**School of Arts of the Portuguese Catholic University**

**Master Degree in Sound and Image**

# Creating Relation: How Some Game Features Can Be Applied To Digital Contemporary Art

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# Abstract

The evolution of technology has increasingly improved the quality of long-distance communication, but with a price: the seemingly decreased value of local direct human contact. Simultaneously, art theories like the Relational Aesthetic posit that contemporary art is increasingly preoccupied in closing this distance gap by providing sociability contexts that are based on creating proximity and relation among the public, leading to an enhanced form of public interaction in art.

This study comes as an attempt to join these two factors in the same problematic by suggesting the use of technology in different ways; in ways that enhance local social contexts instead of fighting against them. And in order to improve upon other efforts, it suggests the application of game theory in these technology based art works. Games have a well-known potential for generating proximity between people that play together, so by applying select characteristics that make games desirable to digital contemporary art works it is possible to leverage this technological advantages to perform meaningful sociability contexts.

This study aims to explain some of these game characteristics and their application in fields other than video games: like for example art works. As a proof of concept, it also contains a detailed description of an example interactive installation: from the technology that powers it to the aesthetic and functional choices that ultimately define it. The feedback and analysis of this interactive installation led to the conclusion that this is in fact a valid and effective approach towards the building of socially significant contexts. This success does not mean that the application of game theory to other contexts is a panacea for all social problems, though, but instead prompts for further discussion about the impact of video games on contemporary culture.

Keywords: Digital Art, Relation, Game Characteristics, Participation

# Resumo

Os crescentes avanços tecnológicos deram origem a evoluções incontornáveis nas telecomunicações, tornando-as cada vez mais fiáveis e inclusivas. No entanto, esta confiança na conquista da distância pode ser vista como tendo um efeito secundário muito significativo: o relegamento para segundo plano do contato humano local, cara-a-cara. Ao mesmo tempo, teorias artísticas como a Estética Relacional propõe que a arte contemporânea se está a voltar cada vez mais para a criação de contextos de sociabilidade que se baseiem na proximidade e relação entre o público, o que leva a formas cada vez mais inclusivas de interação do público na arte.

Esta dissertação surge como uma tentativa de juntar estas duas questões numa mesma problemática. E tenta fazê-lo sugerindo a utilização da tecnologia disponível de formas específicas: trabalhos artísticos que fortalecem a importância e relevância de ambientes de relação e participação locais em vez de os negarem. E como forma de acrescentar valor relativamente a outros esforços, sugere a aplicação de teoria dos jogos a estes trabalhos. O potencial para criar proximidade entre jogadores que os jogos contêm é amplamente conhecido. Aplicando algumas das caraterísticas que tornam os jogos experiências socialmente enriquecedoras à arte contemporânea digital permite que as suas caraterísticas tecnológicas sejam usadas em prol da criação de contextos de relação mais significativos.

Esta dissertação surge com o propósito de explicar algumas destas caraterísticas dos jogos, e de que forma estas podem ser aplicadas em outros contextos: nomeadamente na arte. Por forma a verificar a viabilidade desta abordagem, o documento inclui também a descrição detalhada de um exemplo de uma instalação interativa que segue estes princípios: desde a sua componente tecnológica até às opções estéticas e funcionais que a definem. As opiniões recebidas e a análise feita a esta instalação permitiram concluir que esta abordagem à construção de contextos de sociabilização é viável e eficiente. Este sucesso, no entanto, não implica que a aplicação de teoria dos jogos a outros contextos seja uma panaceia para todos os problemas sociais. Em vez disso, as conclusões atingidas convidam a discussões posteriores acerca do impacto dos videojogos na cultura contemporânea.

Palavras-chave: Arte Digital, Relação, Caraterísticas do Jogo, Participação

## Table of Contents

Figure List ..... 1

1 To Start ..... 4
- 1.1 Our Work Proposal ..... 5
- 1.2 The Work Process ..... 6
- 1.3 The Document's Structure ..... 7

2 *Balance*: The Interactive Installation ..... 9
- 2.1 Project Objectives ..... 9
- 2.2 Context and Past Work ..... 10
  - 2.2.1 *imagine* ..... 11
  - *2.2.2 Pom* ..... 12
  - 2.2.3 *aB* ..... 13
  - 2.2.4 Hindsight ..... 14
- 2.3 *Balance*-specific references ..... 14

3 Game as Process ..... 16
- 3.1 The Game Lens: Four Game Defining Traits ..... 16
  - 3.1.1 Goal ..... 18
  - 3.1.2 Rules ..... 21
  - 3.1.3 Feedback System ..... 24
  - 3.1.4 Voluntary Participation ..... 26
- 3.2 Participation in the Art World ..... 29
- 3.3 Precursors and Influences for *Balance* ..... 34

4 *Balance*: Process and Results ..... 41
- 4.1 Technology ..... 42
  - 4.1.1 Building the Box ..... 42
  - 4.1.2 Computer Vision ..... 44
  - 4.1.3 Audio Setup ..... 50
  - 4.1.4 Software ..... 52
- 4.2 Functionality ..... 55
  - 4.2.1 Appearance ..... 56
  - 4.2.2 Rules ..... 61
- 4.3 Reception ..... 67

5 To Finish ..... 71

Bibliography and References ..... 75

**Figure List**

Figure 1 – Our interactive installation: *Balance*. (Photograph by the author) ........................ 10

Figure 2 – *imagine*. Left: the installation's initial state. Right: a person is building a spaceship from the Lego sculpture (Photographs and photomontage by the author) .............................. 11

Figure 3 – Four people playing *Pom*; two with the provided trackpads and two with smartphones. (Photograph by the author).................................................................... 12

Figure 4 – Left: Space A. Right: Space B. (Photographs and photomontage by the author)... 13

Figure 5 – Jesse Schell's 10 game qualities (Schell, 2008, p. 34) .......................................... 17

Figure 6 – The structure leading the goo balls to the pipe. (Screenshot) ................................ 18

Figure 7 – *World of Goo Corporation* (Screenshot)................................................................ 19

Figure 8 – The Sheep Market (Screenshot. Retrieved from http://www.thesheepmarket.com/ on 30/08/2012)................................................................................................................... 20

Figure 9 – Some examples of sheep. (Screenshots from the website. Photomontage by the author. Retrieved from http://www.thesheepmarket.com/ on 30/08/2012)............................. 21

Figure 10 – Marina Abramović in *Rhythm 0*. (Retrieved from http://www.moma.org/images/dynamic_content/exhibition_page/42552.jpg on 30/08/2012) 22

Figure 11 – Left: The enemy killed Tim. Right: Pressing the button to go back in time. (Screenshots and photomontage by the author)....................................................................... 23

Figure 12 – The beginning of *Bastion*. (Screenshots and photomontage by the author) ......... 25

Figure 13 – *Untitled (Placebo)*. (Retrieved from http://www.queerculturalcenter.org/Pages/FelixGT/placebo.html on 30/08/2012) ................ 25

Figure 14 – *Access*. (Retrieved from http://www.accessproject.net/access2.html on 30/08/2012)................................................................................................................... 27

Figure 15 – Left: *Boktai: The Sun is in Your Hand*’s cartridge. The circle points out the solar sensor. Right: Screenshot from the game. (Retrieved from http://www.konami.jp/gs/game/boktai/english/game_index.html on 30/08/2012. Photomontage by the author. Images were altered for clarity.).............................................. 28

Figure 16 – *Fountain*. (Retrieved from http://www.marcelduchamp.net/images/Fountain.jpg on 30/08/2012)................................................................................................................... 30

Figure 17 – Still from the video (00:27). Note the tilted horizon line. (Screenshot by the author)........................................................................................................................... 35

Figure 18 – Still from the video (01:54). One of the fishermen reeled in a box, while the others were forced to the opposite side of the platform, to maintain balance. (Screenshot by the author)........................................................................................................................... 35

Figure 19 – Still from the video (07:19). The last fisherman and the box, stranded on opposite sides of the platform. (Screenshot by the author).................................................................... 36

Figure 20 – Photograph of the installation. (Retrieved from http://www.snibbe.com/images/projects/boundaryfunctions/small/boundaryfunctions_1.JPG on 30/08/2012) ..... 37

Figure 21 – *aTilt 3D Labyrinth* screenshot. (Image cropped and rotated by the author. Retrieved from https://market.android.com/details?id=com.fridgecat.android.atiltlite&hl=pt_PT on 30/08/2012) ..... 38

Figure 22 – *Tetris*. Note the top left corner: 42 lines correspond to level 4. (Screenshot by the author) ..... 39

Figure 23 – Picture of *Balance*, our interactive installation. (Photograph by the author) ..... 41

Figure 24 – Left: Box schematics. Right: Proposed arrangement. Note the camera under the box. (Images by the author) ..... 43

Figure 25 – Horizontal offset of the projection in relation to the projector. The red line projects the center of the projection origin on the floor. (Photograph by the author) ..... 44

Figure 26 – Schematics for a rear diffused illumination multi-touch table. Although not shown in the image, the projector sits by the camera, projecting from below on the diffusor material. (Retrieved from http://wiki.nuigroup.com/Diffused_Illumination on 20/04/2012) ..... 45

Figure 27 – An example an image produced by a rear DI multi-touch table. (Retrieved from http://wiki.nuigroup.com/Diffused_Illumination on 20/04/2012) ..... 46

Figure 28 – Our Unibrain Fire-I without the lens support and the film square we used as an IR filter. (Photograph by the author) ..... 48

Figure 29 – Left: Schematics for both platforms. Right: Implementation of the second platform. Note that the IR LED light is only visible because our photo camera was unfiltered – it is not visible with the naked eye. (Images by the author) ..... 49

Figure 30 – Screenshot of our camera's feed. The blue and purple lines are *Community Core Vision*'s (a software tool we will introduce and explain ahead) indications. Note that this screenshot was taken with ambient lighting and the projection on the floor: both invisible because our camera was sensitive only to IR light. (Screenshot) ..... 49

Figure 31 – Schematics for the sound setup. (Image by the author) ..... 51

Figure 32 – Diagram of the different software layers we are using. (Image by the author) ..... 53

Figure 33 – *Unity*. (Screenshot) ..... 53

Figure 34 – *Community Core Vision*, or *CCV*. (Screenshot) ..... 54

Figure 35 – Early experiment on *Balance*'s visuals. (Screenshot) ..... 57

Figure 36 – *Balance*'s second graphic iteration. (Screenshot) ..... 58

Figure 37 – *Balance*'s final appearance. (Screenshot) ..... 59

Figure 38 – *CCV*'s interface detail. (Screenshot) ..... 63

Figure 39 – The installation's flowchart. (Image by the author) ..... 63

Figure 40 – Difficulty levels table. Average times and intervals are in seconds. (Table by the author) ..... 65

Figure 41 – The five types of obstacles in Balance. In the bottom row are what we considered the hard obstacles. (Image by the author)....................................................................... 66

## 1 To Start

It is hard to dismiss the importance technology is gaining in our lives. The coming of smartphones shows that computers are closer and more powerful than ever. So pervasive and dependable that it's hard, if not impossible, to imagine our lives should they suddenly vanish.

There doesn't seem to be an ending in sight for that advance, and the adage that says that telecommunications, specially the Internet, are bringing people together, seems everyday more true. But while it is hard to argue against the fact that social networks, video conferencing, phone calls, even instant messaging, allow for proximity where would otherwise only be distance, we feel it is also necessary to acknowledge that this kind of proximity is not a replacement for direct contact. Obvious as it might seem, it's possible that even the reader has once launched an internet browser just to check the weather before looking out the window, or called friends' cellphones instead of ringing their doorbells.

Let it be clear that we don't support a sense of nostalgia for simpler times. What we do support is that it is frequent to favor technological mediation devices over direct interaction, and we think that more can and should be done to improve the value of local human interaction. The way we see it, the quality of this local human interaction can be heightened by technology, instead of replaced by it. And we stand by the opinion that art is the perfect candidate to cater that interstice.

Throughout History, art has had a tendency to turn itself to its public. Art critic and curator Nicolas Bourriaud (2002) sees art as a continuous attempt to establish relation. Broadly speaking, Bourriaud distinguishes three chronological phases: art as connection to a deity, art as representation of an object (though not necessarily a physical, material object) and lastly, art as a catalyst for creating relationship with and among its public (Bourriaud, 2002, pp. 27-28). This public involvement is not new or exclusive to *Relational Aesthetics*; other efforts have appeared, some of which will be later further explored, but it's important to clarify that in this document we will mainly talk about art that requires audience participation.

Coupled with this notion of participatory art is the concept of "participation" itself. Participation is the act of taking part in an event or activity, presumably collective or social in nature. An effective way of leveraging participation is by providing a common objective to many individuals: evolution has taught us that there is strength in numbers, and that more can be accomplished by a group than by its members individually. This behavior can be seen in every team sport: the whole team's objective is to score points, while preventing the opposite team of doing the same. Giving the same objective to all the members of a team is one of the ways with which a game can provide an excellent platform to boost participation, thus constituting a good stage for social interaction and collaboration to develop. While this idea may be very obvious when talking about football, or basketball, or hockey or any other team game, the stigma that surrounds video games can sometimes prevent us from seeing them as exactly the same thing. But in fact, the same fundamental characteristics apply to both video and non-video games.

When we speak about game characteristics we are not speaking about game's content, but about their very core: what distinguishes this medium from others. Painting requires paint and a surface, whereas cinema requires a camera and moving images. When we speak about games, at first it might seem difficult to find a common ground between solitaire, chess, water polo and *Braid* (Blow, 2008). But our goal with this thesis is to present and explain an attempt to categorize this essence, and demonstrate how it can be applied to other fields of production.

It is important to clarify from the beginning that in this document we will not consider the debate about video game's legitimacy as an art form – or, for that matter, what art and its legitimacy are or aren't. In our opinion, the artist's medium of choice is but an option, such as framing, color schemes or composition, and thus makes up a very fallible way of differentiating artistic production from other types of production. We consider it fallacious to infer that a work is or isn't artistic in nature solely based on its medium, rendering this question moot in the context of our dissertation[1]. In this thesis we create a clear separation between the art world and the game world purely for analitical reasons: in order to demonstrate the aplicability of our ideas, we will analyze both established works of art and established video games with the same frame of mind – a frame of mind that is not fundamentally concerned whether said works are artistic in nature or not.

In this document, we expect to explore some of the distinctive characteristics games (especially video games) possess, and evaluate how they can be applied to art production, with the main underlying objective of producing more socially meaningful and participatory works. We will try to demonstrate ways how digital art production, when seen through a game design perspective, can culminate with the construction of devices and, most importantly, contexts that potentiate relationships amongst their public.

This introductory chapter will provide a guide to the rest of the document. At first, the purpose of the document itself will be further clarified. Secondly, there will be a brief overview of the different steps followed during the investigation process. What follows next is a breakdown of the document's structure, so as to provide guidance and reference to the reader throughout its extension.

### 1.1 Our Work Proposal

Our main goal in this thesis is to investigate the pertinence of video game study in the construction and planning of digital interactive art pieces.

Our interest in digital interactive art works stems from the fact that, in our opinion, this form constitutes one of the best ways to create meaningful social interaction contexts. Unlike traditional painting or sculpture, or even cinema, they have the ability not only to affect but also be affected by the public, instead of just presenting themselves to it[2]. Interactive art acknowledges its public, and has the ability to react and influence it, effectively integrating it within itself. By creating and supporting these social contexts, interactive art can turn its public into something more: participants – players, in a way – within the narrative the art piece proposes.

Our interest in the game frame of mind relates to the aforementioned notion of participation. The game form is based on the imposition of artificial limits upon reality; the creation of rules

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[1] As an example – because we see the medium as a choice like any other – determinately declaring that video games are not art is akin to declaring that a landscape, shallow depth of field or the color blue are not art.

[2] Our purpose is not by any means to imply digital interactive art is superior to other art forms, but instead to cater to its specificities.

and constraints that limit what players can and cannot do. The direction of these rules can produce meaning by itself: if one is told to carry a fragile object from point A to point B, the person will infer he should avoid or be extra careful around stairs and other obstacles, maybe even preferring a longer, easier way over a shorter, more difficult passage. The same logic applies with, for example, an extremely heavy or cumbersome object; the carrier inherently knows another person's help will facilitate his task. It is possible to involve people with the simplest objectives, and thus provide contexts in which they are pushed towards collaborating with each other.

