tenor and the baritone. The pitched materials were based on long tones, framing the syllables of the following words: "idea", "memory" and "look" (these are, in fact, the only words sung throughout the entire score). These long tones were also sung into plastic tubes ending in water bowls—operating as primitive vocal filters—and recorded accordingly. The use of this sort of vocal filter is also particularly widespread throughout the score.

The speech recordings were based on some short passages from *Through the Looking Glass,* read aloud by the aforementioned singers. Crucially, the vocalists in charge of these recordings were exactly the same ones that took part in the first (and so far only) performance of the piece. Paradoxically, this is an element of great importance in the delineation of a feeling of sonic duplication throughout the work and raises relevant questions regarding the feasibility of future performances by alternative vocal ensembles.

The definitive audio samples utilised in the performance (which were ultimately controlled by a Reaper sampler patch and a MIDI keyboard) were the result of an intense process of experimentation. The original recordings were transferred through transducers to the surface of different objects and instruments in order to study their unique acoustic behaviours and sonic outcomes. Eventually, a particular distribution of the materials was outlined, defining a limited number of instrumental families. These were divided according to common acoustic properties and similar sonic results. Each of these instrumental families defines the individual sonic identity of each of the four rooms that define the work's setup.

Room I is characterised by highly resonant instruments: tam-tam and piano (with the sustain pedal depressed). These instruments amplify recordings of all the singers' voices with the exception of the soprano, who does not sing until the very end of the work. The resonance of these two instruments is never stopped or altered. Thus, they usually keep sounding for a few seconds after the transducers cease to vibrate.

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[24] A map of the stage setup can be found on page [84](#).

Room II is defined by the presence of a string ensemble: violin, viola, cello and double bass. This room is mainly associated with the mezzo-soprano's voice. The strings and other areas of the instruments are rubbed with transducer speakers in an analogous way to the cello in *Piel y Distancia*. The same methodology and techniques are explored in this piece (linear and circular movements, effects on the bridge, etc.). In this work, however, the materials transmitted through the transducers are fully based on the mezzo-soprano's voice, determining a set of hybrid instruments in which her vocal identity is intertwined with the sonic universe of the strings. In general, there is a substantial difference between the resonating properties of small instruments (violin, viola) and those of large instruments (cello, double bass). The strings of the cello and double bass create more friction against the transducer and provide larger sound boards. This allows a more explicit process of hybridisation between the pre-recorded materials and the sonic identity of the instruments than in the case of the violin and viola. In general, the rubbing processes are imitational, showing a relatively coordinated intervention of all the string instruments. Consequently, this produces a unified texture in which the same audio file (played simultaneously through the four transducers) blends in with the residual sounds generated throughout the rubbing processes. As opposed to Room I—in which the aural recognisability of the original voices is enhanced by the well-resonant attributes of the piano and the tam-tam— in Room II the auditory identification is challenged by the friction and constant movement of the transducers on the strings. The result is a crossbred one, leaving the aural identification of the mezzo-soprano's voice in an ambiguous area. Ultimately, this generates a complex but unitary texture, a unique and intricate form of sonic syncretism.

Figure 48: *Gyre & Gimble* (bars 6-10). Rubbing movements of the transducers on the strings.
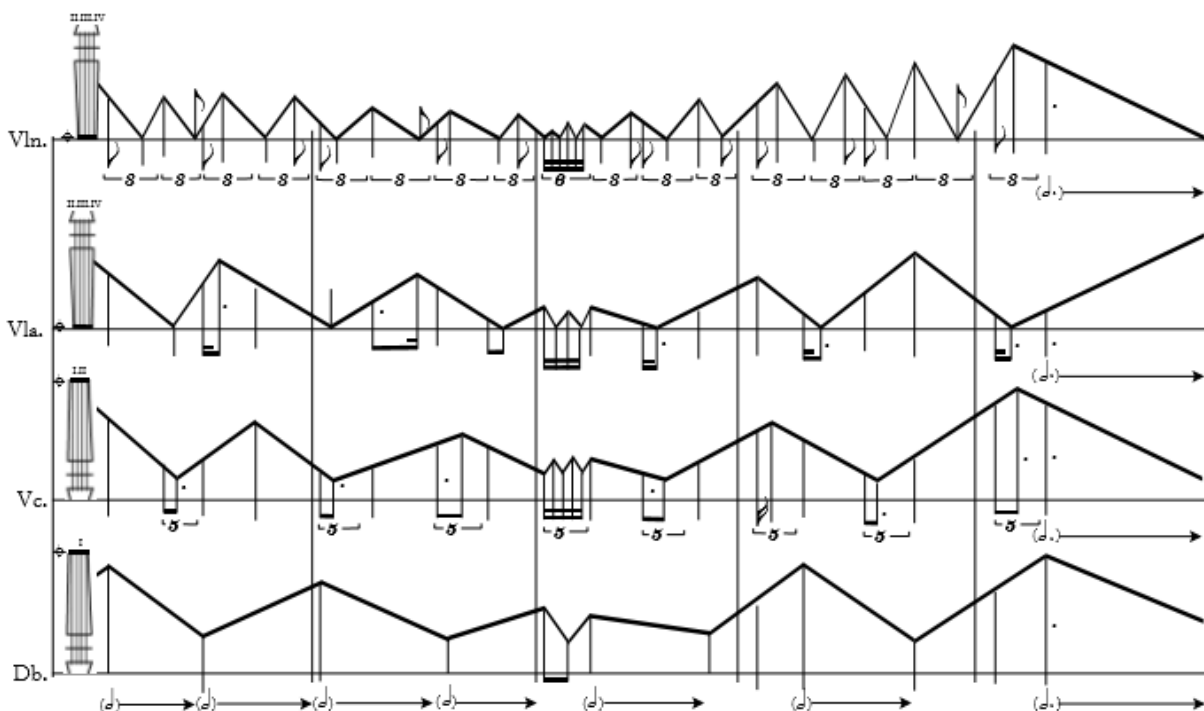
As mentioned in page 84, room III is defined by a number of membraphones—timpani, bass drum and snare drum—with transducers fixed to their drumheads. In general, these instruments are highly effective in propagating the materials transmitted through the transducers (in this case recordings of the tenor's voice). While the bass drum and snare drum operate as static resonators, the individual timpani is manipulated by a percussionist, using the pedal as a modulator. The materials transmitted through the transducer are sonically transformed as the head's tension increases or decreases according to pedal changes. This modulating effect may again be compared to the process of zooming in or out with a camera. Depending on the level of optical magnification certain images are properly focused while others become out of focus. Similarly, particular frequencies from the pre-recorded materials are highlighted depending on the timpani's specific tuning.

A number of supplementary techniques are performed on the timpani's head, adding an extra layer of complexity to the sonic identity of the instrument and blurring, to an extent, the recognisability of the materials played through the transducer. These techniques are mainly defined by rubbing superballs and hitting different beaters on the instrument's head. These are often carried out simultaneously with the pedal changing processes and operate as additional modifiers of the timpani's acoustic properties.

