New concepts and techniques in eco-composition

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This paper has two main objectives: (i) to discuss essential concepts of the ecological approach to composition, proposing the term *eco-composition* as a common reference for theoretical perspectives and compositional techniques; and (ii) to present the multimedia piece *Vivir sin después*, realised within the context of the *Paititi Project*.

Following the Introduction, the paper is divided into two main sections. In section 2 we discuss issues raised by the application of the ecological approach to composition. Regarding the data-gathering procedures, eco-composition provides two effective methods: re-enaction and anchoring. Organisation of sonic materials is done through accumulation of heterarchical layers, giving rise to emergent musical phenomena. Section 3 dwells on the compositional strategies applied in the multimedia installation *Vivir sin después*. We describe the process of re-enacting the first Spanish trip through the Amazon River Basin, carried out by Francisco de Orellana and fifty-nine Spaniards in 1541. Then we address technical aspects of the piece, such as the application of multiple views of single entities, the development of non-hierarchical forms and the manipulation of sonic fields.

1. INTRODUCTION

Paititi: A multimodal journey to El Dorado is an audio-visual installation that focuses on the current situation of the Amazonian region having as a geo-historical frame the first expedition into the Amazon, carried out in 1541 by a Spanish group led by Captain Francisco de Orellana (Carvajal 1542/1992). The work is divided into chapters, which are designed as self-contained multimedia pieces. This paper focuses on the eco-compositional processes applied in the creation of one chapter of *Paititi*: *Vivir sin después* / *É hoje* / *To day*.

Vivir was composed applying ecologically based techniques to the collection, editing, transformation and organisation of the audiovisual material. The acquisition of images and sounds was done through the re-enaction of the Spanish journey along the Napo-Amazon waterways. The processing of the video footage was aimed at obtaining multiple perspectives of single scenes. Accumulation and modularity were utilised to generate and organise the sonic data. Sounds were distributed as sonic fields encompassing and extending the spatial and temporal characteristics of the recorded sound material.

Both editing and processing of the audio material were moulded on the ecological paradigm: materials were selected and organised to create a spatially and temporally consistent environment (Keller 1999). Ecological modelling (Keller 2004; Keller and Berger 2001) was used for the synthesis and spatialisation of environmental sounds. The spectral profile of the synthetic sounds was matched to the characteristics of the recorded sounds.

The first section of the paper will discuss emerging issues raised by the application of the ecological approach to composition: form emergence, heterarchy, accumulation, anchoring and re-enaction. Aspects of the application of eco-composition in installation formats – such as multimodality and image–sound relationships – will also be addressed. The second section will focus on specific techniques of eco-composition as they were employed in *Vivir sin después*: re-enaction of the Orellana journey, multiple views of single entities, non-hierarchical forms and the sonic field.

2. ECO-COMPOSITION

As Georgina Born (1995) stated, a large portion of current computer music research and composition locates itself within the cultural practices of European concert music. Mirroring the views held by well-established areas of musical activity, some electro-acoustic composers maintain that their practice is independent from social, political or racial concerns. They hold that music should represent a universal and timeless language. This concept may appear innocuous in itself. But when backed by institutional structures and educational practices, it becomes a powerful mechanism of censorship and, more important, a *de facto* measure of artistic quality.

Starting in the early 1970s, an environmentally grounded approach to music began to question the view of music as an abstract succession of notes (Schafer 1977). Soundscape composers applied cutting, splicing and mixing to recorded sounds, generally keeping processing and transformations to a minimum (Westerkamp 2002). As a reaction to the dominant

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autonomous approach, soundscape composition enforced a careful contextualisation of the recorded sounds. Thus, composers strived to place sound sources within a specific social, cultural and geographical milieu (Truax 1992).