Apart from the theoretical component, this investigation also includes a practical component: an interactive installation built along the lines of the proposed theory. This installation will hopefully support the validity of this document and its conclusions.

### 1.2 The Work Process

The writing of this document involved of course several different steps. Although their order was not always tight and sequential, in this subchapter we will highlight the most important steps of the investigation.

Before moving on, though, it is important to state that the fundamental idea behind this study has been pondered and worked upon by the author in several past projects throughout his studies. This background work will be further explained in chapter 2.

The investigation for this thesis began with a very pragmatic and atomic view of gaming: the first step was then to cement and expand our knowledge of what gaming encompasses. While the research methods were always based in playing, analyzing and reading about games and their theory, throughout this step we assumed three different postures towards them: first, video game as a product, second, video game as a medium, and lastly, gaming as process.

The first approach was the most direct. Accepting video game as a product sets the gamer as a consumer of entertainment. This part of the analysis was mainly focused on the formal aspects of game design. By playing video games and reading reviews and interviews, it was possible to build up a deeper understanding of the design process behind video games, from the graphics, to sound, to the rule sets that govern them.

The second approach, video games as medium, was made more obvious by delving in the independent side of gaming. Generally and predictably, indie developers are not so concerned with the profitability or marketability of their works; fact that enables them to take risks on the potential for game design to communicating and produce meaning in a way big budget developers generally can't afford to. Furthermore, indie developers often work alone, or in small teams, thus imbuing their creations with a very personal component that is hard to obtain by most major game companies.

The third approach is a step back from the video game world and into a bigger picture. It concerns the basics of the game itself: what is a game, and what are its most basic components. By reading about game theory it was possible to distinguish the thin line that separates gaming from other activities, and at its most abstract form (the four defining characteristics of a game that will be explored in chapter 3) isolate it more as a way of thinking than a potential product or object.

After this first phase of research about games, the investigation followed a second independent way. This study was conducted through books and Internet sources about artists and their works. Focusing back on our art production goal, the second big step of this investigation concerns the art world, mainly the participation problematic; the way participation has been addressed in recent art history, especially from the 20th century *avant-garde* onwards. We were interested in studying the way different authors addressed this concern, not only conceptually by their ideas, but also practically with their artworks. This investigation's results can be mainly seen in the choice of works and artist we elected for analysis throughout chapter 3. We directed our attention to seminal authors that question the notion of participation in different levels and direct their works and thoughts into ways in which their public can be put to test in regards to their own limits. The plasticity and subtlety of the way the public can be oriented to change their purpose – from visitors to targets, participants or even performers – was a very important step in understanding how deep the relationship between creator, art work and public can become.

Finally, after these two big phases we commenced a third one, this time mainly to gather knowledge regarding the practical work. Both conceptually and practically, this phase was more of an evolutionary step that builds upon the author's previous explorations, but attempts to expand them. That was possible mainly because of the study comprised by the two aforementioned study phases, but in regards to technical knowledge we took a risk and started from scratch with new technology we had never used before: the *Unity* (Unity Technologies, version 3.4) game engine, which we learned how to work with in classes, with great reliance in its reference and internet forums. This study's repercussions can be attested throughout the entirety of chapter 4, where we explain in detail all the steps that constituted the practical component of our dissertation.

### 1.3 The Document's Structure

Due to its extension, we tried to guide the evolution of this document in very straightforward and logical ways. We try to properly introduce each point before following on to the next, and attempted to include adequate reflection moments to reiterate and remember the topics approached. Still, in order to provide a good guide to our dissertation, we shall briefly overview the topics that each section of this document will concern, and explain their relation to our main topic.

This first chapter is of course an introductory chapter where we explain our fundamental ideas and how we chose to study them in the context of our dissertation. Moving on, the second chapter will attempt to do the same, but about the practical component of our work: we shall briefly introduce *Balance*, our interactive installation, and clarify its rationale and origins.

Having approached both components of our dissertation – theoretical and practical – we shall then proceed to its expository section: chapter 3 is where our proposed ideas are explained in depth. As our title suggests, we are applying some game features to art in order to create relation. In this chapter we will explain what game features these are, and what we mean by creating relation. We shall start by explaining the game features that we will be attempting to apply to our work; each game feature will be explained resorting to examples that will hopefully clarify our purpose in resorting to them, while at the same time attesting the wide application of what we will call the game lens. After that, we will briefly overview some prominent figures that followed different paradigms in the way they considered the public. These different approaches will help understand the specificities of the approach we finally follow. This chapter will end with a brief explanation on how these different topics are considered in our installation as we further explain its most direct influences. And after explaining some of its theoretical foundations, in chapter 4 we dive fully in the description of all the steps we underwent in the making of our installation. We will start with its technical and functional aspects, by describing the technology we used and why, and then move on to explain more about the aesthetic and functional choices that we made. After that, we saw fit to include an analysis of the last fundamental component of our installation: the public, and their response to our project. That helped us assess the relevance and validity of our ideas, and finally, of the work itself.

Finally, we close this dissertation with a brief critical summary of its contents, and mention other possible investigation topics that it prompted.

This introduction hopefully provided a concise but valuable overview of the topics at hand, so without further ado, we shall start unraveling our opinions and investigation about how we can provide more socially relevant works of digital art by applying some game features to their process and conceptualization.

# 2 *Balance*: The Interactive Installation

As said before in our introductory chapter, our dissertation's main topic revolves around a specific art production approach: the usage of digital interactive art as a producer of social interstitial spaces and contexts. We wish to explore the validity of applying some principles found in games in order to produce interactive installations that provide means for people to connect, to bring visitors together in a meaningful way. As we will explain in chapter 3, our first step to attempt to validate our approach consisted of questioning how our game theory references could be applied to works that already exist, analyzing both artworks and games with the same criteria. But while this analysis was invaluable for our thesis, it's important to remember that its focus relies in the production of works that foster relation, and therefore a strong practical component is indispensable. As a means to ascertain our dissertation's validity, we produced an interactive installation that attempts to leverage the ideas we explore throughout this document: applying our findings to our own work enables us to test if the application of game characteristics to digital art is a valid, constructive or even desirable trait in a work that attempts to create public-centric art works.

In this chapter, we wish to provide an initial overview of our interactive installation, *Balance*, and the process that led to it. We will not delve very deeply on its planning, construction or technologic features yet: chapter 4 provides an extensive explanation of the most relevant aspects of our work. Instead, in this section we will very briefly introduce our installation and put it in the context of our own past works. This chapter's purpose is to introduce a frame of mind, to set the background for our work, and to explain how this thesis and this project came to be. We will start by briefly explaining what our project is. Then, we shall go back to previous projects we made and explain some important insights and results we achieved with them. These descriptions will not only introduce our own approach towards the creation of socialization contexts, but also help to better understand how our present project came to be. Finally, before proceeding to the most fundamental and expository component of this document, we will very briefly speak about some of our project's specific references: not so much about the works themselves, but mainly about the kind of sources we consulted and drew ideas from.

## 2.1 Project Objectives

As is the main study object of this document, with its practical demonstration we wish to create an object that will act as a social catalyst for public interaction. We want to create an artifact that provides an opportunity for strangers to be able to communicate with each other, enhancing social experience. As it was said before, we see art as an actor with the power to provide unique socialization opportunities – constructive ways of bringing people together. And by providing an objective-oriented experience it is easier to invite people to collaborate in its solution; hence the game process.

In order to fulfill these requirements, it is important that this installation is accessible and very simple to use, but still provide challenge and interest. In *Balance* (figure 1), people are presented with a simple problem and a very intuitive interface to solve it. *Balance* features a top-down projection of a circular platform on which marbles fall. These marbles should be guided to the hole in the center of the platform. As it would be expected in the real world, by stepping on the platform it tilts, as if it were reacting to the person's weight, causing the marbles to slide. Even though the platform is merely a projection, the fact that this process is so simple and intuitive makes the project immediately accessible, even for people that are not accustomed to technology. The platform's behavior is also very predictable: if two people stand on direct opposite sides of the platform, it stays perfectly leveled. This predictability in the project's behavior also enables it to admit several participants at the same time, without harming its main logic.

**Figure 1 – Our interactive installation: *Balance*. (Photograph by the author)**

It should be clarified that while the installation is thought as a collaborative effort, our main objective is to provide a social agent. As such, uncooperative or even antagonizing behavior is also a valid consequence of the project. We want to foster relation: it's up to the people if they want to work together or against each other. The project will inherently reward cooperation with the easier fulfillment of the proposed objectives, but no effort will be done to punish uncooperative behavior.

The way we see it, the installation will be successful if it generates a social bubble around it, providing people with an enhanced way of interaction. We hope to provide a starting point to either strangers or groups of known people to participate in a common activity, creating their own narratives and memories as they do so.

### 2.2 Context and Past Work

No idea comes from thin air. As it was previously hinted in subchapter 1.2, the application of game theory to interactive installations is something we've been experimenting with in past projects. Audience participation has been one of the most important factors in our artistic studies and works; there was always an effort to think about and include the public in the artwork, to provide ways for people to affect the outcome of the piece.

To further explain how we approached this issue in the past, we shall now refer to some of the author's previous efforts. What we hope to retrieve from these examples is mainly what we learned about public involvement from each work: because of that our analysis will be chronological, and start with *imagine* (Coutinho, 2009) a multimedia installation.

### 2.2.1 *imagine*

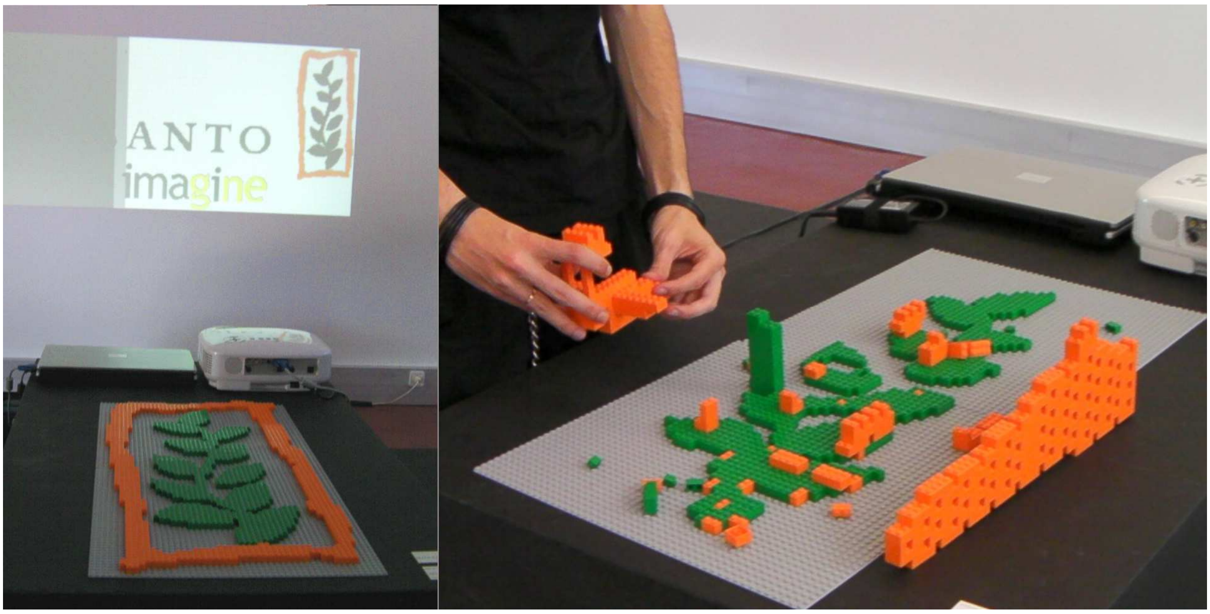


**Figure 2 – *imagine*. Left: the installation's initial state. Right: a person is building a spaceship from the Lego sculpture (Photographs and photomontage by the author)**

*imagine* (figure 2) was an installation composed of two parts: a video projection and a Lego sculpture. This work constitutes a reflection about the patenting of intellectual property; the frivolity with which some companies patent intellectual property that should in our opinion be available in the public domain. In order to metaphorically free up that closed content to the public space again, we built a company's logotype using Lego blocks, and offered the sculpture to the public. A logotype, a corporation's private identifying and unmistakable icon, was given to the public and subjected to its action and modification as retribution.

Since Lego blocks are such a familiar and simple object, people were immediately drawn to the sculpture, and quickly even started playing with each other, even surpassing expectations about audience participation.

With *imagine* we could confirm how it is in fact very possible to provide the public with social interaction contexts. Our main goal with the work was the reinterpretation of the sculpted symbol, but the way it was done had the charming and playful side effect of providing people with a chance to play with each other.

With this knowledge in mind, in the next project we set ourselves to further experiment with this playfulness by isolating it from other content.

#### 2.2.2 Pom

In *Pom* (Coutinho, 2010), participants use their smartphones[3] to play a game of an updated version of the classic *Pong* (Alcorn, 1972). The game mechanic remains as the original: players have to direct their paddle to bounce the ball off. The main difference from the original is that up to 6 people can play the game simultaneously, entering and leaving the game as they please. Again, this provides an opportunity for strangers to jump in the game at any time, allowing for a casual and free fruition. There is, though, an important factor that was preserved from the original: there is only one screen. Players are further brought together by the fact that they all share the same play area, which contributes for the creation of the social bubble that surrounds them (figure 3).

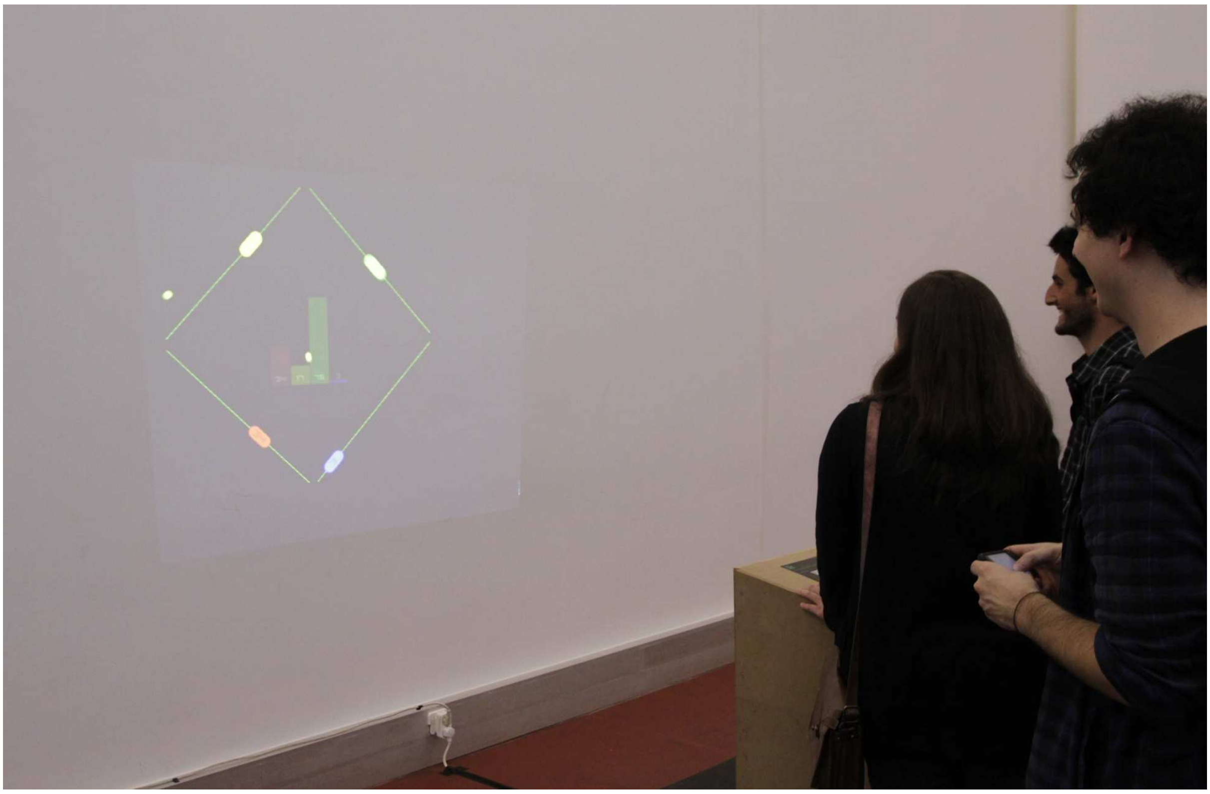

**Figure 3 – Four people playing *Pom*; two with the provided trackpads and two with smartphones. (Photograph by the author)**

While *Pom* was very successful game-wise, it wasn't as effective at fostering relation as it was intended to. Its simple mechanics and immediate recognition were inviting, but the common screen prevented people from properly acknowledging each other. In spite of its graphical simplicity, the constant action made *Pom* a very immersive experience: players needed to constantly focus their attention on the screen, preventing them from realizing their

[3] The installation was initially planned so that participants had to use their smartphones as controllers, but in order to make it more accessible, in the exhibition we decided to make two trackpads available, so that even people who did not possess these mobile devices could join in.

opponents around them. Among groups of friends this was not at all a problem; given the existing familiarity between them already, quickly players even started teasing each other in a playful setting. Maybe because of that, other potential players seemed to feel as if they were "crashing in" on the game. This unwelcoming feeling was also due to the fact that *Pom* antagonizes players against each other; the player's first interaction with each other was a conflict.

