SANDBOX — GRAINS IN MEMORY

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Abstract

SandBox — Grains in Memory is an installation where the sea is evoked as a place of identity and memory. Using sonic fragments and oral narratives collected over the last two years in Portugal, the interactors, who are also narrators and producers of different sound sources, have the power to (re)construct their own sound territory from multisensory experiences. The objective is to obtain new sound landscapes from a sound landscape composed by different sonic fragments. Movement in the sand is detected by vibration sensors which trigger the playback of audio files from a library of recordings stored in the device. There is also a "record" feature that enables participants to contribute with their own memories in sound fragments of interaction experiences.

Keywords

Memory
Interactive Installation
Sound Expressions
Sea
Identity
Narratives
Sound Landscapes
Sonic Fragments

1. INTRODUCTION

The aim of this project is to present an identity landscape existing in the relation man → (fragment) → sea, independent of its representational character: objective (real) or subjective (abstract); the physical with the phenomenological or the natural environment with the symbolic. From this relationship we have new soundscapes, which may make it possible to extend other identity references of the sea and their conflicts, as well as to understand *SandBox*'s space of poetic experimentation concerning the (re) production of a sound landscape composed by different sonic fragments.
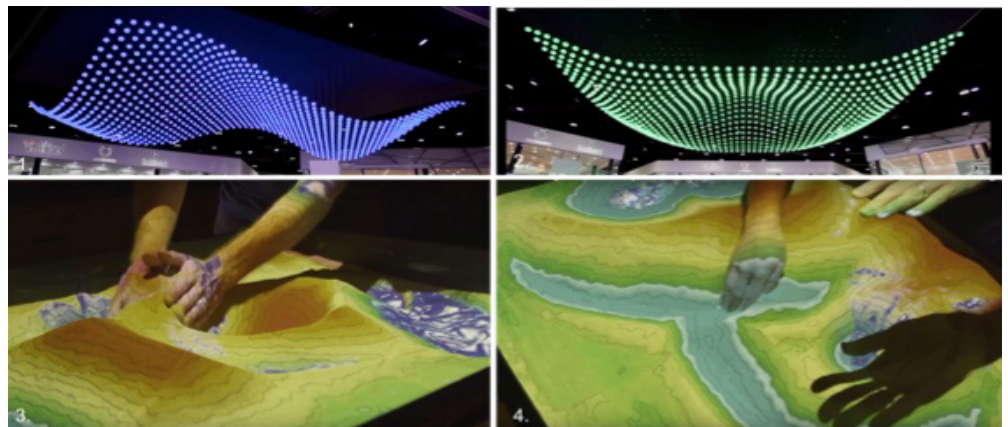
The present work, *SandBox — Grains in Memory*, is an interactive installation, part of the project "Sea Grains: place of memory and identity immersed in sensorial interactive experiences", developed as a PhD research at Faculty of Fine Arts of Lisbon, multimedia specialization. The aim of this project is to produce interactive digital art experiences through the memories of people who describe the sea as connected to them.

The installation consists of a set of sound expressions defined as emotive *swells*,[1] obtained from memory *Plungings.*[2] In those memories the sea is referred as an identity link (Hall 2006). The memory *Plunging and emotive swells* are conceptual elements which are intrinsically linked to the stored set of memories. This set of memories composes a heterogeneous *corpus*. Therefore, the aim is to emphasize the symbolic implications of those memories to point how the (pratical) relations with the context, the sea are placed.

Thus, *SandBox* unleashes emotions, visuals and sensations through sound expressions extracted from the memories of people who are intrinsically related to the sea. Those expressions have been (de)composed from overlapped sonic fragments (noises, whistles, onomatopoeias, songs, voices, natural sounds and melodic fragments) referring to emotive *swells*.

1.1. Contextualization

The art project *SandBox*[3] *— Grains in Memory* started in March 2016, when I was researching installations that use sand and wave movement as immersive elements.

The symbolism suggested by the sand and sea waves has long appealed to me. These essentially dynamic elements are the basic components of the whole conceptual framework involving "sea grains". Coming up with an installation involving

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1

The swell is one of the most common wave types of the ocean, travelling thousands of kilometers from the place it first emerged. The further they go from their original place, the more they become uniform, with wide wave lengths and short amplitudes; in the open ocean, their period (frequency) is about 13 seconds between two waves. (Dias 2005)

2

The concept of plunging has been adopted in this project referring to the article *Spilling, Surging, Plunging: The Science Of Breaking Waves* (The Science of, Volume 1 ISSUE 3 May 2014). Three types of waves and their characteristics are described in the article, where the *plunging* is defined as the act of diving into the deepest.