Inspired by the Soundscape initiative, at the turn of the century, several composers are bringing together environmental processes and musical techniques (Keller 2000; Fontenele 2004; Burtner 2005; Di Scipio 2005). This perspective has been christened with various terms, denoting specific aspects of each composer's practice. Nevertheless, a common denominator of these approaches is the closely knit integration of sound processes shaped after natural phenomena with formal, perceptual and/or social factors wrought by the material of the work. In a recent critique of our multimedia piece, *Vivir sin después*, art theorist Robert C. Morgan used the term 'eco-composer' to characterise the first author's role in the creation of this work. The term seems to summarise the two basic aspects of the paradigm we have been working on during the last eight years: (i) the construction of a theoretical framework grounded on perceptual and cultural data; and (ii) the subsequent development of synthesis techniques and compositional strategies coherent with this theoretical scaffolding.

Stressing the importance given to the extra-musical content of the artwork, eco-composition has taken the concept of contextualisation a step further. Ecologically based techniques provide tools to deal with perceptually relevant sound parameters. By zeroing in on the structure of the sound event itself, it becomes possible to extend the network of meanings along most time scales and into the realm of perceptual cues (figure 1). Moreover, the distribution of sound in space is made available as a variable that can be linked to concurrent processes on the temporal axis. As a result, the procedural relationships between time, space and composition open the door to an interesting musical phenomenon: form emergence (Keller and Capasso 2000).

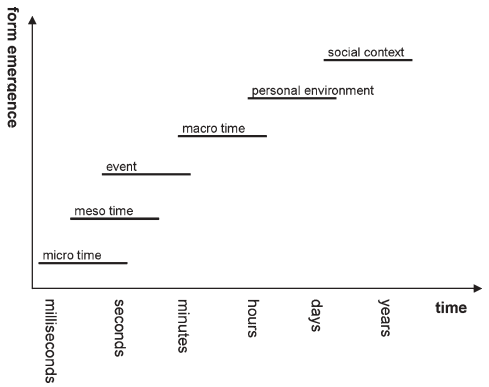


Figure 1. Time scales in the ecological paradigm.

2.1. Why installation art?

S. Emmerson (2001: 19) states that electroacoustic music has the power to revitalise the social aspects of music by providing both a quality listening experience and a space for social intercourse. He suggests three possible scenarios: (i) the multimedia space, where music, visuals, and socialising are combined; (ii) the auditorium, where in-depth listening and concentration are encouraged through the use of three-dimensional sound rendering techniques; and (iii) the installation space, which enforces the coexistence of detailed listening of spatially distributed sources with active social interaction.

Emmerson supports the idea that installation art erases the boundaries between listener, performer and composer. Even though this is true for many works, there are certain mechanisms that must be in place to realise the potential of multimedia environments. In contrast with the traditional concert setting, installation music can be experienced both through its temporal and its spatial dimensions. The perception of the work requires a commitment from the listeners / participants in the form of an action. In the simplest case, this action is their movement through the space. Given the dynamic nature of sound sources, while the listeners change their location, the timbral and spatial qualities of the sources vary concurrently. Nevertheless, this is the most basic type of interaction. A more complex dynamic is created when the distribution of sources is dependent on the actions of the listeners. In this scenario, different forms of mappings between the music's temporal dimensions and the characteristics of the space can be established. Furthermore, the spatial layout of the sources suggested by the imagetic material can also be manipulated in relation to the distribution of the sound sources. The artwork is thus opened to multimodality (Keller 2001).

2.2. Heterarchy

Within the realm of computer music compositional approaches, G. Lewis (2000: 36) has suggested that African-American aesthetics can be clearly differentiated from Eurocentric approaches. Whereas the former present a tendency toward a high density of events in a relatively short time, the latter usually feature slowly moving timbral narratives. This observation may sound overly simplistic, but it highlights the existence of opposed underlying philosophical views determining the choice of compositional frameworks and techniques. The visible (or better, audible) aspect of the frameworks is their sonic result: high density of short events *vs* slowly evolving fused textures. Nevertheless, the most relevant aspect is the process underlying the temporal structure of the music.

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In 1986, Lewis implemented *Voyager*, an improvisational environment where form is the result of interactions among multiple processes. These processes are established locally and form a loose heterarchy which influences the various temporal layers of the musical work. There is no single unifying principle. The work is proposed as a field of possibilities which are realised during the performance of the piece. The interaction of the various processes and the actions of the performer determine the final form of the piece.