These points were taken into account in the next projects, and we will now draw important conclusions with *aB* (Coutinho, 2011).

### 2.2.3 *aB*

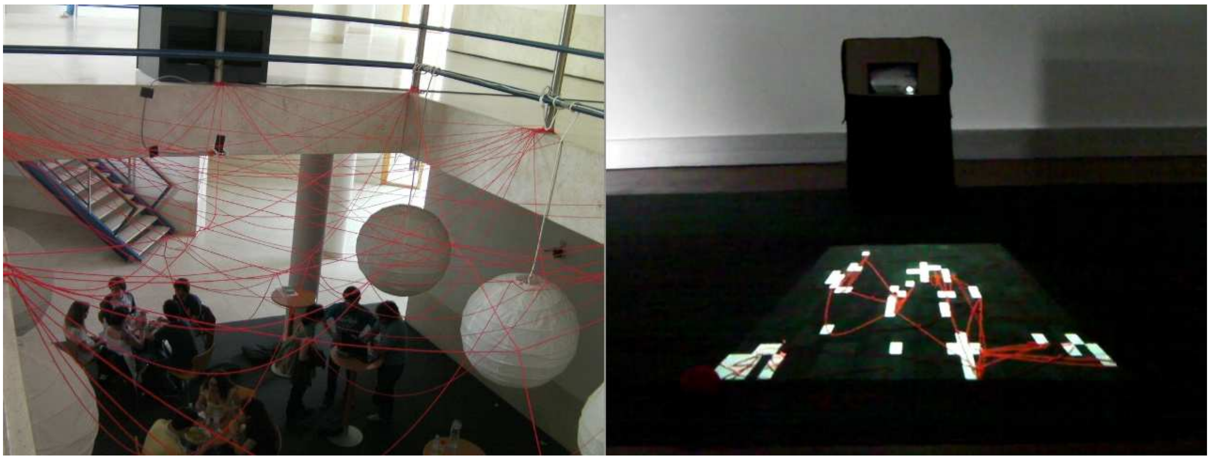

**Figure 4 – Left: Space A. Right: Space B. (Photographs and photomontage by the author)**

*aB* follows a different way of seeing public interaction and integration. It is a reflection upon causality, and the chosen way to illustrate this concept was to segregate cause and effect to two independent but intertwined spaces. A camera on the ceiling of a room analyzes people's movement (space A), and then their paths are mapped and projected onto another room's floor (space B). We can see these spaces in figure 4.

Unlike the previous examples, in *aB* there is no direct feedback to participation: the people that affect the outcome of the work can't see their effects, and the people that see the effects can't affect the outcome. Still, it was important that the information in space B was clear and accessible to visitors. The chosen way to do so was to project the map on the floor, enabling people to gather around it. The top-down view also provides a more tangible grasp on the representation of people's movement, making it easier to understand space B's representation as a consequence of space A's action.

This choice had a very good outcome: despite the lack of possible action, the floor projection enabled people to circle it and reflect about its purpose, while enabling discussion among visitors. Before realizing how the installation worked, peopled even tried to walk on the projection to try to make it react.

Obvious as it may seem, with this work we learned that a floor projection is a good way to gather people's attention, because it enables people to surround it. It also enables visitors looking at the floor to still acknowledge each other using peripheral vision. These characteristics were now adapted in the context of *Balance*.

### 2.2.4 Hindsight

Analyzing these examples with hindsight prompts us towards a series of important notions. First, that it is very easy to playfully integrate people in the context of an exhibition by providing simple and immediate symbols or objects. Second, that even the simplest local multiplayer video games can be excellent immersive social experiences. And finally, that the floor is a very natural place for a projection, since people are used to constantly and intuitively watch both where they're stepping and their surroundings at the same time. Another of the motivations that drove *Balance* was thus the evolution and refinement of previous work form and methodology. As it was stated before, with this document we strive to crystallize knowledge about participation following game theory processes. *Balance* builds on past work with the purpose of providing another form of harnessing game theory applications in art production.

## 2.3 *Balance*-specific references

As we've just seen in the last subchapter, this project builds on an existing knowledge base of other works and references. Nevertheless, each work's specificities require appropriate research elements. In *Balance*'s case most of the references came naturally, due to the core integration between thesis and project; in a way, all the references we mention throughout this document had their importance on the final project. But of course some works weighed more than others, and in order to conform to the four defining characteristics – the pivotal game lens on which this thesis is based and that will be explained in chapter 3 – we too elected four defining references that played the most important part in the definition and conceptualization of our installation.

Another important factor in the choice of our main references was the importance of maintaining a balance between artistic and gaming references. Since this project attempts to be situated in the crossing of these two worlds, it is important to carefully guide its evolution, to prevent either of its separate influences from standing out too much. Consequently, sources had to be varied enough to accommodate examples from both types: the art world and the video game world. That being said, the main inspiration for our *Balance* was a homonymous short animation film by two German director brothers: Christoph and Wolfgang Lauenstein (Balance, 1989). Their animation, *Balance* (Lauenstein & Lauenstein, 1989), prompted and heavily inspired the installation's main game mechanic. In a more indirect way, the game's pace and progression was influenced by the classical game *Tetris* (Pajitnov & Gerasimov, 1986), in a sense that there are independent sequential levels to clear, and the remnants of one level progress to the next. On a more functional and graphical level, our installation took some important cues respectively from the interactive installation *Boundary Functions* (Snibe, 1998) and the video game *aTilt 3D Labyrinth* (FridgeCat Software, 2011). All these references and their purposes will be individually and more thoroughly explored in chapter 3.

Inexorably, since both the theoretical and practical components stem from the same common root, it is sometimes hard to isolate which sections influenced what aspects. As previously stated before, the next chapter will be composed of a deeper analysis of the previously mentioned approach of understanding a game as a process. This attitude was fundamental both in understanding gaming in itself and in learning how its core elements can be applied in other fields. We shall then move on to the expository section of our dissertation, where all the relevant concepts and their relation with each other will be explained.

# 3 Game as Process

When we speak about game as process, we are speaking about more than just a game's fruition. Our game process is much more than what goes on when someone plays a game. In essence, what we mean by game as process is more closely connected to what a given object would look like when seen through a game designer's eyes. This perspective will be further explained throughout chapter 3.1, where we will introduce and explain what we call the Game Lens. Our goal with this chapter is proposing a way of approaching a subject that relies on the questioning of its components based on a game design perspective. Ultimately, by applying these ideas in *Balance*, our installation, we hope to clarify how some game features can be applied to Digital Contemporary Art.

But while in subchapter 3.1 we will direct our attention to the analysis of some works according to very specific criteria, in subchapter 3.2 we will focus on a more global overview of the concept of participation, another fundamental aspect of our study. In that subchapter we will skim art History since the beginning of the 20th century in an attempt to understand how different authors have approached participation; what is the public's role in relation to the art work. This subchapter will help us better understand what we mean when we speak about creating relation, and in what ways that idea differentiates itself from previous efforts, thus clarifying our own positioning towards participation.

Lastly, in chapter 3.3 we will speak more specifically about *Balance*'s specific influences and references, to provide a solid basis on how our work is based on our investigation and sources so far. This chapter will contain a description of our most significant inspirations and explain their relevance in the context of our investigation.

When this chapter reaches its end, our view on games and art should be already be clear. Throughout the entirety of chapter 3 our goal is to better explain our motivations and considerations about the process that makes up the fundamental problematic of our thesis: how some game features can be applied to digital art in order to create socially relevant contexts.

Let us then begin tackling this proposition by explaining the game lens.

## 3.1 The Game Lens: Four Game Defining Traits

While trying to define what a game is, game designer and researcher Jane McGonigal quotes philosopher Bernard Suits in what she considers "the single most convincing and useful definition of a game ever devised: 'Playing a game is the voluntary attempt to overcome unnecessary obstacles.' " (McGonigal, 2011, p. 22).

It might sound like a paradox to say that games can actually be the hardest kind of work we do. But that's precisely one of the ideas Jane McGonigal (2011, pp. 28-34) explores in the beginning of her book. And in fact, this inherent uselessness of games seems to beg for the next logical question: if games are about unnecessary challenges and still animate us in such ways, what if we could apply that motivational potential in "real" work? Alas, this question is outside this thesis' scope. What we shall take from it is the simple realization that the game way of experiencing, what we will define as the "Game Lens", is applicable to other completely different contexts. But before we actually attempt to do so, let us delve a bit further in its meaning.

McGonigal (2011, p. 21) writes that there are four defining traits for a game. They may be hidden, or not in the explicit form we are accustomed to see them in, but all games always include all of them: otherwise they are not games. These four defining traits are: a goal, a set of rules, a feedback system, and voluntary participation. Another author, Tom Chatfield (2011, p. 6) seems to agree: “What is it, then, that makes a game? In one sense, the game is born of a consensus: the learning and obeying of a simple set of rules. This consensus allows both for competition and collaboration; it allows the measurement of better and worse performances, of more and less achievement.” Although the words are different, their meaning seems to be the same: we have consensus as voluntary participation, the agreement on a set of rules, competition or collaboration as means to accomplish a goal, and the measurement of performance as a feedback system.

These four defining traits are the ones we will guide ourselves by throughout this document. Still, it’s important to refer to yet another definition before moving on. Jesse Schell (2008, pp. 30-36), a major reference on game design[4], proposes a set of ten game qualities (figure 5).

Q1. Games are entered willfully.

Q2. Games have goals.

Q3. Games have conflict.

Q4. Games have rules.

Q5. Games can be won and lost.

Q6. Games are interactive.

Q7. Games have challenge.

Q8. Games can create their own internal value.

Q9. Games engage players.

Q10. Games are closed, formal systems.

**Figure 5 – Jesse Schell's 10 game qualities (Schell, 2008, p. 34)**

While Schell’s list is in fact more complete and comprehensive, it doesn’t seem to add anything the four defining traits don’t encompass already; we can generally group each of the ten qualities under the four principles, and actually attempting to do so is an important exercise that will help us realize the range and scope of each of the four characteristics[5].

As it was said before, this subchapter is about the definition of the Game Lens, so we shall finally define it as the application of the four game defining traits to any given object.

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[4] In his book, *The Art Of Game Design: A Book of Lenses* (Schell, 2008) Jesse Schell proposes one hundred lenses (perspectives from which to look at something, e.g. “The Lens of Goals”, or “The Lens of Profit”) to aid in game design process and critique. This approach inspired the use and definition of our term “The Game Lens”.

[5] While we will try to make our choices clear, it is natural that the reader might disagree on how we distribute the qualities among the traits. We acknowledge that, and accept that ambiguity as the reason why we chose to include and relate both definitions.

Applying the game lens is reflecting upon the goals, rules, feedback systems and voluntary participation of a video game, an artwork, a movie, an electrical appliance or any other kind of object. But in order to understand how that can be accomplished, we need to be at ease with each one of the four traits. The rest of this subchapter will then be dedicated to the definition and understanding of each the four game defining characteristics. We will explain what each of the four traits stand for, and resort frequently to Schell's ten qualities for clarification and new perspectives. We will also make reference to examples both in the game world and the art world[6], so as to better illustrate how each of the traits can be applied or subverted. In line with the order we've been following up until now, we shall start with questioning what "goal" means.

### 3.1.1 Goal

A goal is the objective players will work towards fulfilling. It is one of the basis of gameplay because it sets its purpose. In most cases, the goal also sets the winning and losing conditions. Jesse Schell's second and fifth game qualities ("Games have goals" and "Games can be won and lost", respectively) fall into this trait, but we must point out the latter as more of an indication than a literal rule. *SimCity* (Wright W. , 1989) is an example of a game that can be neither won nor lost. It still is, though, completely goal-oriented: the player must build his dream city. The game doesn't provide any explicit winning or losing condition: arguably, one can say that the player wins when he's happy with the city he's built, or loses when the city goes bankrupt, but even in those situations the game never stops by itself. Perhaps counter-intuitively, the fact that there is a goal doesn't mean it can be achieved. As in our next

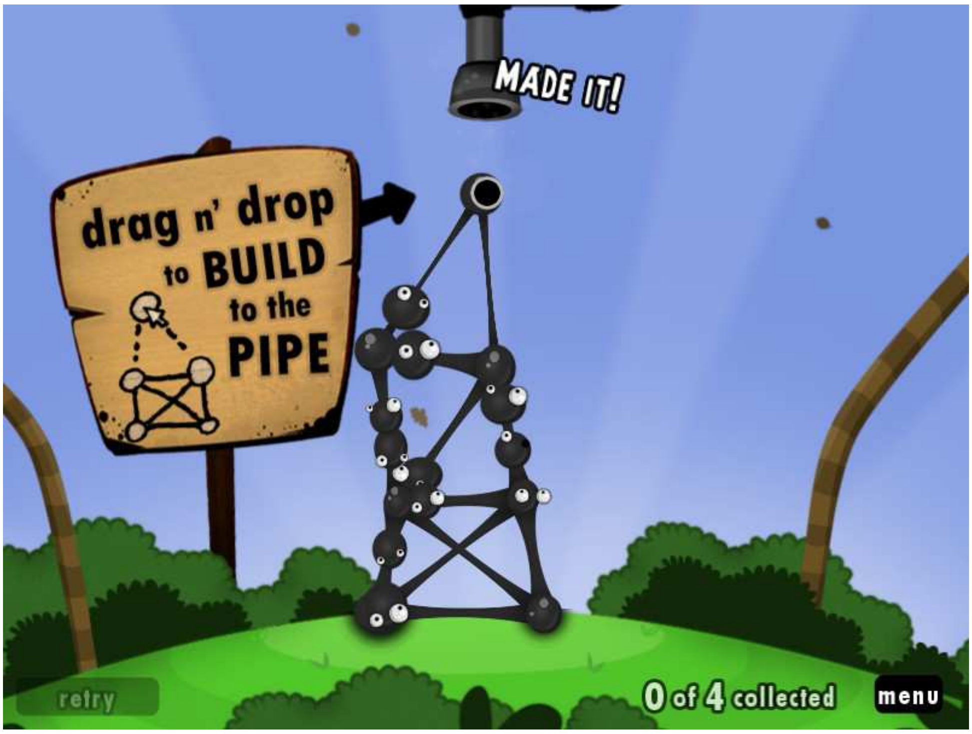


**Figure 6 – The structure leading the goo balls to the pipe. (Screenshot)**

[6] We remind that we refer established art works and established video games precisely to demonstrate how our game lens can be applied to both in a non-discriminatory manner. The order of the examples depends solely on the logical construction of the text. Examples are cited to better illustrate the train of thoughts we're following.

example, a goal can just be an intention.

We will start this analysis by peering upon a video game called *World of Goo* (Gabler & Carmel, 2008). *World of Goo* is a videogame developed by the independent game company 2D Boy that consists on the construction of structures made out of interconnected goo balls that provide a pathway from a starting point to a tube, through which excess goo balls will escape (figure 6).