3

In order to differentiate this art project from the mentioned project, *sandbox* (AR), I chose to write the initial consonants in capital letters and to include the concept "Grains in Memory".

Fig. 1

Researched works.
1 and 2: 104/5000 Kinetic sculpture with symmetrical LED beads;
3 and 4: Sandbox project of augmented reality (AR).

these two substances — sand and water, started to make sense to me at this point. From the outset, the desired concept for this installation was to encompass the memories of "sea grains", ie the "*plunging* in memory" in line with "emotive swells", as evidenced in images from the sea.

In this context, sketching of the sandbox began. Its purpose was to materialize people's memories of the sea, more precisely those that involve them in a network of meanings, either through (re)signification and/or appropriation of identity relations.

1.2. Reference

In the first stage of research, I analyzed the augmented reality *sandbox* project (AR), developed by Davis University of California and WM Keck Center, at the *University of Texas* in *El Paso*. The goal of this project was to develop an integrated real-time augmented reality system to physically create topography models, that are then scanned into a computer and used as a background for a variety of graphic effects and simulations.
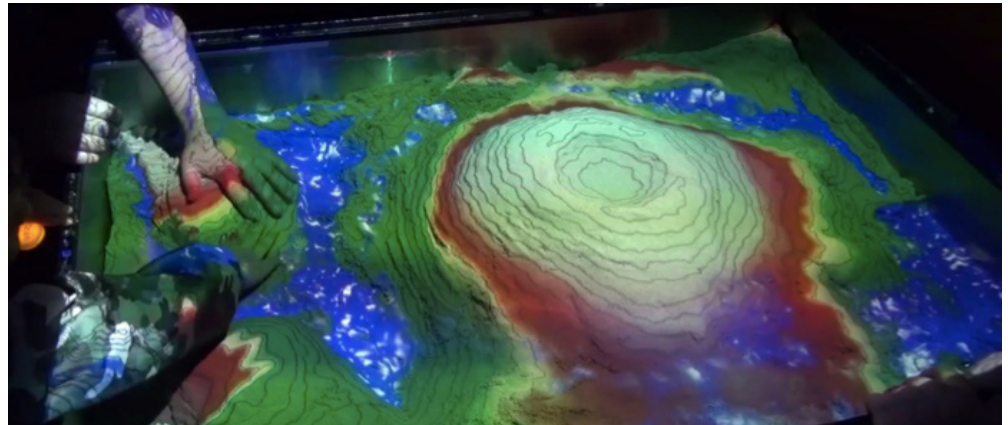
Thus, *sandbox* allows users [4] to create topographic models by modeling real sand, which is then augmented in real time by an elevation color map, topographical contour lines and simulated water. The system teaches geographic, geological and hydrological concepts such as reading a topographic map, the meaning of contour lines, catchment areas, dikes, and so forth.

4
The *sandbox* project (AR) designates "user" for those who interact with the sandbox as "users".

Fig. 2
Sandbox (AR) being presented at *Lawrence Hall of Science* in 2014.

The sandbox is equipped with a 3D Kinect camera, and a projector to show a colorful topographic map in real time. The projection inserts boundary lines on the surface of the sand, allowing the virtual water flow to appear on the surface. For this purpose, a Saint-Venant GPU-based simulation [5] (set of shallow water equations) is used.

This project was inspired by a video created by a group of Czech researchers, demonstrating an early prototype of a sandbox (AR) with elevation color mapping and some limited flow and fluid.

5
The flow of water over the ground is a distributed process, as the flow, velocity, and height of the water slide vary in time and space. The calculation of these variables can be done through the Saint--Venant equations.

1.3. Development

From observing the project of UC Davis' and W.M. Keck Center, I considered my technical limitations in developing something in a similar format. I then analyzed features that I found interesting for my work, and how they would favor interactivity. I therefore adopted the dynamics of the sandbox and the immersive

action of the movement that it allows. This project enabled the first prototype of the *SandBox — Grains in Memory*, presented in October 2016 in Guimarães, at the *Noc Noc Guimarães* exhibition.