Xenakis's (1992) stochastic music is probably the most influential among the several examples of hierarchical compositional methods found in computer music literature. In the early 1960s, he produced a series of instrumental pieces using the software *Stochastic Music* to generate data in text format which he later transcribed to musical notation. *ST/10 080262* is one of the large-ensemble works in this series (Xenakis 1967).

Xenakis's (1992: 134) pre-compositional plan for *ST/10* is to create a work that 'consists of a succession of sequences or movements each *a* seconds long'. We see that although all movements share a common algorithmic origin, their temporal evolution and their length are not based on sonic relationships among sections. Conceptually, each section is a separate entity linked to the other sections by their placement in succession. Furthermore, the length of the section is not determined by the dynamics of its material but by a top-down strategy: all lengths are calculated stochastically before the parameters of the sections are generated. Thus, Xenakis sets a 'temporal mould' which he applies through an automated process onto his material (Keller and Ferneyhough 2004).

Xenakis's *ST/10* and Lewis's *Voyager* present contrastingly different organisational processes. While Lewis's work is shaped by the local musical variables, Xenakis's *ST/10*'s structure is not affected by compositional decisions at a local level. Furthermore, *ST/10*'s temporal mould predates the existence of the work as a whole. Lewis's observations can be further qualified in light of these findings. Placed in the context of a more general discussion, Lewis's and Xenakis's works serve as paradigmatic examples of organisational strategies. The formalist approach that permeates Eurocentric music can be characterised by its methods of musical organisation and by the temporal levels at which these methods are applied. In top-down hierarchical frameworks, the local characteristics of the music have no impact upon higher levels of musical structure or on the formal mechanisms themselves. Heterarchical compositional systems provide an alternative to the formalist approach. These systems allow the composer to establish a dialogic relationship with the materials, where musical form is not the result of one-way control algorithms but emerges from the interaction among several concurrent processes.

2.3. Re-enaction as a compositional paradigm

In order to understand the full scope of re-enaction in composition we need to address three aspects of the process: biological, perceptual and cultural. The three complementary concepts that we will utilise are: structural coupling, attunement, and the formation of the personal environment.

Francisco Varela holds that cognition is not representation but embodied action (Varela *et al.* 1989: 200). This process takes place through a history of structural coupling, in other words, through a mutual determination between the individual and its environment. Thus, it is not a mental representation that establishes the formation of perceptual processes but actual corporal interactions. These interactions are constrained by the possible actions that can be exerted upon the objects. In ecological parlance we define these constraints as 'affordances' (Michaels and Carello 1981). The perceptual manifestation of structural coupling is what Gibson (1966) defined as 'attunement'. The permanent cycle 'action / perception / attunement / new action' is at the core of the process of adaptation to a new environment. Or, more accurately stated, the mutual adjustment between environment and individual can be observed through the set of affordances that emerge out of this process (Warren and Verbrugge 1984).

Bringing the concepts of structural coupling and attunement to the realm of musical experience suggests a very specific process that demolishes the idea of music as a universal language. As we have extensively argued, music phenomena need to be understood as resulting from an individual's record of sonic experience. The concept that defines an individual's specific listening history is called the 'personal environment' (Keller and Capasso 2000). The personal environment places the work within the listener's cultural context and re-enacts his previous sonic experiences. Thus his interactions with the sonic environment, including sounds labelled as 'musical' and 'non-musical', determine his aesthetic experience. In eco-composition, instead of forcing sound and its organisation into abstract 'universal' moulds, the listener's specific background constrains the musical parameter space. As a result, it becomes possible to create a sonic universe informed by the individual's environment. Viewed in this light, there is no culturally neutral listening experience. Music carries the cultural baggage of its social origin placing all sonic stimuli within the personal environment of the listener. The clash between the extra-musical context and the music-specific processes informs the creation of musical meaning and simultaneously reshapes the personal environment. Thus, an ever-changing history of meanings is established.