But while the game itself proposes uncommon but interesting goals and ways achieve it, what we shall talk about is the meta game it includes, called *World of Goo Corporation*. In the main game, all levels include a minimum amount of saved goo balls to pass on to the next level. In an interesting way to increase replay value, all the extra goo balls saved beyond that minimum are sent to a level parallel to the main story: the *World of Goo Corporation* (figure 7).

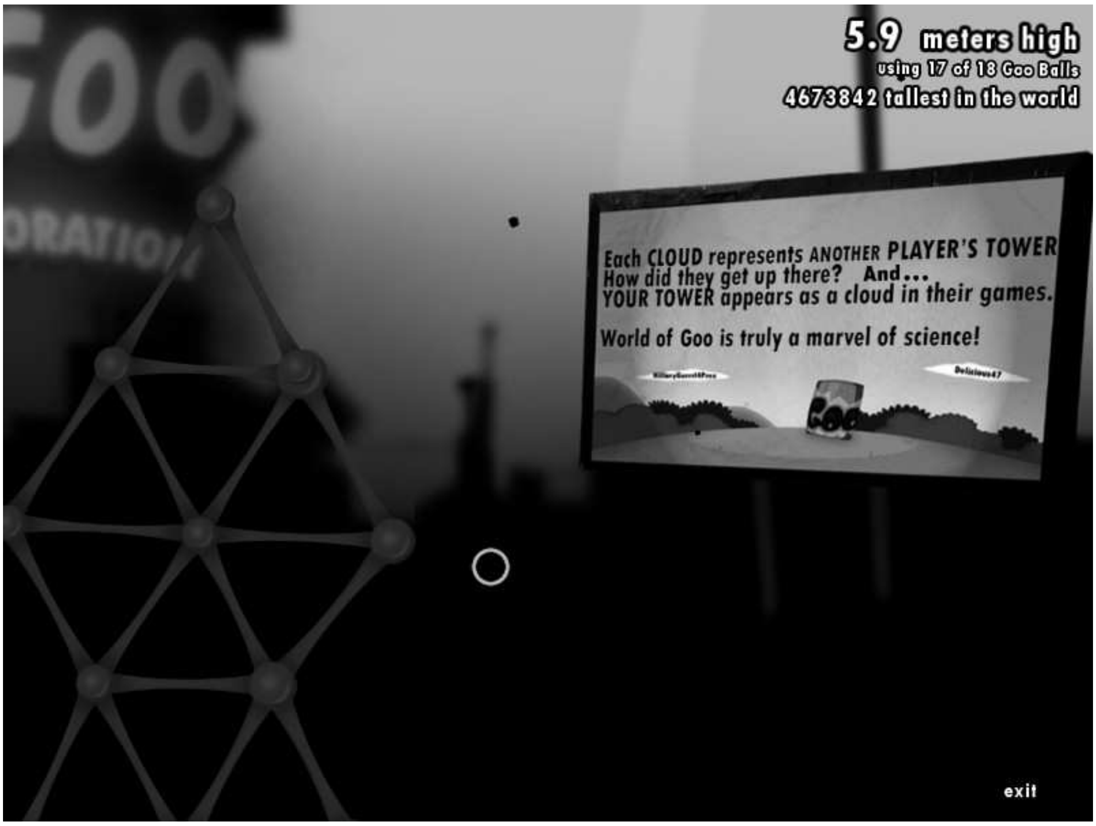


**Figure 7 – *World of Goo Corporation* (Screenshot)**

Here, players can use all the collected goo balls to build whatever they please. There is, though, an implicit directive: the player’s placement on the world’s tower height ranking. As players build up their towers, they can see their rank going up (sometimes by thousands at a time) and small clouds will start appearing in the sky. Each cloud represents another player, stating his/her name, nationality, tower height, and number of collected and used goo balls. These clouds are also placed at their owner’s tower height, so as to provide a more visual means of comparison.

*World of Goo Corporation* is a completely marginal experience in the game. It is nonetheless in our opinion one of utmost importance in *World of Goo*’s popularity. The competition aspect of this very simple directive elegantly pushes players towards building high. And the reassurance that the player is not alone provides a very real feeling of belonging: there are many other goo towers around the world, and at any time there is someone building one along (or against) the player. The lack of direct contact (it is not possible to directly communicate with other players other than by building your tower or reading their cloud) also helps to focus all the player attention in this dynamic, this comforting acknowledgment of the other. In the *World of Goo Corporation*, an unsolvable and open goal[7] can become a very meaningful experience.

In a diverse but still relatable way of seeing, we will cite a work from artist Aaron Koblin, *The Sheep Market* (Koblin, 2006). In this work, Koblin used Amazon's Mechanical Turk[8] to give people a simple goal: "Draw a sheep facing left".

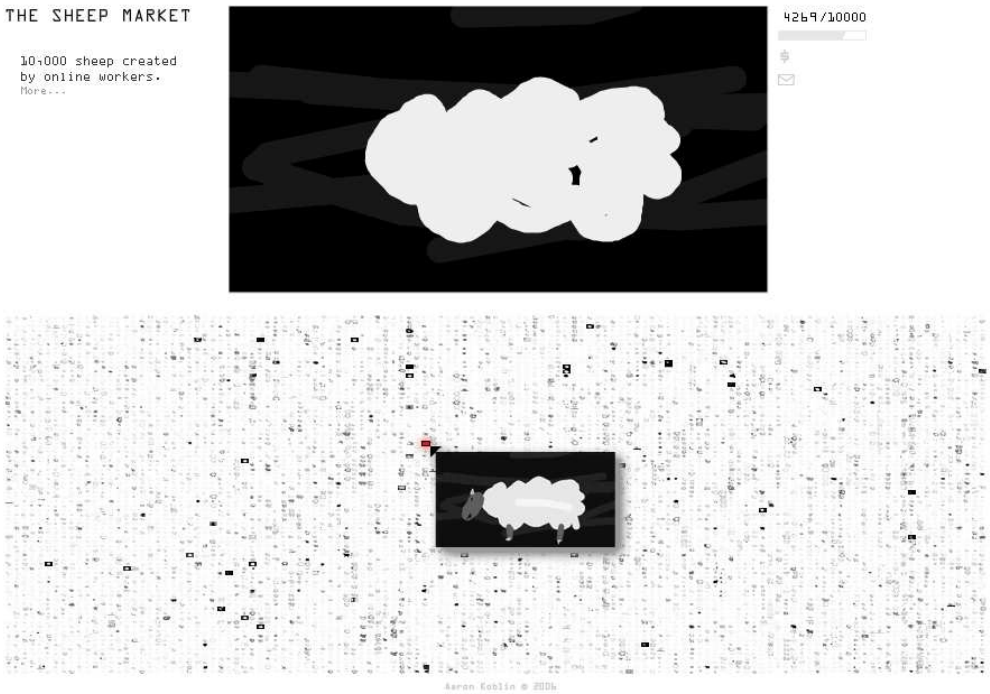


**Figure 8 – The Sheep Market (Screenshot. Retrieved from http://www.thesheepmarket.com/ on 30/08/2012)**

Each person was paid 0.02 US dollar for each accepted drawing, and the final result is a website with a mural of 10.000 sheep (figure 8). By clicking them, the user is able to see the drawing process of each and every one of these sheep. That and the sheer amount of drawings grant this work a very sketch-like nature, as if it was never meant to be completed, but instead always nearing completion.

Not only does this work feature a very open goal and sense of community, just like *World of Goo*[9], Koblin's own selection process allowed for some very interesting results. Looking at

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[7] We remind that we interpret the goal as being "building up" and not "build the highest tower".

[8] This is a service from Amazon.com that provides a means for assignment and accomplishment of tasks that computers are not good at performing but are very easy for humans. (https://www.mturk.com/mturk/help?helpPage=overview on 30/08/2012)

[9] Though one could argue that this sense of community in *The Sheep Market* is tainted by the fact that people are being paid (thus possibly having other motives than the will or openness to be part of a community), and that they were not directly aware of each other until the very end of the project, with the completion of the website.

figure 9 we can see four very different submission examples; the last one is not even facing left! On his TED[10] talk (Koblin, 2011), Koblin shows the very peak of this defiance; a user that instead of drawing a sheep, wrote "Why? Why are you doing this?"

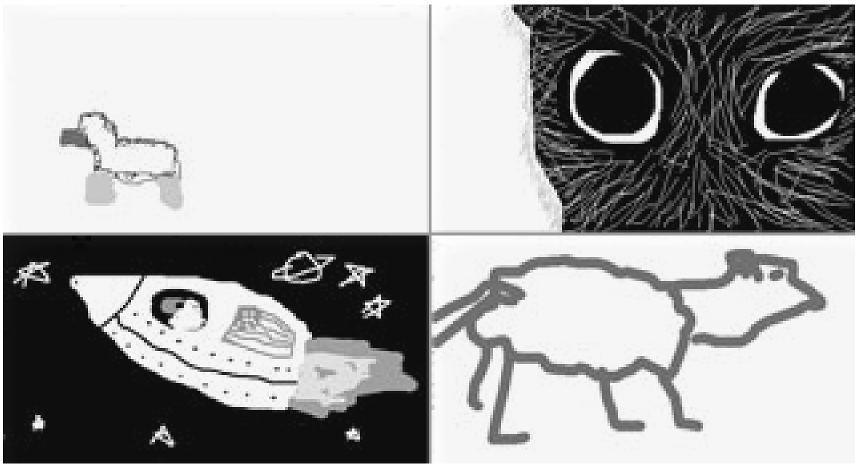

**Figure 9 – Some examples of sheep. (Screenshots from the website. Photomontage by the author. Retrieved from http://www.thesheepmarket.com/ on 30/08/2012)**

The freedom of interpretations and outright defiance of the very motor that powers this work is probably what makes it so interesting. It reiterates that these are tasks computers aren't good at, and that efforts of many, even if they are not aware of it, can easily be coordinated with very interesting results.

As we can see, although a goal is indeed something very basic and elemental, it is a very scalable and modular concept that can be shaped towards very interesting outcomes.

#### 3.1.2 Rules

A rule set is what defines obstacles and limitations within the context of the game. Players can only do what the rules allow them to do, and their goal as players must be the overcoming of the imposed limitations in order to achieve their objectives.

Rules separate game activities from other activities because rules turn them into artificial challenges. As Jesse Schell writes, "When problem solving is removed from a game, it ceases to be a game and becomes just an activity." (Schell, 2008, p. 35). There is little challenge in pinning the donkey's tail with open eyes. We can easily include Schell's qualities four and seven, "Games have rules" and "Games have challenges" under this definition, but there is still room for further exploration, which we will promptly start by analyzing *Rhythm 0* (Abramović, 1974), an iconic work from performance artist Marina Abramović (figure 10).

In this work, Abramović stood inert for six hours by a table with a number of different objects. The table contained objects such as "a rose, a feather, grapes, honey, a whip, a scalpel, a gun and a bullet." (MoMAMultimedia, 2010). Participants were permitted to use those objects however they wanted on Marina: the rules were set. The artist described the

[10] TED is a non-profit organization that operates under the motto "Ideas Worth Spreading". Their mission is to provide people with ideas with a chance to give the "talk of their lives" (http://www.ted.com/pages/about on 30/08/2012)

performance as “six hours of real horror” (MoMAMultimedia, 2010). She says that while at first the public was acting rather playfully, as the performance went on, they started acting more and more aggressively. Marina had her clothes ripped off, had been cut by a knife, had her blood drank and had the now loaded gun forced on her hand, among other things. When the six hours finally passed, the artist moved for the first time, and walked towards the audience: “Everybody ran away. Literally ran out to the door.” (MoMAMultimedia, 2010). The game had ended.

The strong social and cultural implications of this work point us to Schell’s quality three:

**Figure 10 – Marina Abramović in *Rhythm 0*. (Retrieved from http://www.moma.org/images/dynamic_content/exhibition_page/42552.jpg on 30/08/2012)**

“Games have conflict”. But in this case, the conflict is not between two teams: the conflict is between regular people and their own morality and boundaries. As we will further explain when we speak of voluntary participation, all players must agree upon the rules. In this case, we can suppose that all players simultaneously agreed to push their limits, their curiosity leading to an increasingly violent behavior. Since the artist didn’t stop them, people kept on provoking her, testing themselves and each other’s limits, but to no avail. People only realized their actions and their positioning when the performance ended, after six hours. We might assume that it was only when the artist became a real moving person to the public’s eyes that people realized they had been torturing another human being.

*Rhythm 0*’s interest seems to lie in the dynamic it establishes with its audience. After our conclusions, it seems fair to state that without a public, this artwork would not have the same meaning at all. And in this sense, this performance is akin to a game: it only makes sense when played by other people. And people seemed to respond to it by testing the boundaries of the game mechanic they were offered.

Tom Bissell (Bissell, 2010), a journalist and critic that frequently writes about games, wrote the following: "… Games have rules, rules have meaning, and gameplay is the process by which those rules are tested and explored." (Bissell, 2010, p. 96). This definition's implications seem to fit in what we said about *Rhythm 0*, and they certainly fit in with our next example, *Braid* (Blow, 2008).

**Figure 11 – Left: The enemy killed Tim. Right: Pressing the button to go back in time. (Screenshots and photomontage by the author)**

*Braid* is a video game that revolves around its game mechanic: time-control. Every other aspect: its graphic features, character design, background music, were made to conform to that set of rules. With a strong resonance of the classic *Super Mario Bros.* (Miyamoto & Tezuka, 1985), *Braid* is about the relationship of the main character – whom the game calls Tim, although Jonathan Blow, *Braid*'s creator, refers to as "the dude" (Bissell, 2010, p. 98) – and an unnamed Princess. The game's premise is based in the question "What if we could undo our mistakes?" and turns that idea into its very own core mechanic[11]. In *Braid*, the character never dies, and the player never loses: if the dude is mortally struck by any of the game's many dangers, the player must hold a button to turn back time and revert to the state right before the mistake was made in the first place (figure 11). *Braid* features six different worlds, each with a distinct nuance of time-control. In world 2 – the first world – the player can go back in time by pressing a key. In world 4, in addition to that, time flows forwards when the character walks right, and backwards when the character moves left. Unlike so many examples in the genre (platform games), *Braid*'s puzzles are not based on quick fingers or pixel-perfect jumps. Every challenge in *Braid* can be surpassed logically once the player understands the implications and subtleties of the proposed game mechanics.

[11] Jesse Schell (2008) defines "game mechanic" as "… the procedures and rules of your game. Mechanics describe the goal of your game, how players can and cannot try to achieve it, and what happens when they try." (Schell, 2008, p. 40). Although Schell speaks of many defining characteristics in this definition (he explicitely refers rules and goals, and implicitely hints at feedback system by saying "what happens when they try"), we chose to introduce this term here, due to the deeper (in our opinion) connection of game mechanics to rules than to the other characteristics.

In our opinion, *Braid*'s most successful achievement was the fact that the game doesn't need to explicitly reward the player: *Braid* doesn't feature a score or level up system. Even the only collectibles – puzzle pieces – must be used in clever ways to clear some of the challenges. In a conference, Jonathan Blow (Blow, 2010) makes the following brief remark about *Braid*: "The interesting parts of this game, the little discoveries and 'A-ha' moments that you have, all happen inside the player's head." (Blow, 2010)

*Braid* is an example that shows it is possible for rules systems to convey meaning by themselves. When playing *Braid*, one can have a deep understanding of that world, even without having read the story. And for that, we will finish this explanation by associating rules with yet another of Schell's qualities: "Games are closed, formal systems". Games have rules that limit their world's full disclosure: *Braid* is 2D, for example. But these limitations and constraints are precisely what direct players towards what the game designer wishes them to see or experience. One could say that imposing rules in a game is the game designer's equivalent of a film director choosing where to point the camera.

#### 3.1.3 Feedback System

While at first sight it might seem like something either overly complex or not very significant, the feedback system is, like all the four traits, fundamental in every kind of game. Sometimes very implicit and some others very obvious, the feedback system is the mechanism that informs the players on how close (or far) they are from achieving their goal. Since it is affected by and responds to player's input, it validates Schell's quality six: "Games are interactive".