Based on what has been analyzed up to this stage, it was possible to make adjustments and apply other interaction strategies to improve the functions of the box. At this point in the project, I had already eliminated the use of images, prioritizing motion and sound as immersive elements for multisensory interaction.

1.4. In between plungings and swells

Plunging arises from oral narratives recorded in Portugal between 2014 and 2016, where the sea is referred to in the memories of people with different experiences and identities. As with plunging waves, the narrated memories show the emotional intensity related to the "sea" as a place. The sea is defined as a recollection of individually lived moments (Bachelard 2007), where each memory marks its emotional arousal (McGaugh 2003). In other words, the process of belonging permeates realities which are produced in different contexts, levels, and relations, regardless of the time factor:

> (00: 53s)… I was born near the sea (pause), in Hastings. (…) I live in Lisbon because of that. (06: 05s) in Paris, when I was 18, I missed the sea (…) I only realised that when I was far from the sea! (07: 22s) In Hastings I had a sea view with the horizon… like a clean line. (08: 19s) We can see a curve in the horizon if we shake the head! (laughs)… I like guessing what is beyond the horizon. What can the sea be hiding from us? (Plews 2016)[6]

This dive tends to represent more immersive narratives, in other words, narratives from deeper memories of something experienced — the (re)presentation of the personal biographical past, which holds a feeling of belonging and identity with the sea, in an intense way in the emotional aspect:

> (01:24s) I remember well when I was six (pause). Thirty years have already passed, how fast! (01:27s) I remember so well (…) the salt and the strong smell of the sea air around me, and my burning eyes from leaving them open under the sea water. (01:43s) I used to feel the sea through my eyes (pause) (02:03) (smile) like tears falling from my eyes. They were all sea, they were part of that big sea! (Caldas 2014)[7]

To put it briefly, *plunging* in memory encompasses events and / or experiences immersed in intimate / personal feelings for the element "sea", independently of its appropriation (Ricoeur 2007). Therefore, each narrator has his interpretation of what has been experienced, lived and understood from their innermost feelings. Each person then becomes owner of the context "sea", only them have the power to carry out that relationship. Here there is no value judgment, the emphasis is not on describing their lives, but on understanding the link that makes this "sea" an important element in their identity practices.

Complementing the *plunging* in memory, emotive *swells* are hybrid compositions that house the emotional feelings that run through the *plunging* movement. They can be visual only or they can be composed of synesthesia (Wittoft; Winawer 2013), which means that they contemplate other sensory elements, es-

[6]
Interview with PLEWS, Robert. **Interview I**. [19.03.2016]. Interviewer: Adriana Moreno Rangel. Lisboa, 2016. 3 arquivo. MOV (11:03 min/sec.). Available on request

[7]
Interview with CALDAS, Ana Maria. **Interview II**. [26.11.2014]. Interviewer: Adriana Moreno Rangel. Sintra, 2014. 2 arquivo. MOV (23:11 min/sec.). Available on request.
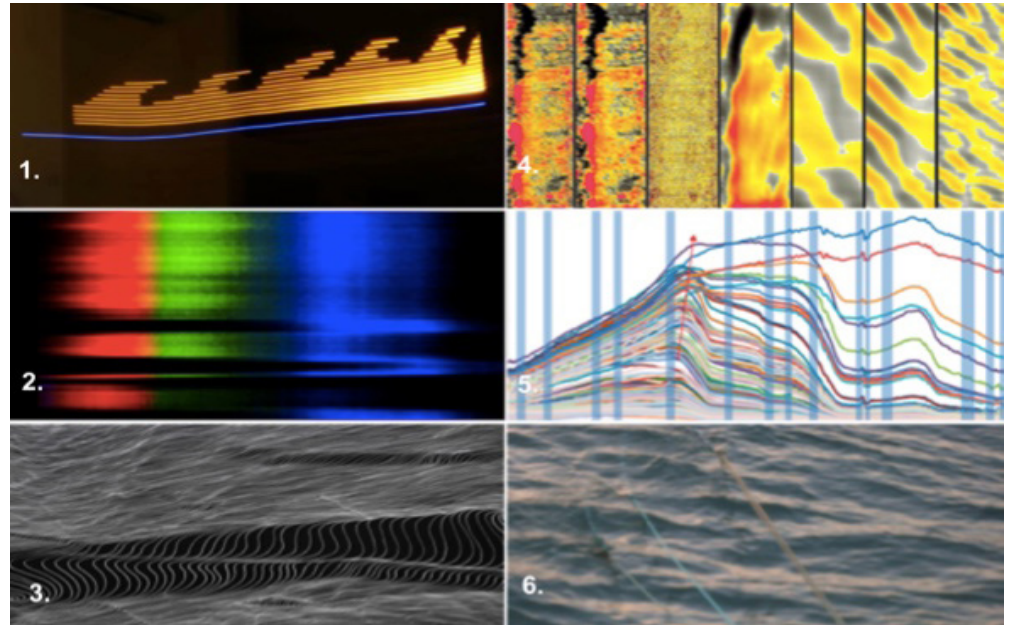
pecially the links between emotions and stimulus. Thus, the *swells* are linked to the set of characteristics of the human sensory system (hearing, taste, smell, sight and touch), which emphasize the ways of feeling the sea of each narrator.