Ecologically based works adopt re-enaction as an integral part of the compositional process. Raw

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material collection is done through re-enacting the situation suggested by the historical and sociological data. This working method provides direct contact with the spatial and temporal characteristics of the locations chosen. Thus the work becomes geographically anchored (Keller 2004). On-site observations allow for comparisons between historical records and current sociological and topographical data. Finally, the historical and geographical framework of the piece is re-fabricated during its presentation, giving the public an opportunity to add yet another layer to the multiple meanings of the work.

2.4. Accumulation as a form-bearing method

The processes of accumulation and timbral transformation inform the techniques employed in eco-composition to generate the synthetic sound material (Keller and Berger 2001). Within the context of ecologically based works, short samples, or grains, are extracted from the recorded sources. These grains provide the basic spectral and micro-temporal features of the sounds to be synthesised (Keller and Truax 1998). Short events, modelled after the characteristics of a chosen recorded sound event, are synthesised by using constrained random distributions of grains. Once the events are synthesised, they are recombined in two ways: intraclass and interclass. Intraclass combinations provide events with a greater number of meso-temporal elements, adding depth and volume to the sound. Interclass combinations create fusions and hybrids among sonic classes, extending the sonic palette into the realm of the imaginary.

The transformations applied to the recorded and the synthetic materials are also guided by the objective of obtaining smooth transitions between the environmental sonic space and the modified sonic elements. After obtaining several hundred simple events through ecological modelling or through temporal and spectral transformations, we proceed to merge these events using constrained stochastic algorithms. When dealing with meso-temporal patterns, this method ensures consistency at a local level while creating a variety of global behaviours (Keller 2000). Especially in the case of sonic classes generated by physical agents (Keller 1999), these methods create patterns not attainable by traditional synthesis techniques.

2.5. Image-sound: non-univocal relationships

Standard film-editing practices, particularly within the realm of sound design, establish a direct cause–effect relationship between images and sounds. Foley sounds are applied according to parameters determined by image angle and distance. Abrupt cuts and amplitude changes are imposed on the sound material, strictly following the changes of camera position in relation to the filmed scene. Sonic time thus becomes a slave of image time. Furthermore, the musical soundtrack is usually unrelated to the Foley track and is cast within the straightjacket of instrumental thought. Cases of integration between Foley and musical elements – although highly effective – are rare.

Ecologically based techniques provide a framework to explore the integration of images, sounds and space. This integration is established by exploring the continuum along the following dimensions: Foley sounds – musical sounds, spatial distribution of sound sources – temporal distribution of sound sources. Various possible relationships between images and sound have been explored during the elaboration of *Paititi*:

(1) The sonic events are directly correlated to the imagetic events. This procedure is akin to the traditional Foley-track editing. Nevertheless, the ability to deal with the spectral and temporal fine structure of the sounds opens up the way to unexpected sound–image combinations.
(2) The sonic events are de-correlated in relation to the imagetic actions. This procedure creates a temporal paradox between images and sounds, which can be explored along the temporal and / or the spatial dimensions.
(3) The sonic events are unrelated to the visual content. This is the usual case with the traditional musical soundtrack. Given the referential quality of environmental sounds, their musical transformation provides a rich source of associations that can be explored to create eerie and dreamlike sonic environments (Keller and Carroll 1999).

The independence of the sonic events' temporal dynamics allows for the three types of image–sound interactions described above. Interesting effects emerge out of the combination of matched and unmatched image–sound elements at the various levels of organisation. The integration of the spatial distribution of sources within the musical organising processes creates a seamless transition between the formerly separated realms of Foley sounds and musical sounds.

2.6. Anchoring

The focus of soundscape composition has traditionally been the sonic environment itself (Schafer 1977; Truax 1984). By contrast, eco-composition emphasises the *relationships* between the compositional processes and the geographical, ethnographical and historical factors that inform the piece (Keller and Capasso 2000). From this perspective, the creative context becomes an integral part of the work. Furthermore, this dialogic relationship between extra-musical sources and compositional methods sometimes creates acute contradictions within the piece, steering the

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compositional process toward new directions. The creation of *Paititi* is a case in point.