Figure 49: *Gyre & Gimble* (bars 15-18). Notation of the timpani's part and other elements in Room III.
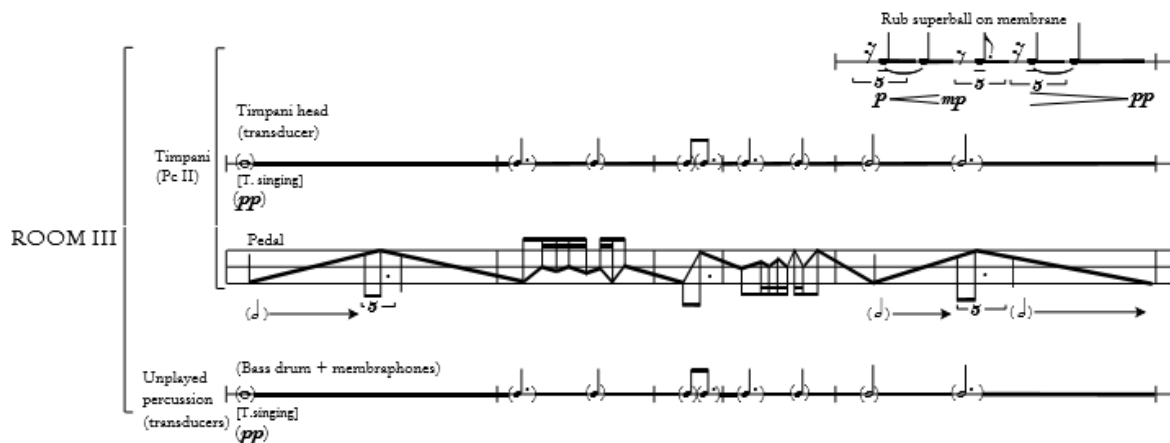
Room IV is characterised by the use of metal as a resonant material. The transducers are fixed to several metal sheets and empty metal tins. The majority of them are utilized as installational elements, hanging at different heights from a number of strategically situated frames and stands. For practical reasons, during the first performance of the piece the metal tins were replaced with small metal sheets in order to achieve a better sound projection. These metal sheets are remarkably diverse in size and shape (the dimensions of the largest one are 2 x 1m while the

smallest is 20cm x 1m). The different sizes produce slightly different reverberating qualities but do not hinder the clear aural recognition of the original sound materials (consisting almost exclusively of recordings of the baritone's voice). In this room, two additional metal sheets are physically manipulated by a couple of percussionists. The materials played through these sheets' transducers are coincident with those transmitted to the hanging sheets. These sheets are utilized in an analogous manner to those in *Huella y Horizonte* and *Isla y Continente* by the application of bending, shaking and rubbing actions. This adds a layer of complexity to this room's overall sonic framework. This space is consequently divided into two halves from a sonic and performative perspective. On one hand, a static collection of metal sheets vibrates almost imperceptibly once the transducers transmit their mechanical energy onto their surfaces (without significantly altering or obscuring the nature of the pre-recorded materials) and, on the other hand, dynamic processes of sonic warping generated by the active manipulation of individual metal sheets. In such a way, and from an allegorical point of view, two kinds of sonic mirrors—static and distorting—are simultaneously suggested.

In this work, there is a constant echoic interaction between the singers and the objects/spaces onto which their voice is transmitted. These echoic relationships take place constantly throughout the score but are often concealed by the distortion processes produced by the acoustic properties of each individual instrument and the supplementary techniques applied to them. Occasionally, this impedes a clear aural association between the original sources and their related sonic satellites. Nevertheless, the process of echoic displacements is a fundamental factor for the work's structural configuration. The singers' pre-recorded voices are utilised as sonic exciters that induce the acoustic response of otherwise inert objects and instruments. This determines an almost dialogical relationship between each singer (with the exception of the soprano)[25] and the specific rooms in which his/her pre-recorded voice is amplified. The interventions of each individual singer usually coincide with the sonic activation of his/her associated room (and therefore with his/her corresponding ensemble or installation). Similarly, the specific vocal techniques performed by the singers on the stage—long-tone singing, singing into water bowls, speaking, etc.—usually coincide with the pre-recorded materials played through the transducers.

Ultimately, the sonic identity of the piece is fully dependent on the individuality of the singers' voices, on their little inflexions and vocal features. The nature of these voices also animates sonically the objects and instruments located in the adjacent rooms. Each singer's vocal peculiarities (individual timbral and articulating characteristics) are then transmitted and multiplied by the use of transducers. Ideally, these vocal specificities should form part of the identity of the

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[25] The soprano is not related to any specific room. As discussed before, she wanders across her fellow singers' territories in the course of her stage journey.

piece, which raises significant questions regarding the suitability of the original electronic part for future performances of the work. This interrogates, as mentioned earlier, the extent to which the feeling of duplication would prevail if different singers were involved in a new version of the piece or, contrarily, whether a complete re-elaboration of the electronic part should be carried out before any new performance. Further questions arise regarding the definitive version of the piece if the electronic part would be constantly reformulated, namely the extent to which the structural framework could consolidate the work's overall identity if the nature of the pre-recorded materials changed frequently. Presumably, as a consequence, this work will always be in a potential state of modification, depending upon the singers' own vocal features and particularities.

Figure 50: *Gyre & Gimble* (bars 34-43). Baritone's part and his associated "room". The pre-recorded materials transmitted through the transducers to the metal sheets largely coincide with the vocal techniques performed simultaneously by this singer.

The soprano's role is also interesting from a point of view of sonic duplication (and also potentially variable depending on the particular rendition of the piece). Her function is defined by a process of mimicry; she shapes her mouth and facial expression according to the materials played through her loudspeaker. These materials are based on relatively modified recordings of her counterparts' voices. This creates an uncanny sense of duplication by which the rest of the singers may hear their own voices, in an illusory manner, once she starts fake-singing (or fake-speaking). The recordings played through her loudspeaker always make reference to the other singers' vocal identity. However, in most cases, these recordings are considerably transformed and distorted by the

use of high and low pass filters, white noise, etc. This often places the aural recognisability of the original source in a fragile, ambiguous territory.

The echoic relationships established between the singers and their related hybrid instruments do not always follow an expected dialectical order of appearance—first the original sources (singers) and then their sonic "replicas". In some passages of the piece, this particular order is inverted so that the pre-recorded materials are heard first, anticipating their actual materialisation on stage by the singers. This is particularly evident in the first bars of the piece, where the tam-tam and the piano amplify the recording of the mezzo-soprano's voice approximately twenty seconds before she begins to sing. This inversion responds to the intention of creating a feeling of temporal reversibility, of altering the somewhat hierarchical relationship between the sonic source and its reflection. As Humphries observes,

> Echo...points to a loss of the Logos, a deferment of origin through the ever repeated, always provisional postulation of a primal anteriority. The first "voice" or origin is always displaced by its own repetition [...] What is being repeated or echoed are other echoes. The question of chronological priority is really moot in this perspective. (cited in Strozier, 1988, p.207)

The echoic interactions are often multiple and simultaneous throughout the score, leading to the concurrent "sonic activation" of several rooms throughout the performance. This creates a complex effect: the aural association between related sources is relatively hindered by the accumulation of sonic events but at the same time reveals the manifold nature of the echoic interactions present throughout the work. Tangentially, this variety of acoustic reflections— produced by the surface and sound boards of different objects and instruments—finds some resonance in some of Plato's notions. The Athenian philosopher observed the distinct sonic reflections caused by the texture of different objects and described the phenomenon in *Phaedrus* and *The Republic*:

> And just as a breeze or perhaps an echo, springing from smooth and solid objects, is borne back whence it set forth. (Plato, 1998, p.61)
>
> The echo of the rocks and the place in which they are assembled redoubles the sound. (Plato, 1989, p.183)

Another relevant element of this work (also from a perspective of sonic duplication) is defined by the presence of a small choir in one of the extremes of the stage. The singers of this

vocal ensemble (whose register matches that of the main singers on the stage: soprano, mezzo-soprano, tenor and baritone) operate as almost concealed and static sonic sources and are sonically related to their scenic counterparts. Their voices are transmitted through long corrugated tubes into the interior of a grand piano with the sustain pedal depressed. The choir's voices are thus dislocated, always heard inside the piano. This lateral choir operates as a halfway element between the actual live vocal performance and the partially acousmatic hybrid universe of the transducers. Occasionally, the choir retakes materials or passages previously sung by the main singers or played through the transducers. Alternatively, in other passages, the choir creates the effect of a distant sonic palimpsest, performing similar materials to those simultaneously executed by the main singers. In both cases, these interactions may be perceived as echoic effects.