With this in mind, the emotive *swells* are composed by performances given in different densities, developed by what is shown through the memories. In other words, they are a reflection of what was felt by the sea.

Fig. 3
Examples of emotive visual swells generated by:
1. PoV PRO POVO device;
2. Portable spectrometer;
3. Open Frameworks;
4. Image generated from the Seawifs sensor;
5. Image of the Spectral Classification of the Sea and Implications for Coastal Ocean Color Remote made by Remote Sensing and 6. Photography.

The purpose of the *swells* is to generate different sensory forms to represent the *plunging*. The narrators' personal archives are used; new records are produced from the places indicated by the oral narratives, and hybrid compositions are created. So, these sensorial interpretations determined by the emotive *swells* are extended in this particular case of the SandBox, which allows a continuous dialogue between the *swells* and new sound sources.

2. SOUND SOURCE: SENSORY INTERACTION SCENARIO

SandBox is performatically a listening box "which invites others to concentrate the entire body in the voice" (Barthes 2009) or in the different sound sources (conventional and unconventional). When previously manipulated, these sound fragments generate different narrative paths, or an appropriation of the initial context — of *plunging* in memory.

It is important to note that in addition to sound, other elements act in the installation. The sand just collected from the sea still exhales the fresh sea air (the rough and moist texture sometimes bothers some people) and its colours change as the seawater evaporates, making it brighter and lighter to move around. But in order to get the maximum interaction in the box, the listening is essential. Sound (in that context) is "directed and easily infected by other sounds and materialities it crosses…, sound brings them closer to their source of identity (…); listening makes the plural singular, the multiple into individual, and the body becomes part of that sound." (Pinto and Ribeiro 2011).

The interactors are also narrators, or (co)authors, and producers of different sound sources. They have the power to (re)construct their sonorous territory, from an experience that is not only "submerged in sound" (Barthes 2009), but

also in multisensory experiments. Thus, the territory is interpreted and introduced in SandBox, but not restricted to it, because its poetry is constantly redesigned by different sensations and sound effects—cuts of experienced moments or impressions perceived by the interactors. The identity content is manifested from this scenario, capable of eliciting a catch of fragmented meanings, which depends on the interpretations made by each individual (Barthes 2005). Thus, SandBox is always unique and individual, because the interactors are triggered to be part of its poetic and mark its identity pulse.

Fig. 4
Test in the wet sand
of Caxias beach,
Oeiras, Portugal.

Accordingly, sound has a central function in the installation. Its ability to evoke emotions, especially through memory, turns SandBox into a space of dialogue that involves and integrates the interaction in multiple sensorial scenarios. It also presents itself as a way of "seeing" (Blesser and Salter 2007; Pallasmaa 2005) and feeling, enabling the interactor to create trajectories personified with the medium, in this case with the sea and its representations.

Fig. 5
Moment of interaction:
SandBox exhibiton in the
lobby of António Rosa
Mendes Library—Campus
de Gambelas, University of
the Algarve (UAlg), in Faro,
Portugal (December 2016).

Therefore, the sound source allows the interactor to immerse and connect sensations of the "sea" as a place, such as the waves crashing on the rocks, seagulls, the wind blowing, someone whistling, a dive; to extend in its own way an intimate connection with what is heard, felt, remembered, silenced, understood, and so on. In short, the sound source contains countless possible meanings of the place "sea".