The Paititi Project originally proposed a reconstruction of the first Spanish voyage through the Amazon River. In light of the data gathered during the Keller–Capasso expedition (Keller 2004), the first project had to be restructured. *Paititi*, in its final form, presents a reflection on the current situation of Amazonian peoples, keeping as a backdrop the historical processes of exploitation of the natural resources and their consequences on the environment and the ways of life of the local communities.

Two chapters of *Paititi* have been presented in public. *Vivir sin después* was shown at ArteXArte in Buenos Aires (Keller and Capasso 2004b) and Haim Chanin Fine Arts in Chelsea, Manhattan, NY (Keller and Capasso 2004a). *Sísifo / Sisyphus* was premiered at the General Consulate of Argentina in New York (Keller and Capasso 2004d). The following section discusses the application of ecological methods in *Vivir sin después* and provides a summary of the contextual issues involved. A more detailed description, images and reviews are available at http://ccrma.stanford.edu/~dkeller. The accompanying DVD includes a short excerpt of the piece. The complete version is available on a limited edition from *business2art.com*.

3. *VIVIR SIN DESPUÉS*

As it was presented in New York and Buenos Aires, *Vivir* features a single-channel video projection with multi-channel 5.1 DTS-encoded sound. The installation-space floor is fully covered with sand. The element of water provides the conceptual axis of *Vivir*. The threat of the storm has made the boat seek refuge on shore. Instead of being afraid, the curious nature of children incites them to play. This playing becomes a ritual to explain their surrounding reality and to search for normalcy even in a storm. The pounding repetitive sounds – echoes of ritual drums, hammering, or an axe falling on wood – give a rhythmic, trance-like quality to the piece. The sounds of distant waves hint to the existence of the ocean, as the final destination of the constant flow of the river.

3.1. Re-enacting Orellana's Journey

Eco-composition provides methods of organisation that are simultaneously employed at several temporal levels (Keller 1999). From the finest temporal level, where the actions of agents on objects furnish the sonic material, to the macro-structural level, laying out the material as sets of open-ended combinations. The process of re-enaction permeates the whole compositional working cycle, from the moment of data collection to the public presentation of the piece. To gather raw material we proceeded to reproduce (live) the situation suggested by the historical and sociological data – in the case of *Vivir*, Orellana's journey through the Napo waterway.

From December 2002 through February 2003, video-artist Ariadna Capasso and composer Damián Keller traversed the route of the first Spanish expedition to reach the Atlantic Ocean from the western part



Figure 2. Still of the multimedia installation *Vivir sin después* (Keller and Capasso 2004a).

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of South America. Our journey began in Quito, Ecuador. We went by ground transportation to the town of Coca and followed the course of the Napo and Amazon Rivers. The objective of our trip was to document the current social and environmental conditions along the path taken by Francisco de Orellana in 1541. Loaded with video and sound recording equipment, and true to the original expedition, we used only water means of transportation (with the exception of the Quito-Coca stretch). For this expedition, we did not make nails, gather wood or build our own brigantines, but used the local's small carved-trunk motorboats and the available waterway transportation. By the time we arrived in Iquitos, Peru, Ariadna had to return. The first author completed the journey by himself reaching the mouth of the greatest river of the world on 3 February 2003.

3.2. Multiple views of single entities

A work that features such distinct materials as those gathered through a five-thousand-kilometre journey requires both coherent and selective recording/editing methods. One of the guidelines used to organise the visual and sonic materials in *Vivir* is the use of multiple views of single entities. This technique is applied to the video recordings through the use of two simultaneous cameras filming from different angles and by making multiple takes of a single location. As much as time and conditions permitted, many locations were filmed at different times of the day to capture changes in light and atmosphere.

The use of a quadraphonic recording setup allows us to obtain sonic material that retains the distribution of sound sources in the two-dimensional field. Recordings are usually over thirty minutes long in order to capture slow variations in the behaviour of the sources. The recordings span morning, afternoon and night schedules, including the rainforest's busiest times of dawn and sunset. Highly distinct sonic behaviours can be observed depending on the time of day and on the location of the recordings.