The feedback system's complexity is highly variable: it can be a simple scoreboard with very few information or the amount of checkers still left on a checkerboard. An important characteristic of a feedback system is confirmed by quality eight: "Games can create their own internal value". And indeed, a game's score has no meaning outside of the context of a game. As Schell (2008, p. 32) puts it: "Monopoly money only has meaning in the context of the game of Monopoly."

In some cases, the feedback system is so interwoven and prominent in the game it can even be used as a means to discover the goals and rules themselves. This last approach is one that has been increasingly applied to video games (McGonigal, 2011, p. 26). Relying of course in the game culture background the average videogame player nowadays has, in some games the player starts playing with no instructions whatsoever, and it is the feedback system that teaches both the goals and rules of the game.

One of such examples is *Bastion* (Rao, 2011), a role-playing game[12] from Supergiant Games. In figure 12 we can see screenshots of the very beginning of the game. When it starts, the main character is lying down, nothing is happening. By pressing the movement controls, the character stands up, and a narrator (of which no introduction or context has been provided so far) starts speaking: "He gets up. / Sets up for the Bastion. Where everyone agreed to go in case of trouble." And this is the only direction or context so far: I need to go to this "Bastion",

[12] Writer and video game journalist Steven L. Kent (2001) briefly describes role-playing games or RPGs as "adventure games in which players traversed elaborate worlds, gaining experience and learning fighting techniques while completing a quest." (Kent, 2001, pp. 539-540).

because there was some kind of trouble and apparently there are people that expect me to do that.


**Figure 12 – The beginning of *Bastion*. (Screenshots and photomontage by the author)**

Using this same system, the dynamic narrator even teaches the player how power-ups and weapons work. He also instructs the player on ways to defeat some enemies, and occasionally even rewards certain feats with praise or taunts.

In a much more poignant sense one could also refer Félix González-Torres work *Untitled (Placebo)* (González-Torres, 1993).

**Figure 13 – *Untitled (Placebo)*. (Retrieved from http://www.queerculturalcenter.org/Pages/FelixGT/placebo.html on 30/08/2012)**

This installation (figure 13) consists simply of a large amount of candy in an exhibition room. While apparently simplistic and even warmhearted, the fact is that González-Torres made this artwork to help him cope with his partner's loss to AIDS[13] (González-Torres, 1995). People were free to take as much candy as they wanted, but the more they did so, the more of the work's formal structure was lost. In a way, the work is itself a feedback system, communicating its expiration as it dissolves by the public's intervention. As time passes, the work's structure slowly withers and fades, as a metaphor for the man's own passing.

The feedback system can be as abstract or symbolic as one wants. But the most important point to retain is its potential for communication. As we've seen, the feedback system can provide a way for players to discover a game's goals and rules. Additionally, the feedback system is also perfectly capable of conveying meaning on its own.

### 3.1.4 Voluntary Participation

Voluntary participation is a very easily overlooked factor, and it is so because it is so obvious: it makes sense that people won't play games against their will. But while that is true, voluntary participation involves a bit more than just wanting to play. In order for a game to unfold, all players must engage in a true social contract, knowingly agreeing upon the goals, rules and feedback system the game will generate.[14] It's an easy task to group Schell's quality one ("Games are entered willfully") under this definition. Surprisingly, the problems created by cheating are also taken into account, here. In essence, cheating is doing something that the rules forbid. In fact, a player that cheats is just playing by rules that other players haven't agreed upon: if all players agree that they can take a peek at each other's hands in a card game, doing so ceases to be cheating and turns into another part of the game mechanic.

We will start expanding on voluntary participation with an example that is apparently based on thwarting the very idea of voluntary participation.

Artist Marie Sester (2003), with her interactive installation *Access* (figure 14), proposes a kind of ad-hoc performance space for the public. In this project, a camera tracking system detects passersby on a passage room. Either automatically or by receiving input from a user controlled web interface, the system chooses one person and locks-in on him; until a new target is chosen, that person will be constantly under a spotlight and hearing voices that say things like "You are so great. You look fabulous!" or "There are 50217 people watching you on-line right now. Are you at your best today?" (Wright, Galusha, & Sester, 2003). *Access*' take on voluntary participation seems to be, on the surface, denying it; it is either a computer or web-users that chooses who gets to participate on the installation. But interesting as it is already, there is more to say about participation in this work with the public's reactions. People are forced into this game, yes, but they have the choice of whether and how to accept or deny it. No matter the way people respond to the installation, the reaction they voluntarily choose automatically makes them part of the game. Some people tried to vigorously run from the spotlight, in an attempt to avoid its grasp, while other people accepted the challenge and

[13] "I made "Untitled" (Placebo) because I needed to make it. There was no other consideration involved except that I wanted to make art work that could disappear, that never existed, and it was a metaphor for when Ross was dying. So it was a metaphor that I would abandon this work before this work abandoned me." (González-Torres, 1995)

[14] "Knowingness *establishes common ground* for multiple people to play together. And the freedom to enter or leave a game at will ensures that intentionally stressful and challenging work is experienced as *safe* and *pleasurable* activity." (McGonigal, 2011, p. 21)

started dancing, for example. Arguably, even with their inaction people are making a choice on how to participate in the game: even by ignoring the spotlight, they are still playing by the rules and following the proposed objective of entertaining other people.

**Figure 14 – *Access*. (Retrieved from http://www.accessproject.net/access2.html on 30/08/2012)**

This leads us to the other quality we chose to associate with voluntary participation: quality nine, “Games engage players”. In *Access*, even the act of ignoring the spotlight engages people within an objective. They voluntarily choose to act casual: avoid standing out to remain unnoticed becomes the challenge of the game they play. But another unexpected example of how voluntary participation and engagement can work can be seen in the video game *Boktai: The Sun is in Your Hand* (Kojima, 2003). This game’s main premise is based on harnessing the power of the sun to power up the main character’s weapon. We are citing this work because in order to harness the power of the sun, the player has to literally let sunlight shine on the game.

As it can be seen on figure 15, the game cartridge includes a solar sensor that is able to measure the sunlight intensity. Since this game was a Game Boy Advance[15] exclusive, it could easily be transported outside. On the right side of figure 15, we see the main character standing under the light shining through a window. If the solar sensor were covered, this light wouldn’t be present. In this example, the voluntary participation contract has an uncommon request for the player: in order to play the game[16], the player must accept what is possibly a new environment for play, and the time and weather restrictions that accompany solar

[15] A portable gaming console by Nintendo.

[16] It is important to understand that this solar exposure is an actual part of the game mechanic: the game can’t be properly played without it.

exposure[17]. The game itself sets locations and timeframes where it should or should not be played, and player's compromise by accepting those rules can be accepted as an engagement within *Boktai*'s own formal system.


**Figure 15 – Left: *Boktai: The Sun is in Your Hand*'s cartridge. The circle points out the solar sensor. Right: Screenshot from the game.**
**(Retrieved from http://www.konami.jp/gs/game/boktai/english/game_index.html on 30/08/2012. Photomontage by the author. Images were altered for clarity.)**

We recognize that this may sound as an easy compromise, or just an arguable initiative to push video gamers out of their proverbial couches. But the fact that the game had two sequels that still use the solar sensor mechanic[18] is a safe indication that the game was engaging enough for people to accept those conditions and play it outside their comfort zone, thus validating again quality nine ("Games engage players").

And it is with voluntary participation that the definition of our game lens comes to an end, paving the way to a more in-depth analysis of the concept of participation. In this subchapter we proposed a way of thinking an object that consists on the pondering of four components, Jane McGonigal's four game defining characteristics: a goal, a set of rules, a feedback system and voluntary participation. After the explanation of each of these characteristics, we now understand better their implications. As such, we can now move on to the next important topic.

Until now we've been focusing on the possibility of applying a game frame of mind to art, but of course that's far from being the only way to approach artistic production. The reason that led us to want to merge the game and the art worlds in the first place was the will to create social sharing contexts to bring participants together. But providing participation opportunities is certainly not a new idea in the art world. And in the next subchapter we will analyze some ways artists have followed to integrate their audience in their artworks.

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[17] It is also worth to point out that the game includes a mechanism to prevent too strong or too prolonged dangerous solar exposure: if the sensor is getting too much light for too long, the character's gun will overheat, rendering it unusable until it cools down.

[18] Although the last one released exclusively in Japan.

### 3.2 Participation in the Art World

Right in the introduction to her book, Jane McGonigal tells us that, as the research director at the Institute for the Future[19], she has "learned an important trick: to develop foresight, you need to practice hindsight." (McGonigal, 2011, p. 5). It is easy to understand how fundamental that way of thinking is: everything evolves from something else, so in order to understand the future, or even the present, one has to understand their roots. Likewise, in order for us to be able to propose a game lens, other lenses and ways of working had to exist before. In this chapter we will speak about some of them, the ones we consider to be more relevant, and describe their pertinence in the context of this document.

In order to provide some background overview, we will go back and once again borrow Nicolas Bourriaud's (2002, pp. 27, 28) idea that art History can be broadly seen by considering the kind of relations art works establish. The first phase can be identified as an attempt to use art as a means to relate to the divine, and lasts until before the Renaissance. As mankind evolves and better understands the world it lives in, that divine becomes increasingly more attainable, and thus the focus of art becomes the relationship between Man and the world. From the Renaissance on, this was the paradigm in place[20]. Finally, Bourriaud cites the early 1990's as the dawn of a new phase: a phase where "the artist sets his sights more and more clearly on the relations that his work will create among his public, and on the invention of models of sociability." (Bourriaud, 2002, p. 28). Bourriaud obviously introduces this chronology as an oversimplification of a very complex question, but it is, nonetheless, an interesting way to begin the approach of participation in the art world. Especially because it helps us better frame one of the most prominent figures of the early 20th century: Marcel Duchamp.

Writer and curator Daniel Marzona (2007, p. 11) writes that in 1917 Marcel Duchamp took a regular common porcelain urinal, signed it with a pseudonym – Richard Mutt – and presented it at a Society of Independent Artists'[21] exhibition. He called this piece *Fountain* (Duchamp, 1917). It was rejected.

Duchamp had been a traditional painter up until 1913; at the 1912 cubist exhibition his painting *Nude Descending a Staircase No.2* (Duchamp, 1912) "was so severely refused (…) that it had to be taken away before the exhibition's opening."[22] (Marzona, 2007, p. 10). Marzona goes on to tell us that this rejection revolted Duchamp so much that soon he turned away from painting altogether, focusing instead in the criticism of institutionalized art. And indeed, Duchamp's ready-mades[23], of which *Fountain* is probably the most famous, are in fact an expression against a closed art system, bound by visual representation. Art critic and philosopher Anne Cauquelin (1992) further explains that by exhibiting random pieces in art galleries, Duchamp is pointing at the fact that the simple action of displaying objects in an

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[19] "a non profit think tank in Palo Alto, California, and the world's oldest future-forecasting organization" (McGonigal, 2011, p. 5)

[20] To Bourriaud (2002, p. 28), even artistic movements that challenged the norm with different ways of seeing (he specifically refers Neo-Impressionism and Cubism) can still be fitted in this second phase. They still are concerned with what is seen, and thus still maintain the dialectical relationship of Man with object.

[21] A group of which Duchamp himself was a member.

[22] Translation by the author.

[23] "Ready-made" was the name Duchamp appropriately gave to the objects he chose for exhibition.

gallery is enough to legitimately deem them art. Duchamp is attacking the fact that, in his time, it is the container, (the museum, the gallery) and not the content (the art work itself) that forms art (Cauquelin, 1992, p. 63): in a bathroom it's a sanitation device, however, in a gallery it's a work of art.


**Figure 16 – *Fountain*. (Retrieved from http://www.marcelduchamp.net/images/Fountain.jpg on 30/08/2012)**

Yet another interesting characteristic of this work is that, with *Fountain*, Duchamp is offering a harsh comment on art institution without resorting to any intelligible form of communication: there are no words[24], no shapes or representations. Indeed, *Fountain*'s rupture with conventional painting is such that even its content is outside of itself. Cauquelin further justifies that "Duchamp's famous sentence 'It's the viewer that makes the painting' should be understood literally. (…) it's no longer about separating the artist from his potential consumer, but about binding them within the same product."[25] (Cauquelin, 1992, p. 66). *Fountain* is consequently an example of an unfinished work that becomes complete with the observation of an active viewer. And although it only does so at a purely intellectual level, one can think of it as an early way of acknowledging the public. Duchamp's ready-mades are symbols addressed to and meant to be deciphered by a viewer; by themselves they are just objects that pose no statement.

Anne Cauquelin's analysis already imbues *Fountain* with meaning and significance, but there is still more to say about this fundamental work. We mentioned before that *Fountain* contains no words, but that's not entirely true, and Peter Bürger (Bishop, 2006) provides a very interesting consideration for the only word it does: "When Duchamp signs mass-produced (a urinal, a bottle drier) and sends them to art exhibits, he negates the category of individual

[24] Apart from the signature and date, that we will appropriately discuss further ahead.

[25] Translation by the author.

production." (Bishop, 2006, p. 50). What Bürger means with this, in line with the anti-institutionalized art we mentioned before, is that Duchamp is again mocking the museum institution by asserting his authorial right over a generic mass-produced object. Bürger further explains that Duchamp is not only criticizing a system where a signature is worth more than the work itself, but also opposing the very relevance of an art system that revolves around a single individual – the artist – as the sole valid producer of art (Bishop, 2006, p. 50). And in fact, the demystification of the bourgeois artist as a higher being, producer of content, was one of the objectives that early 20th century avant-gardes strived to fulfill. And they did so by trying to thin the gap between art and "the praxis of life where it should be preserved, albeit in a changed form." (Bishop, 2006, p. 48). Further discussion in this topic is outside the scope of this thesis: our objective is to study participation, after all. But these ideas are very important as context for the next topic we will explore.

In a radio broadcast, artist Allan Bukoff (Bukoff, 2008) describes Fluxus as a group of international artists that used "radical art, strange activities, objects and performances and upside-down creativity" to counter the cultural tightening and normalization that was affecting human culture in the early 1960's. And indeed, Fluxus appearance was highly divergent and influential. One of Fluxus' strongest traits was the fact that their approach to art and life was a humorous one, frequently engaging in pranks and gags as their way of working. These pranks and gags were frequently targeted at an audience. As Bukoff describes: "At a Fluxus concert or event, the performers get the audience to do things. The performers are entertained by the audience." (Bukoff, 2008). Bukoff's radio broadcast includes excerpts from an interview with Fluxus' founder George Maciunas (1977), and through his words we can learn about some of Fluxus' activities. Most of the examples Maciunas refers, though, show how literal that stance could be. In one performance, after the audience is sitting in their places, the performers[26] started throwing tomatoes at them; a gesture traditionally associated with an audience that doesn't enjoy the performance. In another, the performers built a net out of scotch tape, hanging near the ceiling of a room, held by four structural points. When visitors gathered in the center of the room, the performers would cut the tape at these structural points, causing the net to fall, effectively trapping participants under it.

Humorous as these examples might be, they don't seem very fair to the participants that get entangled in them. Maciunas speaks of a form of approaching participation that is based in including the public in the artwork, yes, but as a tool, as an inert component that seems to have little to no effect in the outcome of the work. Bukoff (2008) clarifies that Maciunas (and not necessarily the Fluxus group) seemed to prefer to prank and irritate the public rather than entertain it. And indeed, this is a form of audience participation that seems to directly clash with our previously mentioned notion of voluntary participation; there was no previous agreement from the public's part[27]. And that is a factor artist Allan Kaprow (Bishop, 2006) directly reacts to: "… to assemble people unprepared for an event and say they are

[26] As a resonance of the loss of individual authorship, previously mentioned with Duchamp and the 20th century avant-gardes, Manciunas understands Fluxus as a collective. Therefore he doesn't refer specific authors for these performances, speaking instead as "we".

[27] Although one could argue that knowingness could be present if people entered the exhibition expecting situations out of their control. Even an unpleasant situation could have a positive impact, provided that the participant is counting on it: not unlike people riding roller-coasters (feeling of impotence, fear, loss of control) in search of excitement.

'participating' if apples are thrown at them or they are herded about is to ask very little of the whole notion of participation." (Bishop, 2006, p. 103).