Figure 51: *Gyre & Gimble* (bars 145-148). The choir retakes the materials being played through the transducers in Room I, generating an echoic effect.
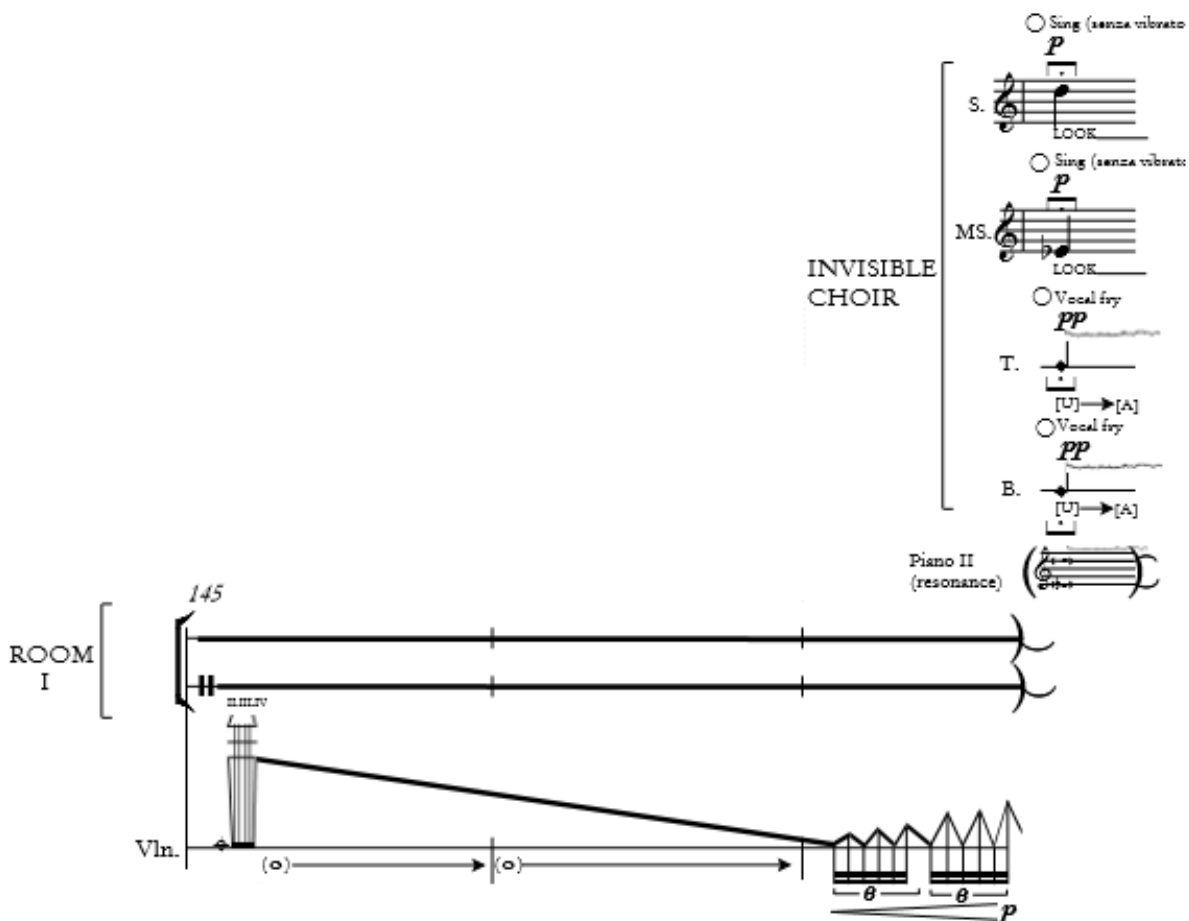
Figure 52: *Gyre & Gimble* (bars 204-205): simultaneous performance of similar materials (speech) by the main singers and the hidden choir.

The choir may also be regarded as a group of doppelgangers that operate as immobile versions or representations of their active counterparts. From a poetic point of view, they may be perceived as external commentators or perhaps as somewhat immaterial extensions of the main singers' psyches. They belong to a static, inaccessible parallel realm, which is only sensed by the onstage singers through the piano's resonant aura. This instrument works as an amplifier and as a connector between two disconnected realms. The only main vocalist that enters the hidden choir's territory is the soprano right at the end of her journey across the stage. Eventually, and from a theatrical perspective, she becomes one more member of the choir, symbolizing the conclusion of a progressive process of objectification. From a different perspective, platonic resonances are evident in the disconnection between the choir and the stage. In the well-known allegory of the cave, Plato describes the dissociation between the echoed voice of the passers-by and the shadows observed by the prisoners. These prisoners do not know any other form of reality than the one suggested by the shadows projected on the wall from objects passing in front of a fire behind them, and by the echoes of voices in the distance.

And suppose further that the prison had an echo which came from the other side, would they not be sure to fancy when one of the passers-by spoke that the voice which they heard came from the passing shadow? (Plato, 1989, p.206)

A similar phenomenon occurs in *Gyre and Gimble.* The main singers on the stage are only able to apprehend elements from the parallel realm—the lateral choir—by means of sonic displacement. The choir remains physically detached; the voices are poured into the piano but these singers do not create any visual contact or physical interaction with their counterparts. The choir voices are perceived as disembodied, ethereal echoes by the main cast, pretty much like the materials transmitted through the transducers onto the different instruments and objects on stage. The link between these two parallel spaces is only unidirectional; the choir voices are channelled into the piano and consequently into the stage realm (the onstage tenor occasionally sings into a corrugated tube, but his voice also ends in the piano's interior, without reaching the choir). Therefore, the presence of the choir's parallel, alternative space is only aurally acknowledged by the main singers, without establishing any kind of communicational process with their counterparts.

4.5) *Nombre y Vacío:* **Hölderlin, speech duplications, language reflections and writing gestures**

In *Nombre y Vacío* (2016), scored for percussion, double bass, piano and MIDI controller keyboard, speech becomes a fundamental material for the outline of duplicated sonic sources. As in previously discussed pieces, some of the instruments (double-bass, piano, tam-tam and one timpani) are often sonically excited by transducer loudspeakers. For the first time in my music, a transducer speaker is rubbed on the piano strings (not just statically fixed to them). In such a way, the sonic hybridisation between this instrument and the materials played through the speaker is determined by processes of friction. Additionally, a fairly unique percussion setup is utilised throughout the piece. It consists, among other instruments, of one timpani (whose drumhead is sonically excited by rubbing a transducer and other small objects), a tam-tam (with a transducer fixed to its central area) and an old reel-to-reel tape player from the 1960s. The timpani's pedal is used as a modulator for the materials transmitted through the transducer while the tam-tam operates as an unplayed resonator. The reel-to-reel player is similar to a standard tape recorder. The materials recorded onto the blank tape of the reel-to-reel player coincide with the ones played through the transducers. These materials are then distorted and manipulated throughout the performance in several ways: turning one of the reels at different speeds, "scratching", lightly tapping the reels, etc.