Similarly to the procedures applied to the visual material, the sonic organisational strategies utilised in *Vivir* aim at obtaining multiple views of single entities. The visual material is edited to reflect the concepts of circularity and recurrence. The sound materials generated by means of ecological models provide an endless variation of unique events within unified sound classes. Interrelated sonic classes are created by manipulating the sources' temporal and spectral structures. Thus, sound materials can be easily re-contextualised and recycled, mirroring the conceptual framework of the former inhabitants of the region (Rival 2002). As will be discussed in the section entitled 'The layout', this network of symbolisms is also extended to the spatial structure of the piece.

3.3. Accumulation of water drops

The process of accumulation informs the techniques employed to generate the sound material for *Vivir* (Keller *et al.* 2002). Short samples, or grains, are extracted from the recorded sources providing the basic spectral and micro-temporal features of the sounds to be synthesised. In this case, sounds of rain and dripping water are created through the use of sampled water drops. Events are synthesised by using constrained random distributions creating sound classes in which no single event is identical. Once the events are synthesised, we recombine them in two ways: intra-class and inter-class. Intra-class combinations provide events with a greater number of micro-temporal elements, adding depth and volume to the sound. Inter-class combinations create fusions and hybrids among sonic classes, furnishing perceptual links between the recorded material and the synthesis models.

The transformations applied onto the recorded and synthetic material are guided by the objective of obtaining smooth transitions between the environmental sonic space and the artificially modified sonic elements. Spectro-temporally complex sounds only need to be transformed slightly by using real-time granulation (Rolfe and Keller 2000). This process was applied to produce the enhanced gesture of the child repeatedly hitting the trunk with a stick. Not surprisingly, the collected material presents a wide range of behaviours from harmonic stable evolutions to fast-varying temporally complex dynamics. Most of the work consists of creating timbral bridges (Keller 1999) among the environmental sonic classes. Thus, the source material utilised for the sounds produced by the children is seamlessly integrated with the background sounds of the creaking boat.

3.4. Non-hierarchical form and the sonic field

Fray Gaspar de Carvajal's (1542/1992) chronicle of the Spanish expedition includes descriptions of several sounds he heard throughout his voyage. These sounds were produced either by instruments or by animals. The descriptions are complemented with details on the appearance of animals, plants and topography. Hence, his chronicle constitutes the first resource for data on the sonic material encountered in the journey. The exploration of remote sites along the Napo and Amazon courses provided recordings of birds, insects and complete two-dimensional environments at various times of the day. These recordings were used as a mould for the development of sonic fields, which serve as the compositional basis of *Vivir*.

The installation format demands both a tight relationship between images and sounds and very flexible temporal patterns of organisation of audiovisual material. Video images establish temporal cues which have to be carefully manipulated in order to integrate

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the temporal patterns presented by the imagetic actions and the temporal patterns obtained through the editing process. In ecological parlance, we could say we are dealing with meso-level patterns – imagetic actions, and macro-time patterns – editing-based sequences of events. This means that the temporal organisation of a video scene is the result of the temporal material provided by the raw images, moulded by the macro-temporal distribution of the edited video frames.

Two processes underlie *Vivir*'s temporal and spatial structure: accumulation and modularity. As previously discussed, accumulation informs the way sonic materials are created and organised. Sound events are constructed by modelling environmental sources and by creating timbral transformations among existing sonic classes (Keller *et al.* 2002). The synthesis methods exploit overlap and accumulation by building up complex events from the sonic micro-level, i.e. the grains. *Vivir* is composed of three independent scenes. Each scene is organised through a process of sequential accumulation of modules, yielding a form that is both structurally coherent and open to different macro-configurations.