3. SPACE AND TIME: (RE)TERRITORIALIZATION

SandBox addresses some situations of interaction between space and time—overlaps of instants (Bachelard 2007)—which mark the path of the (re)territorialization of constructed (personal) experiences through the sound source of the "Sea" as a place. In this particular case, sounds can (re)configure space, me-

mory and emotion through breaks between the present and the past. Thus, the appropriation of the "sea" as a place, made by the interactors, is accomplished by means emerged from its constant readings and interpretations. They can trigger possible pauses or, perhaps, void spaces ready to be filled with different appropriations.

This understanding of the narratives in *SandBox* is also beyond its physical space. Some interactors immerse in the box, but do not record their impressions. Instead, they simply mention what they felt during the experience, or emotionally demonstrate their experience. [8]

In any case, the interactions in *SandBox* extends access paths to very particular readings, and for this reason it was necessary to reconfigure the first prototype of the *SandBox* to better enable the interactions. The means of listening has been modified—a headset with a built-in microphone—and the addition of a new sensor, which can stop what is being played. Thus, triggering narratives is at the discretion of the interactor. With those adjustments, we expect *SandBox* to get its insight not only visually and/or verbally, but also through voice recordings.

Fig. 6
Two moments of *SandBox* in Portuguese cities, Guimarães and Faro.
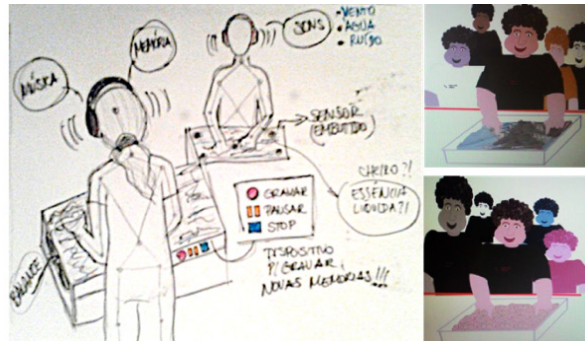
After making the modifications in the box, questions have arisen: would it be possible for *SandBox* to present the Sea as possibilities of synesthetic production capable of influencing human sensory perception? Could *SandBox* conduct a synesthetic experience, ie, conditions to trigger the various sensors that a person can experience? From a first prototype, we realized that SandBox provided a multisensory experience for the participants—tactile, olfactory and auditory.

4. SANDBOX — GRAINS IN MEMORY

SandBox — Grains in Memory is an interactive installation which presents the sea as a place of synesthetic production, capable of persuading human sensory perception through sonic fragments and memories—oral narratives recorded over the last two years in Portugal. These oral narratives are (re)appropriated and overlapped from sonic fragments produced by different sound sources.

Firstly, tactile immersion of the interactor is requested to drive the (fixed) sensors on the submerged sea sand acrylic surface. Those sensors evoke the *plungings* in memories, which are revealed (randomly) by different identity dips and, consequently, different cultural and contextual displacements, even if it is an apparently "common" place.

Fig. 7
First outlines of the
SandBox emphasizing the
human sensory senses.

4.1. Between traces and memories — sound landscapes

The sea smell is evidenced by the movement of the hands through the sand, which connects the tactile experience to the traces of sound expressions (noises, melodic fragments, music, voices, natural sounds). After this first moment, the interactors are invited to record their own memories — new sonic fragments — either by his own voice or by any sound narrative. Thus, fragments are (re)composed and sound landscapes are constituted by the interactors.

Fig. 8
SandBox before and after
an interaction.

After this first moment, the interactor is invited to record his own memories and/or insert new sonic fragments, either by his own voice or by any other sound narrative (noises, whistles, onomatopoeias, song fragments, music, voices, natural sounds, among other possibilities).

Above all, the (re)constructions and deconstructions of the sound expressions previously stored in *Sandbox*, will allow the interactors to (re)compose *SandBox* through their own sound landscapes. Therefore, the narratives become either intermittent or continuous, since the process of (re)composition produced by the interactors is not a linear path, but a construct one, made of different sonic fragments and memories that they had experienced in their identity practices related to the sea theme.