Figure 53: reel-to-reel recorder utilised in the performance of *Nombre y Vacío* (photograph by the composer)

Figure 54: setup of *Nombre y Vacío* (graph by the composer)
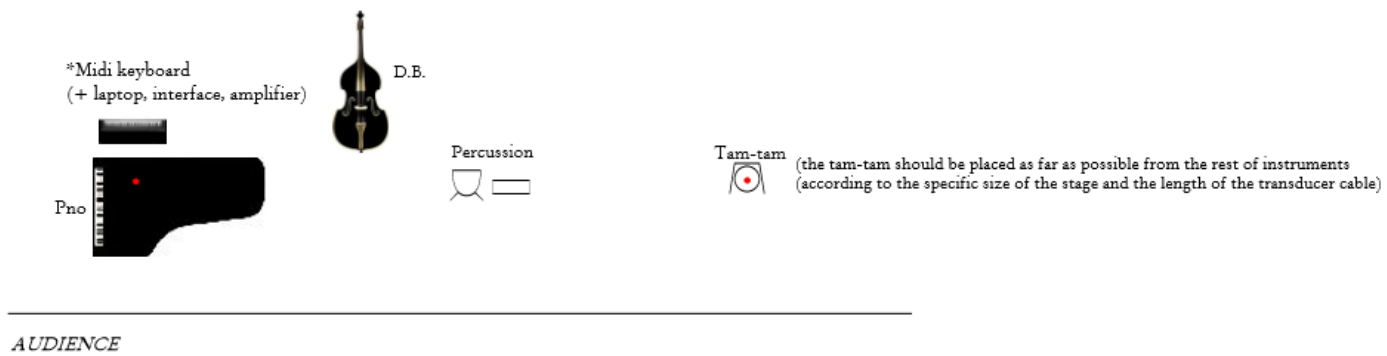
The materials played by both the transducers and by the reel-to-reel player consist of a number of recordings from a hymn by Hölderlin: *Noch Eins ist Aber zu sagen* (Yet One Thing Remains). Several recitations are mixed and juxtaposed generating a relatively uniform sonic layer. Additionally, a few pitched tones (linear sine waves) were added to the background of the speech recordings, creating a structural and auditory link with the pitched materials played by the instruments. The text by Hölderlin is hardly understandable, not only because of the accumulation of different speech layers but also by the process of rubbing and friction against the instrumental surfaces. This unintelligibility is paradoxically related to the semantic content of the actual poem,[26] which describes the limits of language, the ultimate vacuity of meaning and the need for words to resolve, eventually, in silence. This is also somewhat indirectly suggested by the piece's title, literally translated as *Noun & Vacuum*.

Not only speech's sonic properties were relevant for the piece's conception. The poem's syllabic articulation was utilised to generate rhythmical structures, materialised by the rubbing gestures performed with the transducers and other objects. These actions resemble, to a certain extent, the act of writing. The movement of objects (transducers, scouring pads and superballs) on the piano strings, double bass strings and the timpani's head are often derived from the poem's syllabic structure. The speech recordings are rhythmically articulated through these "writing gestures", which in turn are arranged according to the text's syllabic organisation. Ultimately, the

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[26] The poetic fragment used in this piece (*Yet One Thing Remains*) has been extracted from Hölderlin's complete poetic works: Hölderlin, 1995, p.418.

Noch eins ist aber	Denn weil du gabst
Zu sagen. Denn es wäre	Den Sterblichen
Mir fast zu plötzlich	Versuchend Göttergestalt,
Das Glück gekommen,	Wofür ein Wort?
Das Einsame, dass ich unverständig	Und es hätte die Schwermut
Im Eigentum	Mir von den Lippen
Mich an die Schatten gewandt,	Den Gesang genommen
	[...]

combination of pre-recorded materials and the rubbing processes generate a set of interrelated sonic hybrids, crossbreeds between speech and the acoustic properties of the instruments. The emulation of writing is particularly patent in the timpani's case. Its drumhead operates as a blank sheet of paper on which the materials played through the transducer are, from a metaphorical perspective, sonically imprinted.

The similarity of the underlying audio files, all of them based on Hölderlin's recitations, generates a sense of sonic duplication between the different instruments. Even if different acoustic effects are brought out during the rubbing processes, the common sonic layer transmitted through the transducers generates a general sonic unification within the ensemble. In some passages of the work, the specific sentences of the poem driving the underlying rhythmical articulation are quoted on top of the staves, operating as referential messages. This process leaves traces of the original text throughout the score, which might hopefully create instants of reflection and thinking in the course of the work's performance. Additionally, this could be regarded as an almost imperceptible reference and as a concealed tribute to Luigi Nono's late works.

This superimposition of text-related materials (recordings of Hölderlin readings transmitted through the transducers and articulated on the instrumental surfaces according to the poem's syllabic structure) is, once more, related to the notion of palimpsest. To a certain extent, palimpsests are associated with the idea of duplication: textual layers placed on top of other textual layers, materials superimposed over similar materials. This determines processes of erasure and re-texturing. In *Nombre y Vacío*, this is suggested by the stratification of sonic and gestural elements. The nature of the original speech recordings played through the transducers is somewhat erased by the friction created during the processes of rubbing (or "writing", from an allegorical point of view). Thus, the identity of the speech recordings is masked, creating new sonic layers that may in turn be subject to further erasure. These additional processes of deletion/obliteration are explored in the piece by the usage of different objects/beaters (e.g. superballs, scouring pads, various mallets), which are rubbed on the instruments at the same time as the transducers. The manipulation of these objects often follows the rhythmical patterns derived from the poem's syllabic structure. The erasure processes determine new sonic results as well as fluid interactions between the new and previous layers of material.

Figure 55: *Nombre y Vacío* (bars 37-42). Rubbing processes of transducers and other objects on different instrumental surfaces. The quotes from Hölderlin's hymn are notated on top of the upper staves.

During the compositional process for this piece, I became greatly interested in Cy Twombly's painterly palimpsests. Many of his large graffiti-like works include calligraphic designs and scribbles, often layered in palimpsest-like structures that reveal the different phases in which the work was produced. Script is the medium utilized by Twombly to generate material. This is often discontinued and fractured by processes of deletion and overwriting. These processes are, from a pictorial perspective, similar to the stratification of speech and related sonic sources in *Nombre y Vacío.*

Figure 56: Twombly, C. (1968). *Untitled* [oil, crayon & pencil on canvas]. Retrieved from: www.goo.gl/ALUive
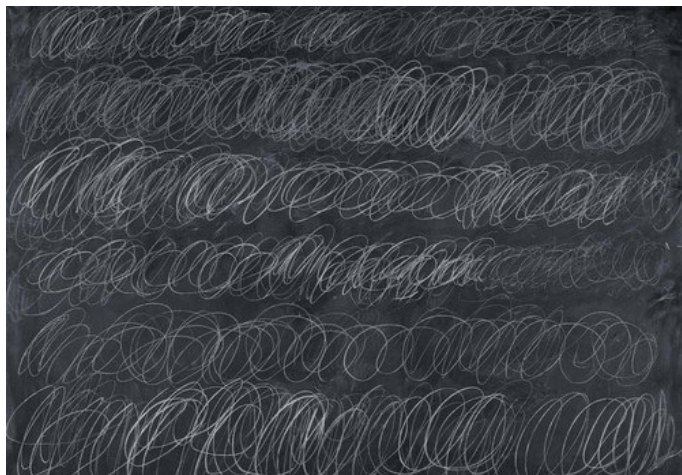
Roland Barthes described the importance of the background layer in Twombly's work as it determines the framework in which the inscriptions and scribbles are drawn, conditioning their inherent materiality and the way in which they are presented. The nature of these backgrounds—their colour, texture, surface irregularities, etc.—is fundamental in Twombly's paintings. They influence the shape, contour, roughness and durability of the materials outlined on them.

What constitutes graffiti is in fact neither the inscription nor its message but the wall, the background, the surface (the desktop); it is because the background exists fully as an object that has already lived, that such writing always comes as an enigmatic surplus... that is what disturbs the order of things; or again: it is insofar as the background is not clean that it is unsuitable to thought [...] and therefore very suitable to everything that remains. (Barthes, 1985, p.165)

In *Nombre y Vacío,* the "backgrounds" are equally relevant. These are defined by the different surfaces and resonant areas of the instruments, which condition the nature and acoustic properties of the materials projected through the transducers. The level of roughness and resistance posed by the different surfaces defines the ultimate sonic texture and the specific effects generated in the process of friction. This process veils the clarity and comprehensibility of the pre-recorded speech to a considerable extent. The ultimate result is defined by an accumulation of sonic layers: residual instrumental effects and speech. In this superimposition, the performative gesture becomes a crucial element in determining the level of audibility of each particular sonic stratum.