The spatial, spectral and temporal transformations among sonic classes are a distinct feature of ecologically based techniques. In *Vivir*, these types of transformation are applied on the synthetic and recorded sonic classes. The timbral classes utilised in *Vivir* include: drops of water to produce the storm and the rain, wood-cutting, and voices of children. First, grains are extracted from the sampled sonic environments. Patterns of spatial and temporal distribution are applied on the pool of grains. Finally, the resulting events are organised within a coherent sonic field. That is, the position of the sources is correlated to the action taking place in the scene, and ecological constraints are applied to the movement of the sources. Through these processes, the sonic environment is rendered as a coherent space–time continuum that complements the visual content.

3.5. The layout

Some of the key aspects of pre-Columbian cultures and myths are temporal circularity or recurrence, duality and complementarity, and mimesis (Girard 1958). These views guide the spatial layout of the visual elements within the installation space. The space is delimited by a circular white scrim (figure 3). In its full-size format, two video channels are projected onto the scrim walls. Both are edited to the same soundtrack and show different but complementary scenes simultaneously. As the visitor enters the darkened space, the projections on the curved surfaces create a sense of distorted dimensions. This distortion parallels the unknown faced by the local inhabitants in the spiritual realm, and by the Spaniards in the natural realm.

4. CONCLUSION

The conceptual framework for eco-composition has been extended to encompass the elaboration of multimedia works. Anchoring is proposed as a way to bring together the geographical and historical contexts of the work. Linked to this concept, re-enacting is employed as a methodological paradigm. In other words, the situation contemplated as a geo-historical frame for the piece is reproduced *in vivo*. Methods in video manipulation were designed to obtain consistent results in the context of the ecologically based sonic

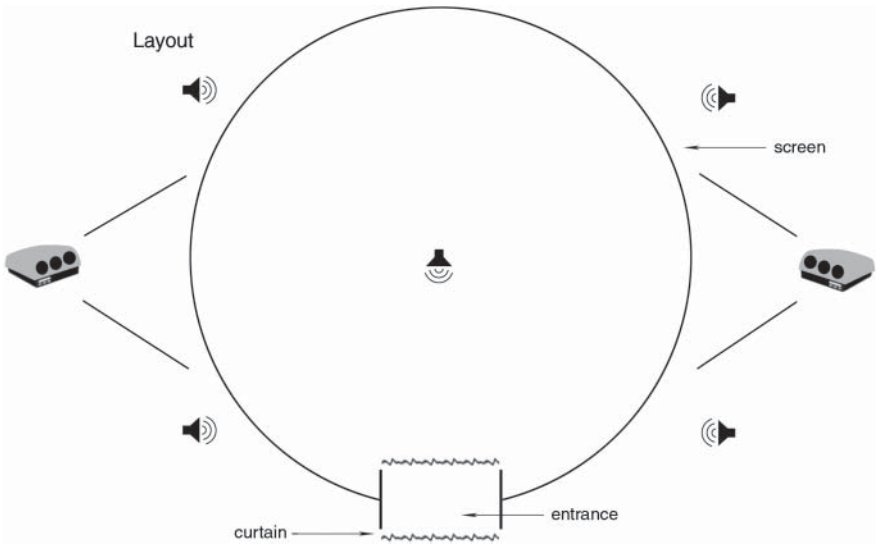


Figure 3. *Vivir sin después*: layout of the installation space.

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organisation. The adopted approaches include non-univocal image–sound relationships and multiple views of single entities. Synthesis and spatialisation techniques are integrated within a unified representational system: the sonic field. The ecological framework is also applied to the distribution of the elements in space: the installation layout reflects the concepts of circularity, recurrence, duality, complementarity and mimesis suggested by the cultural perspective adopted for this piece.

Areas of musical practice that have been addressed by the ecological perspective include: (i) audiovisual material interaction, (ii) sound synthesis, (iii) sound processing, (iv) spatialisation, (v) audience / artwork interaction, (vi) musical analysis (Windsor 1995; Keller 1999; Fontenele 2004; Keller 2004; Burtner 2005). Within the ecological methodology, sound events are the result of the interaction among sonic elements at multiple temporal levels. Just as musical form is an emergent property of the distribution of sound events in time and space, macro-level processes are shaped by the action of the public within the space of the work. Thus, the artwork comes into being by the dialogic relationship between public, processes and materials.

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