In fact, Kaprow stands for a much different approach to participation. He defends that before every happening[28], all the involved participants should precisely agree upon the terms in which the action is going to unfold; after this discussion, "artist" and "viewer" are words that lose their meaning to the common aggregate "participants" that now all share. By following this protocol, Kaprow likens the happening to a parade, football match or a play; a more or less loosely scripted event where spontaneity and improvise can still take place, and maybe even take over (Bishop, 2006, p. 103).

Kaprow describes a very inclusive model of participation. At its core, we can find the recreation of lifelike situations. And this is a premise as democratic as can be: everyone knows how to act as they do every day. Kaprow's interest in lifelike situations is such that he even states to prefer participants with no acting, art or performance background: "Actors are stage-trained and bring over habits from their art that are hard to shake-off" (Bishop, 2006, p. 103).

With Kaprow's happenings we then have a participation system that not only is fully inclusive, but also doesn't require more than the knowledge of the happenings' general rules.

Transitioning on to our next and last reference, we can identify this idea of a work available to everyone, a work that enmeshes in life itself, and uses participants as an active constituent of the artwork also as a fundamental one in Bourriaud's relational aesthetics. But despite these similarities, there is at least one important difference towards Kaprow's happenings: as we saw, Kaprow strives to achieve (imitate) real life with his happenings. Happenings are an attempt to represent real life, and therefore can still be thought to fall into the second paradigm of the three mentioned in the beginning of this subchapter: the establishment of relation between Man and the world.

With relational aesthetics, Bourriaud proposes something different. It is no longer a question of representation, but of pure interrelation; the creation of interstices that exist between different elements. The validity of a relational artwork stems from its ability to connect artist, work and public within the same equation, while still allowing for a multitude of outcomes and points of view.

Bourriaud presents relational artists as a group of people with fundamentally novel ideas: "Relational art is not the revival of any movement, nor is it the comeback of any style." (Bourriaud, 2002, p. 44). According to him, relational aesthetics was a product of a look towards the present and a clear line of thought towards the fate of art production. Relational aesthetics promote immediacy and local presence as a direct opposition to the virtuality of telecommunication. In essence, it is a socially involved art tendency that strives to bring people together in a very literal sense, by discussion, by participation. "It seems more pressing to invent possible relations with our neighbors in the present than to bet on happier tomorrows." (Bourriaud, 2002, p. 45).

[28] It was Allan Kaprow that coined the term "Happening" in this context. A happening is an activity, typically one common in everyday life, in which players and participants engage in a combined play. (http://www.moca.org/kaprow/index.php/2008/02/14/what-is-a-happening/ on 08/02/2012)

This last approach to participation is, according to its proponent, unprecedented, and different enough to require such a distinction from past looks at participation. Following a relational frame of mind, it is possible to create art works that engage people in art in a much more meaningful way than ever before, for it is their own inputs or reactions, their own interpretation, their own communication that constitutes the art work itself. The formal manifestation of the art work is secondary when in contrast with the value of participation.

Reaching the end of this subchapter, we should take a look back to refresh what we discussed. We started with Bourriaud's take on an art history based on the relations art establishes. This led us to the broad implication that before relational aesthetics, art was mainly interested in representation: the establishment of relations first to a deity, and then to objects, to concepts. With this in mind, we moved on to speak of one of the most influential art works of the 20th century: Marcel Duchamp's *Fountain*. Duchamp's stance against institutionalized art contributed to the understanding that visual representation is not fundamental for meaning: *Fountain* conveys its meaning through its own purpose and placement, involving a viewer as participant through the active deciphering of its content.

After that, the question of the signature, the authorship certification, and its critique led us to move on to the Fluxus movement and its founder George Manciunas. Here we can see some attempts to integrate participants in the midst of the art work, eminently in performance. But the fact that this participation seemed to stem from a pure role inversion of actors and spectators (with questionable results for the participants) pushed us towards Alan Kaprow and his happenings. Kaprow advocates that it is fundamental that everyone involved in participatory events be informed about the actions they are undertaking, thus pointing to a democratic participation system where author and visitor drop any hierarchic notion and merge in the collective "participants".

This democratic and inviting view of participation finally led us back to Bourriaud's relational aesthetics: a theory of art that sees art works as relation pivot points between the author, the work itself, and participants, reuniting them in a meaningful local experience.

While it should be easy to see the connections between relational aesthetics' notion of participation and the purpose of this thesis (the will to create relation), it must be said that the context provided by this analysis of previous approaches is invaluable, even to better understand the specificity of Bourriaud's ideas.

The next subchapter will be about the specific references that most inspired *Balance*, the interactive installation. In it, we shall better explain the influence that these two subchapters had in its conceptualization.

### 3.3 Precursors and Influences for *Balance*

As we have seen throughout this document, there were numerous examples, both in the art and in the game world, that provided support for the theory at hand: the application of game characteristics to art production. Thus, each one of these works inexorably constitutes an influence in many ways. Still, some references were more direct than others, and in this subchapter we will speak of the most fundamental works that propelled the practical project, *Balance*[29], in the direction it eventually came to follow. But in order to better understand the reasons for these references, it is important to remind what *Balance* consists of.

There was a continuous concern to position *Balance* in the intersection between art and video games: after all this thesis is about creating relation by applying game characteristics to digital contemporary art, and not a manual of either of those fields. That is an idea that should be kept in mind as we analyze these references.

What we mainly drew from the art world was the relational aesthetics' take on contemporary art. At the core of *Balance* is an intention to deliver an art work that intrinsically contains in its essence a way to bring together an audience in a participatory context; one that leverages interaction, not only between the artwork and its public, but also between participants. To this end, we provided ways for people to work together in a collaborative environment: we provide a task that, while soluble by an individual participant, is easier when several participants work together. Although, in line with an active fruition paradigm, that sentiment never becomes more than a suggestion: participation and collaboration are never more than subtly proposed, and it's up to participants to interpret this intention as they see fit.

About the project's form and function, *Balance*'s most prominent feature is a big projection on the floor that shows a top-down view of a circular platform with obstacles and a hole. Periodically, marbles fall from above, landing on the platform. Participants in this installation must step on the projection space, and depending on their position, they affect the platform's balance, tilting it as if with their own weight. Participants must use this mechanic to indirectly guide the marbles to the hole. Several people can participate at the same time; in fact the objective is more easily fulfilled if many people work together. But it should be said that there is nothing to stop other people from interfering negatively, tilting the platform in wrong ways; that is up to the participants.

With this brief description in mind, we shall start analyzing *Balance*'s main references. In line with the game lens, each one of these references concerns and explains the project's positioning on each of the four defining characteristics.

As it was referred before in chapter 2, the most notorious and fundamental reference was the short animation *Balance* (Lauenstein & Lauenstein, 1989).

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[29] For the sake of clarification, let us explain here that, unless otherwise stated, *Balance* refers to the interactive installation made as a complement to this thesis.

**Figure 17 – Still from the video (00:27). Note the tilted horizon line. (Screenshot by the author)**

This animation starts off by showing a circle of five men in the center of a platform. At some point, one of them steps forward, causing the platform to start tilting in his direction (figure 17). Promptly, the remaining four men step forward as well, balancing the platform once again by evenly distributing their weight. They repeat this process until all of the men are at the edge of the platform, at which point they proceed to take out fishing rods from within their


**Figure 18 – Still from the video (01:54). One of the fishermen reeled in a box, while the others were forced to the opposite side of the platform, to maintain balance. (Screenshot by the author)**

overcoats. They throw their lines out, and soon, one of them gets a bite. As he is reeling the catch in, his weight becomes such that all the remaining fishermen are forced to run to the opposite side of the platform to keep it stable. At this point we see that, surprisingly, instead of a fish, the fisherman has reeled in a box (figure 18).

At first, the fishermen stay put to enable the fisherman who caught the box to inspect it more closely. But soon, one of the other fishermen in the group steps out, tilting the platform in order to slide the box in his direction, effectively stealing it from its original captor. Quickly, curiosity is replaced by jealousy, as each fisherman attempts to investigate the box by himself. Eventually, the box becomes such an obsession that one of the fishermen becomes hostile, cruelly pushing all the others off the platform. But ironically, his struggle for domination made him forget the very nature of the world he lives in; in the end, he and the box end up stranded in opposite sides of the platform, unable to reach each other (figure 19).

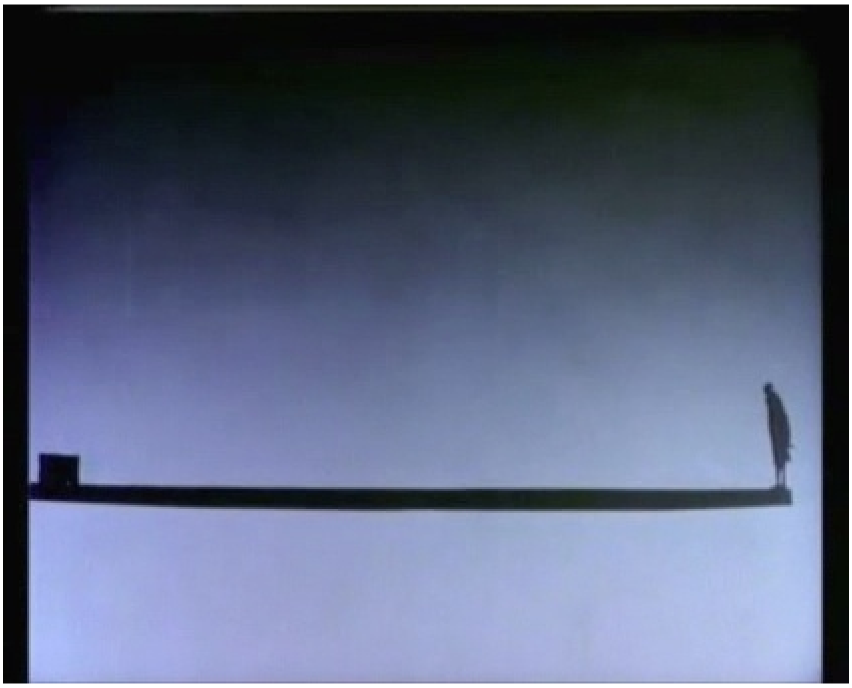

**Figure 19 – Still from the video (07:19). The last fisherman and the box, stranded on opposite sides of the platform. (Screenshot by the author)**

The Lauenstein brothers' film shows a group of people that failed to cooperate because their goals became incompatible. Before the box, they were all working together, enabling each other to fish. But as soon as their individual goal became "get the box", their collective goal "maintain the balance to avoid falling" became secondary, ultimately culminating with all but one of the fishermen's demise.

*Balance*, the interactive installation, was first thought of as a different take on this same world. The fundamental difference between the installation and the film is that in the former there is, at all times, one common goal: getting rid of the "box"[30]. Still, as opposed to the film's scripted narrative, the choice in the installation remains open: people can either collaborate in this common objective or interfere with the system, preventing its fulfillment.

[30] This box is not literal, and should be understood as "the object preventing us from keeping the balance".

In a way, it's people's decision on how to follow this objective that will become *Balance*'s (installation) story line.

This duality in the film was reinterpreted to constitute the installation's goal. In *Balance*, the installation, the goal is to "get rid of the marbles".

But in order to give a context to this goal, it was required to think of a way to physically implement the project. To that respect, as a more technical and interaction reference, we shall cite artist's Scott Sona Snibe's (1998) interactive installation *Boundary Functions*.

**Figure 20 – Photograph of the installation. (Retrieved from http://www.snibbe.com/images/projects/boundaryfunctions/small/boundaryfunctions_1.JPG on 30/08/2012)**

In this installation, the artist set a camera and a projector above the space we see in figure 20. The camera detects where people are standing within the projection area, and sends that information to a computer. The computer processes that information and sends it to the projector, which in turn projects on the floor lines that divide each participant's personal space. As people move, or enter and exit the projection space, these lines dynamically change to accommodate them.

There were two reasons for including this work here. The first is related to its technical implementation: as we will more thoroughly see in chapter 4, *Balance* uses similar technology to achieve the same kind of detection. The second concerns its simple interface: as it was stated before on chapter 2, the floor is a very natural place to deploy a projection: people are naturally used to looking at the floor while acknowledging each other. This work proves precisely that; the prominent projection square invites people's participation, and even if there's nothing going on with the projection when people come by, as soon as they set foot on the projection area, the installation responds, using it's feedback system to teach people how it works, and the dynamic between different people's interaction to hint at its meaning. These are definitely characteristics that we want *Balance* to have: we want the project to be immediately usable without any kind of prior knowledge or technological requirement, but still require people to acknowledge each other and react accordingly. And because the focus is in people's relations, it is important that the game neither forces participants to stay nor prevents them to get out; people should be free to come and go at any time. In this regard, that choice should depend solely on participants.

This freedom forms the voluntary participation component of the project. *Balance* invites participation without imposing it, but is still based in creating relationships between members of the public, since it relies on either collaboration or interference: stances that in this context can only exist between people in relation to other people.

Moving on, we still required a format that could include all the features referred so far. The first game reference we chose was *aTilt 3D Labyrinth* (FridgeCat Software, 2011), an Android game (figure 21).

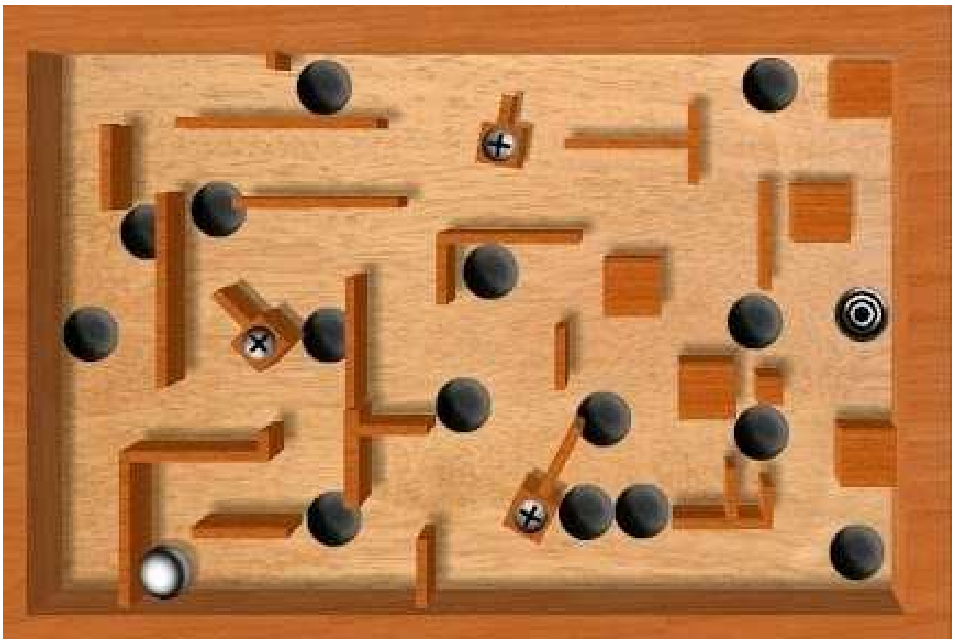

**Figure 21 – *aTilt 3D Labyrinth* screenshot. (Image cropped and rotated by the author. Retrieved from https://market.android.com/details?id=com.fridgecat.android.atiltlite&hl=pt_PT on 30/08/2012)**

Itself based in traditional wooden toys, *aTilt 3D Labyrinth* is a game where the player has to maneuver a ball within a labyrinth in order to drop it in a specific hole. This objective falls perfectly in line with the previously mentioned "get rid of the marbles"; players affect the balance of a platform in order to guide an object to an exit. And in *aTilt*'s case, the game uses the Android device's built-in accelerometer, so that the action of tilting the phone causes the game's labyrinth to tilt in the same way, enabling the required indirect control of the ball. Despite using a different technology, *aTilt 3D Labyrinth* was a reference for *Balance*'s rules;

in essence, both consist of balancing a platform to guide a ball to a goal. With *aTilt* we could also see examples of the kind of obstacles that could be present in such a game[31].