The intensity of gesture defines the amount of friction created against the different surfaces and, as a consequence, the dynamics of the instrumental effects in relation to that of the pre-recorded materials. Thus, gesture becomes an intermediary and regulatory element, adjusting the levels of presence and absence of each sonic layer. This generates gradual auditory shifts between the different strata, creating a flexible and dynamic dialectical interplay between different materials. In Twombly's work, this stratification is often perceived as a process of correction, as if the upper layer would prevail over the underlying ones. This is, however, relatively deceptive as the work's identity is, in my view, based on the stratification of erasures, on the presence of faint evidences and remains of past states that establish a dialogue with the foreground materials. A similar effect takes place in *Nombre y Vacío* whereby the shift between foreground and background materials is constant and fluid. Barthes regarded the function of erasure and correction in Twombly's work as an actual procedure, as a means of generating visual palimpsests.

Twombly seems to cover up other marks, as if he wanted to erase them, without really wanting to, since these marks remain faintly visible under the layer covering them; this is a subtle dialectic: the artist pretends to have

"spoiled" some piece of his canvas and to have wanted to erase it; but then he spoils this erasure in its turn; and these two superimposed "failures" produce a kind of palimpsest. (1985, p.179-80)

In my work, the nature of the speech-based audio samples generates a feeling of aural uniformity between the instruments. Even if the friction of the transducers on the instruments' surfaces creates different acoustic responses (different palimpsest-like relationships), an echoic identity is always preserved. This generates an underlying impression of sonic duplication between the instruments, which is progressively shattered as the piece progresses. This is due to the gradual vanishing process of speech-based audio files in favour of pitch-based ones. Eventually, the sound of speech disappears completely. In the last bars of the piece, the transducers only play pitched materials that consist exclusively of recordings of high double-bass overtones.

The process of speech removal coincides with some of the thoughts encapsulated in Hölderlin's poem: *Wofür ein Wort?* [why a word?][27], *und es hätte die Schwermut mir von den Lippen den Gesang genommen* [and melancholy would have taken the singing away from my lips].[28] Clearly, these sentences imply a sense of removal, of a certain distance from language itself, as if the words were about to abandon the poem. This idea is emulated formally in my work by the establishment of a general, progressive verbal fade out. Following this principle, at the end of the piece only the sound of the double bass is transmitted through the transducers. At this point, the double bass becomes a self-mirroring instrument (like the cello in *Piel y Distancia*) as its pre-recorded sound is projected onto its strings and other areas of its geography. The process of speech dissipation is not only carried out electronically through the transducers. It is also symbolized in the score by the placement of the poem's text on top of rests and not above other "sounding" passages, as exemplified by the next figure.

Figure 57: *Nombre y Vacío* (bars 173-185)

The use of superimposed speech recordings—Hölderlin's recitations—for the configuration of the work's audio files could be interpreted as a further sonic palimpsest; an accumulation process that obscures even more the comprehensibility of the actual words. The use of relatively uniform speech-based audio files does not only respond to a strategy to create duplicated sonic sources but, from a figurative and almost illusionistic perspective, to a way of animating inert objects and instruments through the use of words. The evenness generated by the superimposition of various speech layers creates the impression of a general, common sonic substratum, which is distributed among all the instruments on which the transducers are placed. Tangentially, the use and projection of speech as a basal, incomprehensible material finds resonance with some of Benjamin's notions on language, especially those associated with the rather metaphysical idea of an inter-objectual form of communication. According to Benjamin, inanimate things communicate in a sort of silent, ungraspable, imperfect kind of language that is transmitted and propagated through a "more or less material community" (1997, p.67).

> [...] art as a whole, including poetry, rests not on the ultimate essence of the spirit of language but on the spirit of language in things, even in its consummate beauty [...] Language itself is not perfectly expressed in things themselves. This proposition has a double meaning, in its metaphorical and literal senses: the languages of things are imperfect. (Benjamin, 1997, p.67)

The distribution and transmission of speech-based materials onto the body of the instruments could metaphorically be interpreted as a representation of Benjamin's intangible communication processes established between inanimate objects. This network of language-based sonic materials constitutes the sonic framework of the piece and operates as an almost concealed set of references to Hölderlin's enigmatic stanzas. In this work, language is mostly deprived from its semantic content. It becomes an underlying sonic layer that unifies the different sources on stage and creates a feeling of acoustic duplication. The poem's semantic content is, however, somewhat conveyed by the actual structure and distribution of the materials throughout the piece. Speech gradually vanishes in *Nombre y Vacío*, just as words seem to cease in *Yet One Thing Remains*.

4.6) *Mano y Mente:* **circularity, multiple transmissions, spectres and background reflections.**

Mano y Mente (2017) is a work for solo percussion, scored for a reel-to-reel tape player from the 1960's, tam-tam and a large number of bowls and other small objects. The tam-tam is never played by the percussionist but resonates by means of a transducer fixed to its central area. The audio file played through the transducer consists of a slowly and gradually ascending sine wave. This sine wave is always present in the background, appearing and disappearing according to gradual processes of volume increase and decrease. The rest of the instruments utilised during the performance are placed and manipulated on a relatively large table.

Figure 58: setup of *Mano y Mente* (graph by the composer)
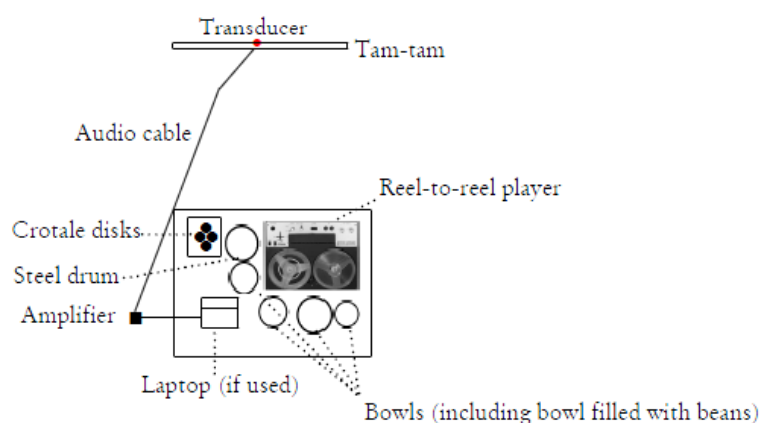
The objects placed on this table consist of a small steel drum, the old reel-to-reel player, crotales and six small bowls of different materials (ceramic, wood, glass and a larger one filled with water). These bowls are used in several ways: as containers into which different objects (small dry beans, marbles, golf balls, Baoding balls) are poured and/or as receptacles subject to different processes of manual rotation. In general, throughout the piece there is a process of transmission by which the beans and marbles are poured from one bowl into the next one. This generates different acoustic effects depending on the materials the bowls and containers are made of. In some occasions, the beans and marbles are poured onto a set of crotales, creating a twinkling metallic effect. Ultimately, this process of transference ends in a bowl filled with water. The beans are dropped into the water and thus become irrecoverable for further pouring processes.

Figure 59: setup of *Mano y Mente* (photographs by the composer)

The different objects poured into the bowls are often subject to a process of circular rotation, created by turning the bowls at different speeds. This adds specific levels of acceleration to the marbles, golf balls and Baoding balls as they tend to spin gradually faster once the bowls are rotated. This process of turning generates an overall impression of circularity throughout the piece. The motion of the spherical objects within the bowls generates different acoustic responses depending, once more, on the resonant properties of each container. A particularly interesting effect is generated by the steel drum. The contact of the different objects with the instrument's metal plates excites different diatonic pitches. The individuality of these pitches is more clearly perceived at a low turning speed.