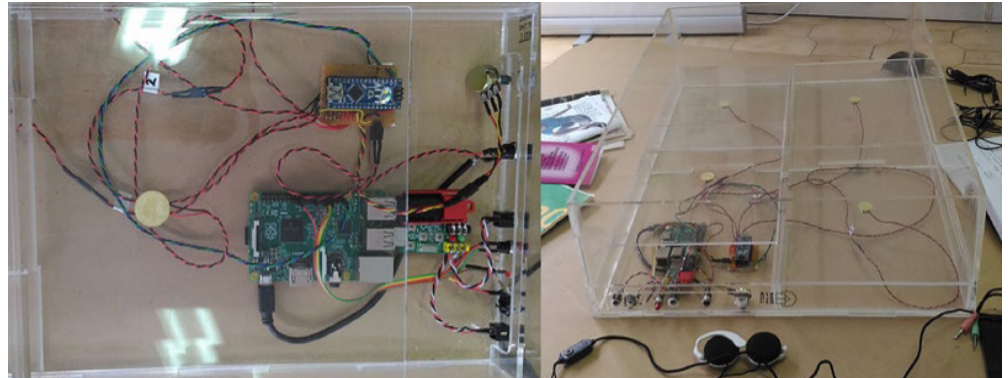## 4. SANDBOX — GRAINS IN MEMORY

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4.2. Installation setup and operation

4.2.1. Setup

The installation is adaptable and can be assembled either indoors or outdoors. It is a 0.6mm thick acrylic box, with dimensions of 60 cm length, 45cm width and 15cm height, divided into two compartments: at the (internal) base is an Arduino nano microcontroller board, a Raspberry Pi computer and an 8GB USB drive; On the outside of the base there are five I/O devices[9] — audio output, power on / off, recording switch, power supply, and sensors sensitization. In the upper part there is a platform divided in 4 movable trays (each one with one sensor) and a single sensor in the center (stop), which support the sand and the movement of the interactors. To listen, both speakers or headphones can be used, depending on the environment. To accommodate the acrylic box, a table with compatible dimensions is ideal. To connect the power source, one electrical plug is sufficient and, when required, an extension cord with at least 2 power outlets.

4.2.2. Operation

All of the hardware that permits interaction with *SandBox*, including audio recording and reproduction, is located in the base of the box. Vibrations created by movement in the sand are detected by four piezoelectric elements that are measured by an Arduino Nano microcontroller. If there is sufficient vibration (as defined by an adjustable threshold) a pulse is sent from the Arduino to a Raspberry Pi Linux computer, which randomly selects and plays an audio recording stored on a USB flash drive using OMXplayer. During audio playback, no other recordings are played; however, a push-button in the form of a rock lying in the

sand permits the participant to stop the playback and continue interacting with the installation. An additional button on the exterior of the box, when pressed, signals to the Raspberry Pi to make a new 30s recording using arecord via the attached microphone, which is then added to the collection of recordings on the flash drive.

5. CONCLUSION

SandBox — Grains in Memory is an active and continuous work in progress, always capable of getting new sound landscapes. It also continuously expands forms of experiencing identity relations with the sea as a place. Therefore, some preliminary results and experiences were described in this article, both about the technical production of the installation, and the immersive experiences of the interactors during its exhibitions.

On the immersive experiences, the use of time (length) and space (covered areas) was observed as influencing the interactions in *SandBox*. Interactors established their particular immersion levels with the box, which resulted in different multisensory experiences according to the tactile path they set. The box, therefore, was adjusted to the rhythm imposed by their movements.

We also observed that many interactors placed their hands only in one side of the box, triggering more action to the sensors located under that specific surface, while the other sensors entered in a kind of inertia. As a result of this behaviour, the next interactor, while manipulating the sand around those inactive areas, found it more difficult to interact with the whole, intuitively forcing the central sensor (positioned by a rock) to restart the box.

It is important to emphasize that the initial objective of the central sensor was to override the activity of the other active sensors. If the interactors did not wish to continue listening, they could press it to stop all sensor activity. By doing that, a new path of different sonic fragments was restarted.

Regarding the technical construction of the intalation, some adjustments were made in order to improve interaction with the box. We found, for instance, that the use of headphones changed the way interactors listened to the sonic fragments. The headphones enhanced sound details, and we believe the experience was less intimate when sounds were played on speakers. After including headphones, *SandBox* obtained more recordings than the first prototype exposed.

Thus, **SandBox** is fulfilling its objectives as an experimental piece of work, adapting itself to each new experiential context and technical challenge. In the next stages of this project, we intend to expand our experiences with Sandbox in order to experiment new identity references. Hence, new narratives will be collected from different people.

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