It's also important to stress that we chose to reference this game instead of the original wooden toy because *aTilt* is itself an expansion upon the toy that inspired it. This game explores its medium's specific capabilities, adding complexity in a way the wooden toy couldn't: in our opinion, tilting the phone to balance the ball doesn't introduce anything over the original, but dynamic obstacles and several labyrinths with varying difficulties do. *aTilt* includes many levels with different obstacles. Apart from that, its top-down view was a good clue on how the projection could look on the floor. *aTilt* was also an important aesthetic reference by providing a good starting point for the graphic representation of obstacles and marbles.

But while *aTilt* presents interesting ideas on how to approach *Balance*, it's important to note that it's complicated levels, while being at home in a smartphone, probably wouldn't work so well in the context of the interactive installation. We can't expect people to spend the kind of time and effort required to play with precision while still preserving the opportunity to freely enter or leave, especially because a change in the number of participants immediately requires an adaptation in play style. Thus, the levels must be much simpler than *aTilt*, and also quicker to play. Furthermore, there also shouldn't be any interruption between one level and the other: the installation should always be running, with no loading times or slow level changes. And with these new problems in mind, we cite our last reference: as it was already mentioned in chapter 2, it is the classic game *Tetris* (Pajitnov & Gerasimov, 1986) (figure 22).


**Figure 22 – *Tetris*. Note the top left corner: 42 lines correspond to level 4. (Screenshot by the author)**

[31] There is, though, a relevant difference that should be mentioned. *aTilt 3D Labyrinth* is composed of a rectangular board, to better account for the Android device's form factor. In *Balance*, we have a circular platform, to facilitate public approach. Consequently, the obstacles had to be redesigned to account for the different form factor.

In *Tetris*, the player has the ability to move left and right and rotate falling blocks, and has to do so to stack those blocks in order to form horizontal lines. Once the play area is fully filled with a horizontal line, that line will disappear, leaving more space for blocks to fall into.

We chose *Tetris* because of the elegant way it solves the aforementioned problems: players need blocks to form lines, but at the same time, the more blocks, the more cluttered the play area becomes. If the player is doing a bad job of organizing blocks, the game becomes more unwieldy. The play area's clutter becomes thus also an indication of the player's performance: a feedback system.

Adapting the same way of thinking to *Balance*, as more marbles come in play, the probability that one of them will fall in the hole is higher, although if that happens, it will probably be more due to the marbles' collisions with each other than to participant input. In fact, obstacle excess also diminishes precision and freedom of movement, making it more difficult for people to maneuver them into the goal. Likewise, the game play clutter becomes a feedback system.

Also, in *Tetris*, when a player scores ten lines, the level goes up, and consequently the game becomes harder (blocks fall quicker), but the pieces in play so far remain in play. On one hand, a new level doesn't mean a new start, but an increase in difficulty. On the other, the player's history, the pieces that fell since he started playing, remain uninterruptedly in the play area, acting as a feedback system. This is also another important feature that we wished to implement in *Balance*: a sense of uninterrupted gameplay that keeps into account the player's history thus far. In order to implement this, when *Balance* participants manage to take ten marbles to the goal, a new playing board comes up[32], while the excess marbles from the previous fall into the new[33].

These were the main references from which *Balance* more closely stems from. To summarize this subchapter: we wanted to propose the cooperation challenge seen in the Lauenstein's film *Balance* as a goal, to foster relation within participants of the installation. In order to do so, we referred to *Boundary Functions* as a good example on voluntary participation; a simple interface that allows for the easy and casual integration of people. We then looked at *aTilt 3D Labyrinth* for inspiration in rules, obstacles and aesthetics. Finally, we looked at the classic *Tetris* in order to further improve the installation's logic, mechanic and feedback system.

This concludes the expository component of our thesis. The next chapter will be devoted in its entirety to our interactive installation, *Balance*. We will cover every aspect of its production, from its technical choices to the problems we faced, expand on its conceptual component and discuss our achieved results.

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[32] This doesn't necessarily mean a more difficult level. The installation was made to be in a public space, open to all kinds of people, and we can't expect the same skills from a six-year old child, a sixteen-year old teenager, or a sixty-year old adult, for example. But we would certainly be amiss if we didn't try to make the installation interesting for all of them. As we will more closely see in chapter 4, *Balance* features an adaptive difficulty system, meaning that the more efficiently people play, the harder the game gets. Conversely, if a level proves to be too difficult, the next one will be easier.

[33] Although, since the marble's movement is directed by a physics engine, there is always some unpredictability associated with it: it might happen that when a new level comes up, the marbles get thrown out of the platform instead of passing on to the next level. This choice will be further explored on the next chapter.

## 4 *Balance*: Process and Results

In this last content chapter we will focus mainly on the final project, *Balance*; the materialization of the investigation made thus far, and an attempt to show that, although sometimes seen as different and incompatible worlds, art and games share a common ground that can be explored to enhance both participation and engagement.

Before we move on, though, we should take our time to definitively describe the installation, so as to provide a clear purpose for all the steps we will describe throughout this chapter.

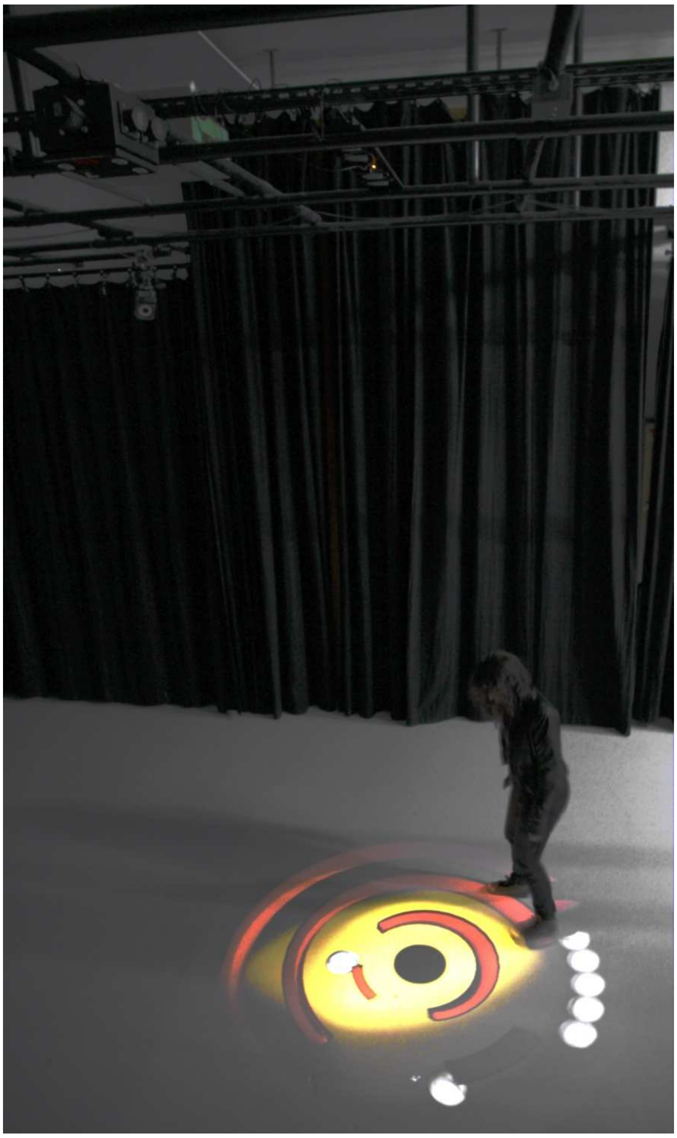

**Figure 23 – Picture of *Balance*, our interactive installation. (Photograph by the author)**

*Balance* (figure 23) is an interactive installation. Its most evident manifestation is a projection on the floor, a big projection of a platform with a hole in its center. Periodically, virtual marbles will fall from above on this virtual platform. At any time, participants can step on the projection, and thus on the virtual platform. This will cause the virtual platform to tilt, as if the participants were actually stepping and applying their weight on it. By tilting the platform, the marbles on its surface will of course move, as a consequence of gravity. By using this input method, participants can then position themselves so that the marbles are drawn to the center of the platform. *Balance*, as well as all other final projects of the four Sound and Image master's specializations[34], was publicly exhibited on the 3rd of May 2012.

Throughout this chapter, as opposed to the process we've been following thus far, we will provide a much more technical explanatory narration of the work process than an expositional theoretical component. It will of course, nevertheless, resort to previous examples and concepts in order to better explain and justify both functional and aesthetic choices throughout the project.

We will start by approaching *Balance* from a technical standpoint. At first we will analyze the technology it comprises, both hardware and software. We will then move on to detail how this technical apparatus is put to use, by further explaining *Balance*'s appearance and functionality. Finally, this chapter will end with an analysis of the single most fundamental pillar of the installation: the public. In the last subchapter we will study the public's reaction to an installation that is essentially made for them, and discuss our results: does the installation actually succeed in fostering relationship, or does it fall short on its objectives, and why do we think either of the outcomes took place.

And now without further ado, let us then start by explaining the technology behind *Balance*.

## 4.1 Technology

As previously said, in this section we will explain and justify each of the technical aspects that compose the installation we developed. We will start with its physical format – the hardware we used and how we installed it in the context of the exhibition – and then move on to the software implementation, by explaining the tools we used, and the most important steps of the development process.

### 4.1.1 Building the Box

An important choice made from early on in the project was that in order to maximize the installation's effectiveness as a relation catalyst, its presence must be very focused on the objectives at hand. As such, we wanted to make *Balance*'s necessary technology as unobtrusive and inconspicuous as we could. As previously said, the core of the installation's mechanic is a tilting platform. Providing a real platform that people could stand on quickly looked like a very expensive (both money and logistics-wise) endeavor, not to mention the lack of accessibility or even possible danger of such an object. If we wanted *Balance* to be an inclusive work, it had to be perfectly safe and harmonious for people of all conditions and ages. And in the previously mentioned Scott Snibe (1998) installation, *Boundary Functions* we found a very viable solution for this issue: an overhead projection with a camera to detect people's movement. As we stated before, mainly on chapter 2, the floor is a very natural place for a projection, since people are naturally used to look where they're going while still remaining aware of their surroundings. And of course, with no real platforms or tilting floors the installation is perfectly safe.

[34] The four specializations are Animation, Cinema and Audiovisual, Digital Arts and Sound Design.

In order to implement this solution, then, we had to find a way to attach a multimedia projector to the ceiling in such a way that it would project on the floor. Apart from that, we also needed an overhead camera for the detection, and a computer to process both the camera and the projection's images.

Our solution to that problem started by focusing on the projector. A multimedia projector is obviously much easier to set on an horizontal position than on a vertical one, but we needed it to project vertically, to the floor. Fortunately, projecting on a mirror tilted forty-five degrees from the ground can easily solve that problem[35].

And since we needed to build a platform to hold both the projector and the mirror in a high place, we might as well make it so it also holds the remaining material we need. The detection requirements were just a very small and light camera[36], and we chose an Apple Mac mini[37] as our machine so that our setup was small and light enough to be easily hung to a ceiling. As soon as we had all the required measurements we had a wooden box built, tailored to the specific size of each of the components of the project (figure 24).

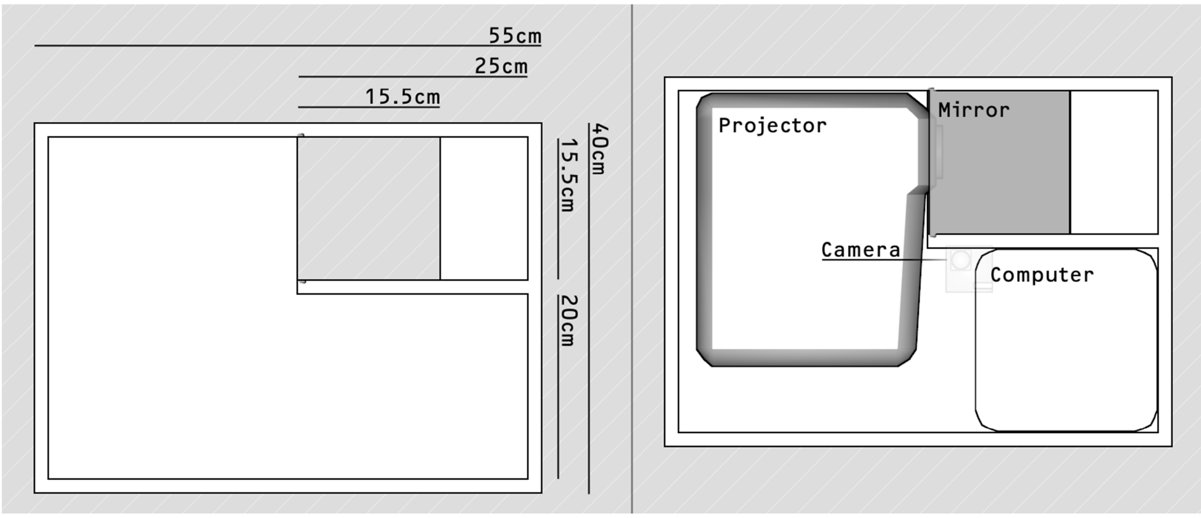


**Figure 24 – Left: Box schematics. Right: Proposed arrangement. Note the camera under the box. (Images by the author)**

The box was designed to be as compact as possible; again we stress the importance of hiding the technological component of the project in a discreet and inconspicuous manner. However, our effort for a compact container might have been excessive. Striving for the elimination of empty spaces, we failed to consider enough extra room; when the box came to our hands, there wasn't enough space in the back of the projector to plug the necessary cables. Cutting an opening on the back of the box easily solved that problem, but as we tried out our setup for the first time, another issue came to our attention: the mirror did not sit at an exact forty-five

[35] The image will be reversed and, of course, mirrored, but that's easily corrected in the projector's own options. This method has the added benefit of enabling the projection to be slightly bigger, due to the extra distance from the projector to the mirror that it has to travel.

[36] Computer vision, the acquisition and processing of visual information by a computer, typically uses very small cameras with low resolutions. This process will be explained in more detail further ahead.

[37] Apple Mac mini 5,2 mid-2011.

degree angle, but at a slightly more acute one. As a result, the projection was not being reflected directly below the box as we predicted, but some space in front of it.

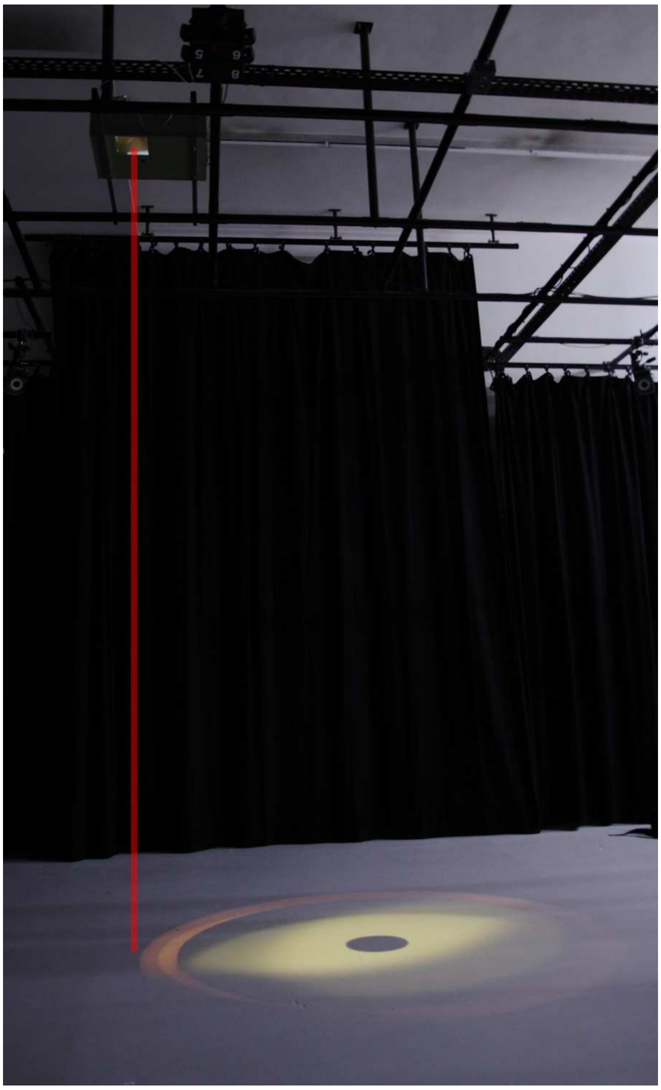

**Figure 25 – Horizontal offset of the projection in relation to the projector. The red line projects the center of the projection origin on the floor. (Photograph by the author)**

While this wasn't a problem for the projection itself, the placing we chose for the camera wasn't ideal anymore. This projection offset meant that if the camera were to be placed at its previously designated place, it wouldn't be able to properly capture the whole projection area. But before being able to properly understand why, we need to explain in depth how the detection in our project is made. The next subchapter will explain in detail the fundamental aspects of participant detection in our installation.