This sense of circularity is also clearly observable in the reel-to-reel tape recorder. This device's mechanism operates by the regular rotation of two reels that spin the magnetic tape on which the audio is recorded. In my work, this impression of circularity is exacerbated by the artificial changes of speed applied to one of the device's reels. This is carried out by the manual turning of the left reel, which is performed by holding a small tab fixed to the bobbin's surface and rotating it in a clockwise direction. The speed changes—either artificially accelerating or slowing down the reel's regular velocity—generate a process of sonic distortion of the materials recorded on tape. The variation applied to the turning speed is carefully indicated by specific linear graphs on top of the reel-to-reel stave (the higher the line the quicker the action, see figure 60).

Usually, there is a simultaneous use of the two hands throughout the piece; one generally in charge of the reel-to-reel player and the other manipulating different bowls. There is a partially coordinated usage of circular gestures, materialised by the concurrent movement of the two hands. This feeling of gyre, of rotation, is also noticeable from an aural perspective. Increasing the turning speed intensifies each bowl's dynamics while accelerating the reels raises the pitch of the materials recorded on tape. As a result, the delineation of circular movements by the two hands may be perceived as a form of gestural duplication.

Figure 60: Mano y Mente (bars 1-8): simultaneous reel turning and rotational movements applied to the ceramic bowl.
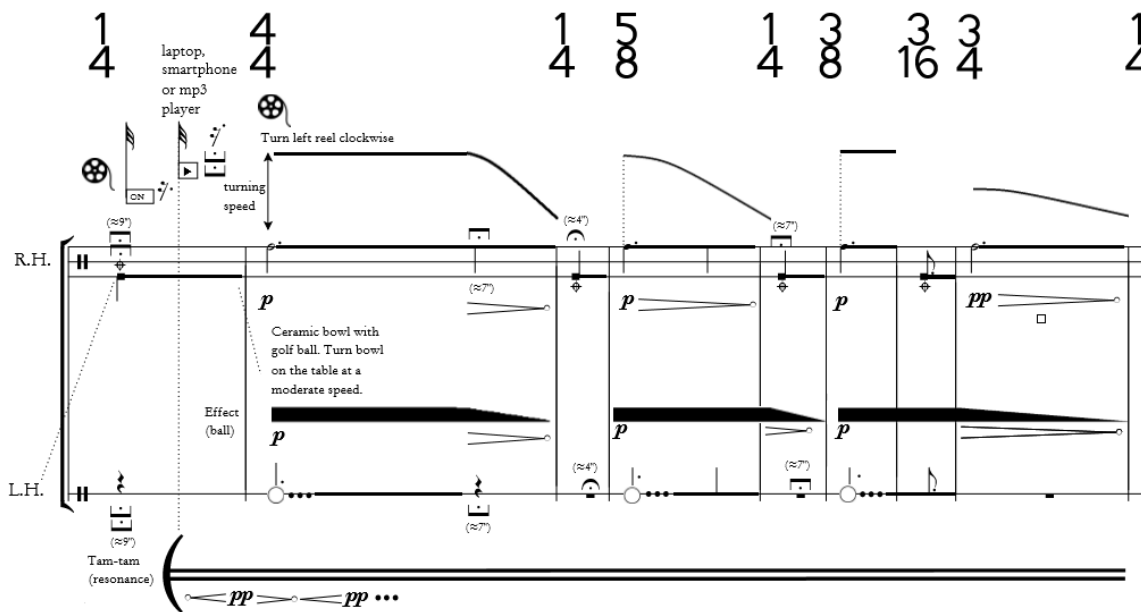
The use of each hand as an individual operative entity responds to the metaphorical idea of splitting the percussionist's performative role into two somewhat independent—and often mirroring—parts. The piece's chiral character implies a clear structural dualism, two parallel and interrelated material layers interacting at the same time. This is also somehow reflected in the work's title, *Mano y Mente* (literally "Hand & Mind"), which implies a certain division and disjunction of the performer's identity.

The reel-to-reel player's materials—defined by a slowly ascending sine wave—coincide with the audio file played through the tam-tam's transducer. This sine wave was recorded onto an old magnetic tape, which contained old recordings of unknown people speaking: domestic conversations, holiday recollections, etc. The sine wave was therefore superimposed over these voices, which are always discreetly present in the background. These may be potentially perceived as ghostly appearances, as sonic spectres that emerge from the uniformity of the sinusoidal wave. Therefore, throughout the piece there is an indirect access to a relatively private sonic realm, to the

voices and recollections of random individuals. For me, this adds a further poetic component to the piece, creating an alternative, somewhat concealed but evocative sonic substratum. The usage of ghostlike verbal traces in this piece finds resonance with some of Gerhard Richter's works. Richter's quasi-photographic portraits are often slightly blurred, out of focus, as if a patina of *sfumato* veiled the images' original definition. This creates a particular effect by which the portrayed faces and bodies acquire a somewhat spectral presence. In order to achieve this, Richter would gently sweep the brush across the original painted images until obtaining the desired level of blurriness. In some of the portraits—such as the one shown in next figure—the body is so diffused that almost blends with the background horizon.

Figure 61: Richter, G. (1971). *Portrait Dieter Kreutz* [oil on canvas]. Retrieved from: https://goo.gl/c9GKOd

From a sonic perspective, the masking effect created by this sine wave over the pre-existing speech is similar to Richter's blurring process. This sine wave conceals and dilutes the audibility (and thus the comprehensibility) of the underlying speech. Eventually, only a filtered trace of the actual words permeates through this slowly ascending pitched line. The ghostlike sonic presences inhabit an area of in-betweenness, an undefined border between foreground and background. This is also clear in some of Richter's portraits in which images seem to emanate from the background but without ever reaching the sharpness of the foreground, as if they were behind a veil or an unclean glass. This borderline state defines the nature of spectres, as Sauter (2014) observes:

> A ghost is neither absent nor exactly present [...] In other words: he is luminal in nature; he is nothing but pure border. The ghost himself is the border between two realms: absence and presence. (p.216)

Evidently, a feeling of sonic duplication is established between the reel-to-reel player and the tam-tam as they play the same sine wave. However, this sonic concurrence is often shattered by the processes of turning and speed variation applied to the reel-to-reel player. Throughout the work there is a constant shift between states of distortion and a standard, idiomatic reproduction of the tape's materials once the reels are not manipulated. This creates an aural alternation between sections in which an impression of sonic duplication is clearly established between the two instruments and passages in which this effect is suddenly interrupted.

This sense of duplication is also progressively modified. Whereas the tam-tam's transducer plays the audio file from the beginning to the end, the reels are often manipulated and rotated in an opposite direction to their standard motion. This implies that the tape is frequently rewound to an earlier point. In such a way, the intervallic relationship established between the tam-tam and the reel-to-reel player is altered several times over the course of the performance. In fact, the intervallic distance becomes larger and larger as the work progresses. Additionally, as discussed before, the occasional presence of "sonic phantasms" conditions, to an extent, the feeling of aural duplication suggested between the two different sources.

Another kind of acoustic duplication is established in passages where two bowls are simultaneously rotated, inducing, as a consequence, the parallel circular motion of the objects contained in them. Even if the ultimate acoustic result may differ, the articulation of the materials in a circular fashion may create an auditory linkage and an impression of sonic reciprocity between the two bowls. In this case, the precision of each hand's gestures (performed in an imitative or quasi-symmetrical manner) becomes a decisive element.

Moreover, during these sections, a clearer sonic correspondence is established between the tam-tam and the reel-to-reel player as the performer is physically unable to manipulate the reels. Therefore, sonic equivalences are established both in a left-right and a back-front axis (the bowls are placed on the table, parallel to the audience, while the tam-tam is located behind the performer and the reel-to-reel player—see figure 58). Hence, this particular setup allows a cross-like set of acoustic bridges between complementary instruments.

Figure 62: *Mano y Mente* (bars 81-88), coordinated turning movements applied to two different bowls.

In this work, the two hands operate as rotational devices that suggest different turning speeds, coincident and independent cycles and loops. From a perspective of gestural semantics, the largely horizontal circular movements of the hands symbolize cyclicality and periodicity.

> A round trip that resembles going and returning, ebb and flow, is represented by an advance followed by a retreat of the hand. But a recurrence 'without going back' can only be evoked by a circular movement forwards. When this gesture is repeated it corresponds to the notion of a cycle [...] which supposes the repetition of a series of events in a determined order. (Calbris, 2011, p.151)

This feeling of cyclicality is also suggested by the reels' standard turning motion. The circular process of tape winding, typical of this kind of analogue devices, is based on a rotational, spindle-like mechanism. The reels are mounted on a spindle, which is set in motion by a small motor (as a matter of fact, the discreet sound of this motor as it spins becomes an additional layer of the work's sonic framework). This impression of periodicity is also noticeable in the case of the tam-tam. The audio file played through the transducers is subject to gradual and regular changes in dynamics: crescendo and decrescendo, emergences and dissipations. This suggests a sense of regularity, a cyclical shift in the level of presence of this background resonance.

Figure 63: sketch of *Mano y Mente* (drawing by the composer)
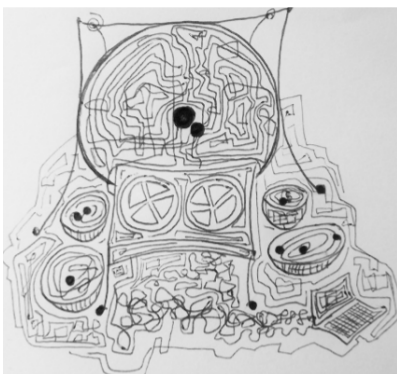
Chapter five: a unitary sense, paradoxes and potentialities

In the previous chapters I have attempted to analyse and study the phenomenon of duplication in my own works and music history from spatial, performative and sonic perspectives. Even though this division is helpful in highlighting some of duplication's specific aspects and derivations, the nature of this phenomenon is often more complex, defined by the sum and simultaneous interaction of several spatio-gestural and sonic elements. Often these components are inseparable, as their junction defines the overall audio-visual experience. The duplication of gestural and sonic elements is often perceived as a unitary phenomenon, conditioned by the concrete spatial and acoustic circumstances in which it takes place. Evidently, the perceptual processes involved in the identification of duplication cannot be reduced to the specific categorisation and compartmentalisation proposed in my analysis. This is a far more intricate and convoluted process that is ultimately conditioned by each individual's perceptual idiosyncrasies.

In this regard, even if my analysis intends to be exclusive and precise in the approach to certain topics and issues, a number of elements only partially or tangentially related to the main topic of discussion end by emerging. This is nevertheless necessary to build a general picture and to establish a properly intelligible context. This is particularly evident in the third and fourth chapters, where occasional references to sonic and spatial issues are respectively displaced in order to create appropriate conceptual frameworks. Thus, a number of topics and elements that do not strictly deal with the chapter's main issue—but may be related to the next or previous chapter's content—have been alluded to for the sake of clarity. The techniques applied to the metal sheets in *Huella y Horizonte* and *Isla y Continente* are paradigmatic examples of this ambiguity. The curvature levels achieved through the bending processes can be clearly categorised as spatial elements, as they configure visible symmetries and parallel shapes on the stage. However, the simultaneously generated acoustic effects cannot be detached from these spatio-gestural implications; both elements are directly interrelated and dependent upon each other. Therefore, in general, the overall audio-visual experience of duplication is far more fluid and heterogeneous than possibly suggested in the course of this thesis.

Another issue that greatly conditions the perception of duplication is our feasibility of comprehending the totality. This is particularly true from a visual perspective. Duplication involves a minimum of two elements, which in a clearly dynamic, performative environment, require a multiple and simultaneous process of observation. This is often challenged by issues such as the distance between the instruments/performers and by the total number of visible elements on the

stage. Naturally, this is compensated by the process of sonic duplication, which suggests a concomitance between the different sources even if they are not visually apprehensible at the same time. Other problems arising from this study involve the level of sameness or difference—from both aural and visual perspectives—necessary in order to suggest a sense of duplication. This is mainly dependent upon individual perception. Hence, differentiating between what is duplicated and what is not becomes, at times, an altogether personal task.

Even if duplication's level of significance in my music varies from piece to piece, its immanent presence operates as a guiding thread between the works. The relevance of duplication for the listener's experience may be, as stated before, a subject of conjecture depending on individual perception and particular auditory priorities. Nevertheless, in my eyes, the usage of duplication involves a set of aesthetic principles that transcend the experiential domain and end by driving the actual compositional processes, even if this is not always evident or easily perceivable. These principles condition the treatment of the materials and their spatial signification and eventually determine a series of concrete stylistic features.

In my music not only are the compositional processes influenced by duplication, but also most of the pre-compositional conceptions are as well. The initial ideas tend to appear as spatial drafts, often implying duplicated instruments, singers and/or resonant objects. Consequently, in my case, the notion of duplication usually predates sound and form, the process of mirroring becomes a preliminary substratum from which the rest of ideas are derived. These pre-compositional ideas are usually influenced by the mirror as a concrete and figurative device. The issue of distance, place and displacement, oneness and multiplicity are already present in this embryonic state, setting the framework for further considerations and compositional developments. The mirrored spatial distribution of instruments, performers and objects is usually a central aspect of this preliminary state, opening the door to potential sonic and spatial duplication processes, further displacements and acoustic paradoxes. This kind of spatial complexity, embedded in my own pre-compositional thinking, finds once more an echo in Foucault's thoughts on reflectivity and the mirror.

> By duplicating itself in a mirror the world abolishes the distance proper to it; in this way it overcomes the place allotted to each thing. (2001, p.22)

In my recent works the notion of duplication pervades the entire compositional process, from the earlier steps in the piece's conception to the subsequent structural and material development, possibly permeating into new works.

As revealed in the second chapter, the significance of sonic and performative duplication in the history of music is considerable. Nevertheless, it is rarely regarded as an autonomous or independent factor but rather as a corollary or as a side effect of different musical, gestural, spatial and architectural concerns. In the course of this thesis I have attempted to demonstrate that duplication, in all its forms, can also be an original and transcendental point of departure for the creation of a personal compositional language. Duplication involves a number of possibilities and potential ramifications that transform it into an almost interminable source of creative elements. This potentiality is defined by an endless number of feasible displacements and the decentralization of sonic and performative sources, which allows complex spatial interactions and the generation of unexpected acoustic phenomena. Mentioning all the possibilities of duplication would be a nearly impossible task. As an illustration, however, I would like to concisely enumerate and describe the aspects of duplication that have had a direct impact in my compositional language, focusing on their possible applications and potential creative implications:

Discovering new sounds and/or unveiling the nature of disregarded materials

Duplication may operate as a tool for discovering new and ignored aspects of the actual sonic sources that would otherwise remain unacknowledged. In such a way, the duplication of a specific sound or gesture underlines and highlights its inner features; it discloses aspects that would otherwise remain at a secondary or subordinate level. The process of disclosure is generally achieved through the simultaneous multiplication of specific sounds and effects, which are consequently emphasized and reinforced. This unveiling aspect coincides, to a considerable extent, with some of Arthur Danto's ideas on philosophical duplication.

> The possibility of doubles, in which the pairs are exactly alike relative to some schedule of descriptions, may reveal factors outside this set with reference to which our attitudes toward one or the other of the counterparts may differ. The method of philosophical duplication is a powerful lever for lifting factors into consciousness, which otherwise might never have been acknowledged – presuppositions upon which our attitude towards the world has always depended, though we might not have realized their crucial role, since it never had been challenged. (Danto, 1999, p.213)

Creating alternative listening and perceptual contexts

The discovery of new effects and the processes of sonic disclosure may determine specific conditions for the actual listening experience. The process of sonic duplication may alter and influence the behaviour of the materials at hand and the subsequent process of reception. In this

regard, the conscious design and configuration of particular auditory environments may be an effective tool for the active manipulation of the listener's perceptual conditions. The feeling of physical displacement and disorientation is a typical effect of distorting and infinity mirrors. Similarly, sonic doubles imply a certain auditory decentralisation, a dislocation of the sound sources that may lead to a state of sensory alienation.

Outlining complex spatial relationships

Another likely application is defined by the outline of spatial relationships and the demarcation of audio-visual territories. The use of duplicated sources is particularly effective in this regard as coincident sonic and visual entities usually suggest a sense of belonging and interdependence. Even if small, a certain amount of separation and distance is always established between these related sources. This in-between space can be regarded as a confined territory in which the processes of sonic exchange take place. This might be a useful resource for works that aim at establishing complex spatial interactions between various sonic sources. Following this line of thinking, another potential derivation of duplication may involve the suggestion of parallel spaces. This is mostly accomplished by the use of acousmatic and/or invisible sonic sources that reflect the materials played live onstage. An auditory linkage is then established between the observable and non-observable domains. This may create the impression of alternative, inaccessible universes, connected to the observable realm by a series of audible reflections and shared sonic materials.

Generating sonic uniformity

This potential application is defined by the creation of sonic continua, by the generation of acoustic evenness and flatness. This is achieved through the seemingly transitionless exchange of identical and similar materials between a number of instruments and/or sonic sources, generating homogenous sonic strata.

Mirrors and doppelgangers

From a visual perspective, working with performative doubles (doppelgangers) and duplicated objects and instruments may be effective in defining mirror-like scenarios and specular gestural configurations. These may concur with simultaneous processes of sonic duplication, reinforcing the overall audio-visual experience or, contrarily, may operate as separate, individual entities. Our fascination for the reflecting and displacing powers of the mirror—so often emulated and displayed

in literature, cinema and other art forms—responds, ultimately, to the actual object's liminal nature. The mirror operates as a borderline between utopias and heterotopias, representation and reality, sameness and otherness, etc. Eventually, our confrontation with the mirror questions our identity and the truthfulness of our senses:

> This virtual duplication of stimuli (which sometimes works as if there were a duplication of both my body as an object and my body as a subject, splitting and facing itself), this theft of an image, this unceasing temptation to believe I am someone else, makes man's experience with mirrors an absolutely unique one, on the threshold between perception and signification. (Eco, 1986, p.210)

Creating poetic and metaphorical associations and references to the subconscious

A number of symbolic and evocative aspects may also be linked, in an allusive manner, to the concept of duplication, producing, in some cases, allegorical and subconscious connotations. The implications derived from echoic and mirroring interactions may be useful for generating particularly suggestive poetic contexts. The role and signification of the subconscious is also potentially brought to mind by duplication. In this regard, Freud's essay on the uncanny is especially revealing. According to Freud, the duplication of the familiar is responsible for engendering the *Unheimlich,* a feeling of the unnatural. This is produced by the identification of a chopped part of our natural identity in everyday objects and other people, evoking in us a feeling of unfamiliarity:

> A person may identify himself with another and so become unsure of his true self; or he may substitute the other's self for his own. The self may thus be duplicated, divided and interchanged. Finally there is the constant recurrence of the same thing, the repetition of the same facial features, the same characters, the same destinies (Freud, 2003, p. 142)

The potential applications of duplication clearly exceed the scope of this limited list. The combinations and interactions of this phenomenon's different modes of manifestation are manifold. It is precisely this versatility, this sense of multiplicity that gives duplication (in all its possible forms) such a conspicuous role throughout the history of art. As a composer, I intend to represent such diversity by addressing different issues and forms of this phenomenon in my works and by integrating them into a personal aesthetic universe. Although the technical and practical aspects of duplication are central to my music, creating a poetics around it is an even more ambitious

objective, as the construction of a defined poetics involves a sense of continuity and consistency throughout a corpus of works. In this regard, duplication should operate as a recurring and consolidating element, permeating through the identity of the compositions.

Thus, extrapolating the specific poetic and evocative properties of duplication into the foreground of the actual pieces—and thus highlighting its attributes—may define and consolidate a specific aesthetics. Hopefully, in my music these processes of extrapolation and disclosure are apparent enough to suggest a compelling sense of aesthetic cohesion and integrity. Alternatively, from an allegorical perspective, duplication may be compared to a self-referential mirror; a device able to multiply, replicate and expose one's personal compositional procedures, material preferences and poetic universe. In this respect, the function of duplication may transcend its actual set of roles and behaviours and become a tool for unveiling and reflecting one's unique artistic features. This may also lead to a deeper awareness of one's particular creative identity, as admirably expressed by Borges in *Ars Poetica:*

> A veces en las tardes una cara
> nos mira desde el fondo de un espejo;
> el arte debe ser como ese espejo
> que nos revela nuestra propia cara[29]
> (1999, p.161-162)

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[29] At times in the evenings a face
   Looks at us out of the depths of a mirror;
   Art should be like that mirror
   Which reveals to us our own face
   (Borges, 1972, p.157)

Appendix

One of the works composed over the course of this PhD, *Title 14,*[30] is not strictly related to the main subject of research. The composition of this work responded to a professional compromise (a commission from the Impuls Festival in Graz) undertaken before the actual PhD started. Here is a short description of the piece:

Title 14 (2014): for flute, clarinet, alto saxophone, harp, piano, violin, viola, violoncello
Duration: 10'
First performance: 25/02/2015, Klangforum Wien, conducted by Clement Power at Mumuth Graz.

      This work is based on the iteration and almost constant reinstrumentation of short musical gestures. These are rearranged in different ways throughout the score, interlocked amongst relatively static, horizontal segments that revolve around specific pitch centres. These gestures are expanded, compressed and at times frozen throughout the score. This piece is structured in a number of quasi-independent panels, a formal approach observable in many of my works. Each different panel focuses on a specific sound universe based on different combinations of already presented materials. Ideally, each panel may generate a new perceptual condition, without losing a sense of continuity and structural consistency.

      Additionally, my work *Room & Elbow* (2016)[31] could be regarded as a reorchestration of *Piel y Distancia* (see sections 3.1.4 and 4.3). A metal sheet with a transducer fixed to its surface (manipulated by a percussionist) and an unplayed piano with transducers fixed to the lower strings were added to the setup. These new instruments were utilized as resonators for the materials played through the transducers. These materials coincide with the pre-recorded sounds transmitted to the strings and sound boxes of the cello and the unplayed violin in *Piel y Distancia*. This process produced a series of additional echoic interactions between the incomplete string quartet and the newly incorporated instruments.

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[30] Score of this work: https://1drv.ms/b/s!AoRvEdlR5f1XghIneneGq8ILxDmh
[31] Audio of this work: https://soundcloud.com/abel-pa/room-elbow, score of this work:
https://1drv.ms/b/s!AoRvEdlR5f1XghNW6zjjT5YnCifN

Figure 64: setup of Room & Elbow (graph by the composer)
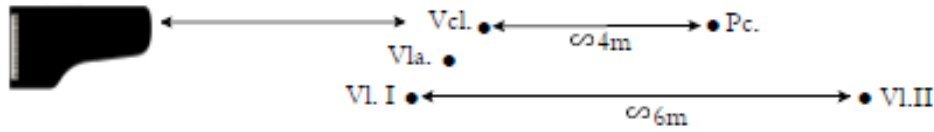
Room & Elbow (2016): for violin, viola, violoncello, percussion, unplayed violin, unplayed piano, transducer loudspeakers and midi controller keyboard (1 player).

Duration: 13'

First performance: 31/11/2016, Vertixe Sonora Ensemble, conducted by Pedro Amaral at the Reina Sofía Auditorium (Madrid).

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