#### 4.1.2 Computer Vision

In order to know where people were standing in the virtual platform, we had to find a way for the computer to detect their position and use it to apply weight on it. As mentioned before, we did that with a camera, through computer vision.

Computer vision is a broad term that concerns the visual acquisition, treatment and processing of video images in order to extract data. The data we needed was the participant's position on the projection.

In its essence, the process is not very different from the one used on optical tracking multi-touch surfaces[38]: a camera films the back of the surface, and a computer tracks user's fingers from the video-feed. Such information, like number and position of fingers, is then routed to relevant applications that react on it. These multi-touch tables are notable for the use they make of infrared (IR) light. In a typical diffused illumination multi-touch table[39] (figure 26), IR lights are placed underneath the projection area, as is an IR sensitive camera.

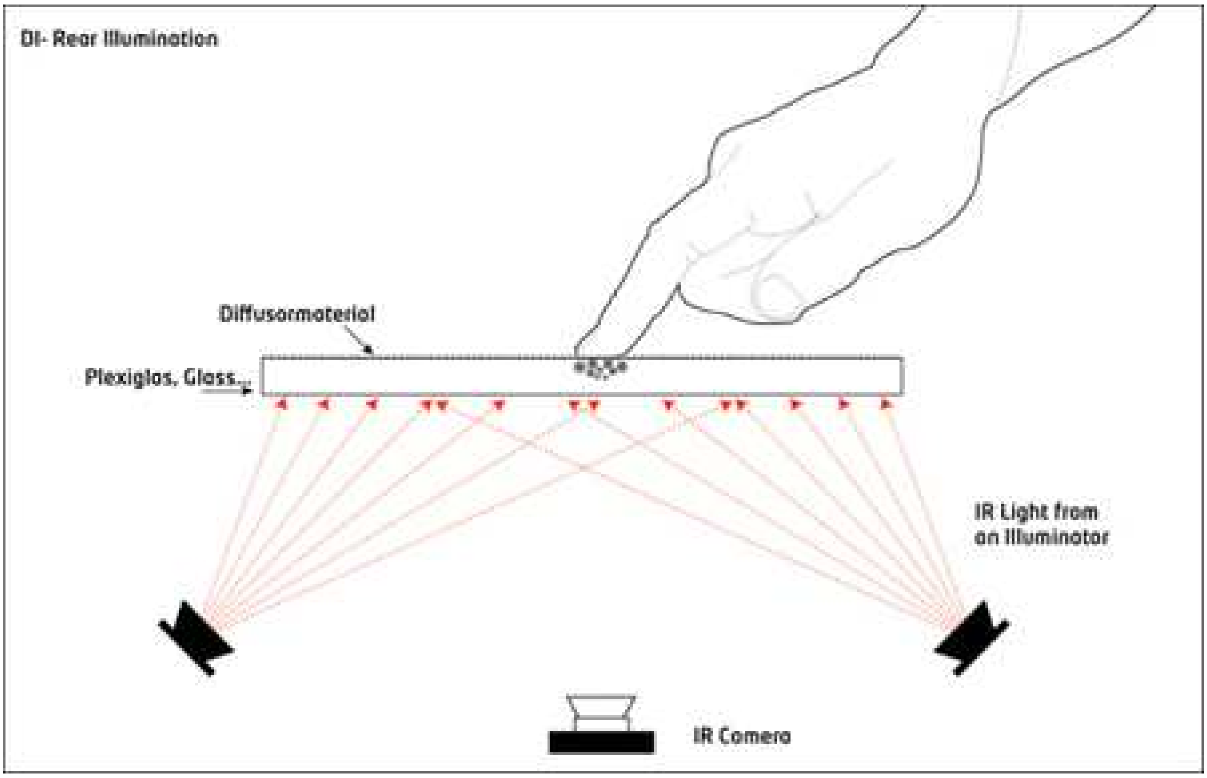


**Figure 26 – Schematics for a rear diffused illumination multi-touch table. Although not shown in the image, the projector sits by the camera, projecting from below on the diffusor material. (Retrieved from http://wiki.nuigroup.com/Diffused_Illumination on 20/04/2012)**

The light from the IR illuminators lights up user's fingertips (figure 27), and when a camera captures that image, the computer can analyze it to find its brightest spots; blobs. This process is called blob detection[40], and in tandem with the next step, blob tracking[41], it is possible to

[38] A multi-touch surface is a surface – often a table – that somehow senses fingers or other objects that enter in direct contact with it. There are many ways of producing such a surface (capacitive touch screens used in smartphones are examples of multi-touch surfaces), and optical tracking is one of them.

[39] There are many methods for building optic multi-touch tables (as of 20/04/2012 a number of these are explained at http://wiki.nuigroup.com/Hardware). We chose to describe the diffuse illumination method because it is the one that more closely resembles the setup we used in the installation.

[40] "Process of picking out bright areas of a camera image and somehow relaying them to a computer as a touch." (http://wiki.nuigroup.com/Multi-Touch_Terminology on 20/04/2012).

extract the position of each finger relative to the projection, enabling the computer to respond appropriately.

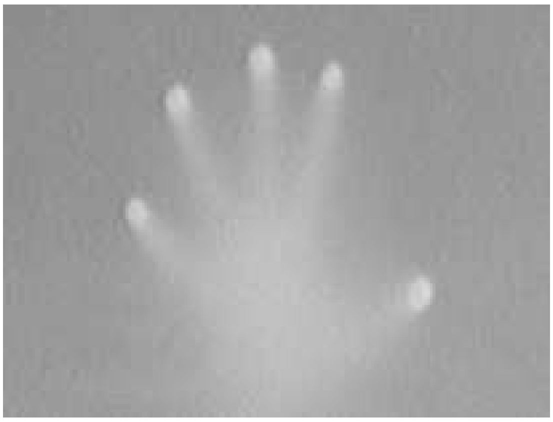

**Figure 27 – An example an image produced by a rear DI multi-touch table. (Retrieved from http://wiki.nuigroup.com/Diffused_Illumination on 20/04/2012)**

The usage of infrared light is due to two crucial factors. First, if the camera were sensitive to visible light, it would also capture the computer's projection, which would make proper finger detection much harder, if not impossible. Second, since the used light wavelengths are invisible to the human eye, it is possible to accurately light the capture area without adversely affecting either the projection or the user.

After explaining the inner workings of this method of multi-touch surface it is easy to understand how the same technology can be applied to our installation: in our case, in lieu of fingers we had whole people, and as a surface we had the floor itself, but the principle and challenges remained the same. We required ample lighting on people's head and shoulders, so that they could be easily captured by an overhead IR camera.

In order to circumvent the need for IR illuminators as in the explained example, we thought of taking advantage of the motion capture studio[42] present on the School of Arts' campus. Since the studio has a lighting grid, hanging the box with our material would be remarkably easy, and since it operates with infrared light, we thought that the entire area would be intensely lit and thus, perfect for our detection.

In computer vision, strong and even scene lighting is of the utmost importance. Since its purpose, in this case, is to provide means to react to user input, blob tracking has to be as fast and accurate as possible. Good lighting helps the camera distinguish between actual blobs and other information[43], and minimizes the need for processor intensive and time-consuming image corrections. If there is any noticeable time lag between input and reaction, the illusion of stepping on a virtual platform is lost. Like a mouse click that takes a second to register on a button: although small, the time frame is enough to bring to evidence the causality between

[41] "Assigning each blob an ID (identifier). Each frame we try to determine which blob is which by comparing each with the previous frame." (http://wiki.nuigroup.com/Multi-Touch_Terminology on 20/04/2012).

[42] In 2011 a motion capture studio was built in the UCP's facilities. This kind of studio is oriented for animation production, allowing a person wearing a body suit fitted with reflective markers to be detected and tracked three-dimensionally by an array of cameras, thus allowing for a computer to capture a real-life actor's movement and use it in virtual characters.

[43] Such as image artifacts, noise or the palms of user's hands (when only the fingers are required).

mouse click and button press, instead of intuitively bypassing it as "clicking the button". In order to optimize this process, blob tracking is usually performed with very low resolutions but very high frame rates[44]: a smaller image translates into a quicker analysis and reduced processing time, and a faster frame rate allows for a more continuous and fluid feedback from the application. Because of this, the ideal camera for our project was not a very high-end camera, but a small and reliable one[45]. We already had a good choice in our workspace: a Unibrain Fire-I digital board camera. This is a small black and white[46] Firewire camera that comes with interchangeable lenses[47]. Despite running at just 30 fps, a relatively low frame rate for blob tracking, the included lenses have a good aperture value of f-2.0[48], which translates into low camera noise and good usage of the existing light. While this camera is not an IR camera, like most, if not all digital cameras[49], its sensor is also sensitive to infrared light. In order to use it for our purposes we needed to filter out all visible light from the image, letting only infrared light pass. Surprisingly, such a filter can be easily fashioned out of developed overexposed film or a floppy disk (http://www.brighthub.com/multimedia/photography/articles/43805.aspx on 30/08/2012). By positioning a square of either material over the sensor, visible light will no longer reach it, effectively turning a regular camera in an IR camera (figure 28).

In spite of our tests with IR LEDs[50] revealing similar performance with both filters, we eventually chose the film.

Confident on our setup, we moved on to mount it on the studio. But unfortunately, we were met by a disappointing lack of performance: our camera was almost unable to detect the studio's lighting. The reason came as a clarification from Vicon's (the motion capture equipment supplier) costumer support: the studio lighting operates on a different wavelength than the LED's we tested the camera on[51]. That meant that our filter was inadequate for usage in the studio: it was filtering out most of the illumination, producing a very low-quality image, impossible to use for our detection.

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[44] Frame rate is the speed, measured in frames per second, at which a video camera captures images. A frame rate of 25 fps means that every second the camera takes 25 pictures, i.e., the camera takes a picture every twenty-fifth of a second (0.04 seconds).

[45] In our case the detection was being performed on a 320 by 240 resolution at 30 fps. As a means of comparison, the 1080p24 standard, a common Full HD format, uses a resolution of 1920 by 1080 pixels at 24 fps.

[46] In IR tracking there is no benefit in using a color camera: since we are just detecting a single light wavelength, light intensity (bright or dark) is all the information we need.

[47] There is usually no mechanical zoom function in such small cameras, so the only way to change the field of view is by changing between different focal length lenses.

[48] The aperture of a lens is literally, how open its iris is. Small lenses don't usually have a way to change it. A high aperture value (i.e. a small f-spot number like 1.8) means more light will hit the sensor, at the cost of a more shallow depth of field.

[49] Cameras that block IR light typically do so through the application of a filter on the lens, precisely because the sensor can still detect it.

[50] Light Emitting Diode. A LED is a very efficient electrical component capable of emitting a reasonable amount of light with a very low energy cost.

[51] 780nm versus the 850nm of our LED's.

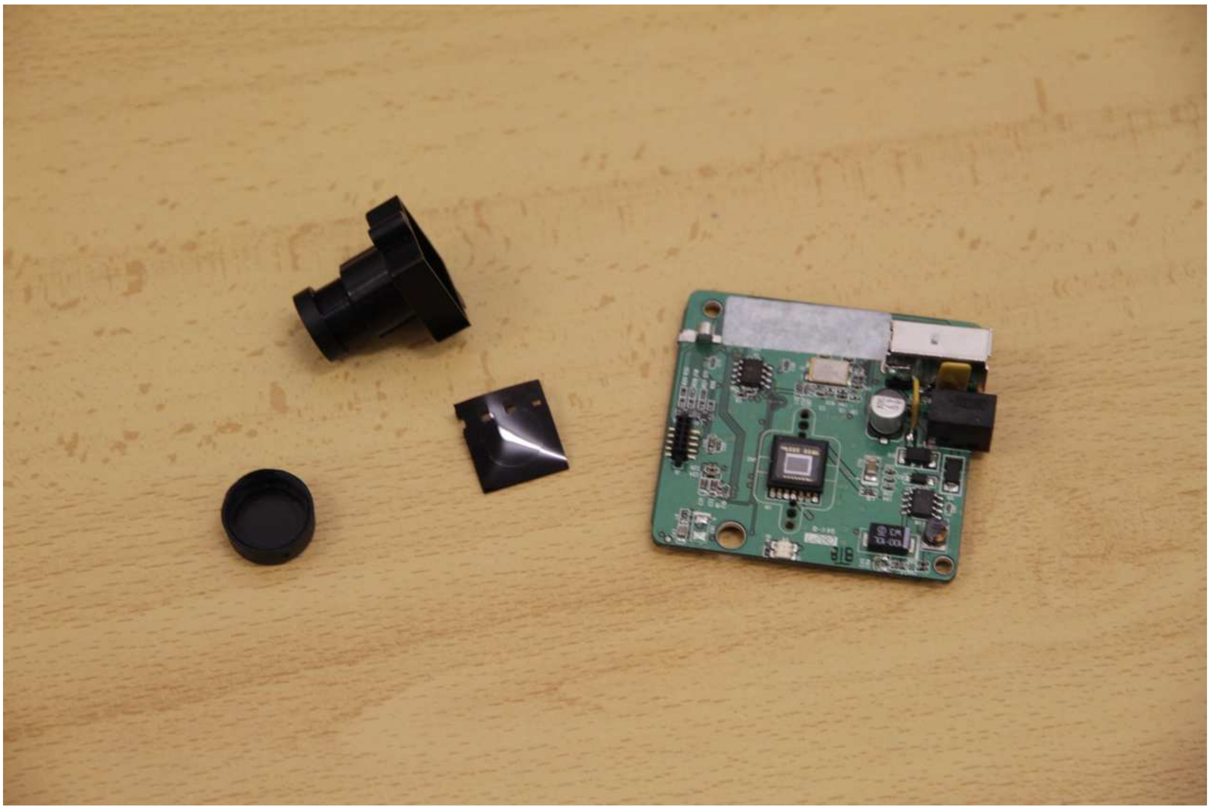

**Figure 28 – Our Unibrain Fire-I without the lens support and the film square we used as an IR filter. (Photograph by the author)**

But as we will now see, although at first this setback was met with disappointment, it was actually a boon that steered us towards a better approach.

We finished the previous section by stating that because of the projection's offset, positioning the camera directly under the box was not an ideal solution. Now that we have finally finished explaining how the camera detection works, we can understand why. Let us recapitulate our problem: since the mirror was tilted in an angle smaller than forty-five degrees, the projection was not being reflected directly under the box, but at an offset position from it. Thus, if the camera were to be placed facing down under the box, it would not capture the whole projection. In order for the camera to be able to capture the whole projection, it would have to be tilted to compensate for the projection's offset, which would result in a distorted image. While that would mean a less than ideal scenario for the detection, we were hoping that the ample light we were expecting from the studio would counterweight the detection quality to an acceptable level. As it didn't, at this point, we had two choices at our disposal: either we produced an appropriate filter, or used another light source.

In spite of producing ample IR light (as proven by using the motion capture equipment as intended), the studio's light sources themselves, due to their wavelength's proximity to visible light, produced a dim red glow. This glow is perfectly visible with ambient lighting, and in the low-light conditions required by the projection it would be far too conspicuous to be acceptable. In the studio there are ten illuminators, surrounding each of the ten camera's lenses. For an unsuspecting visitor, the result would be at the very least intimidating: average people that walked in on the exhibition would see ten cameras circled by red halos pointed at them, and such a nuisance certainly clashed directly with our wish to hide technology. Ironically, once we fully realized its implications, one of the reasons that led us to choose the studio for our exhibition in the first place was no longer justifiable. Still, our other main reason – the lighting grid – allowed our next move.

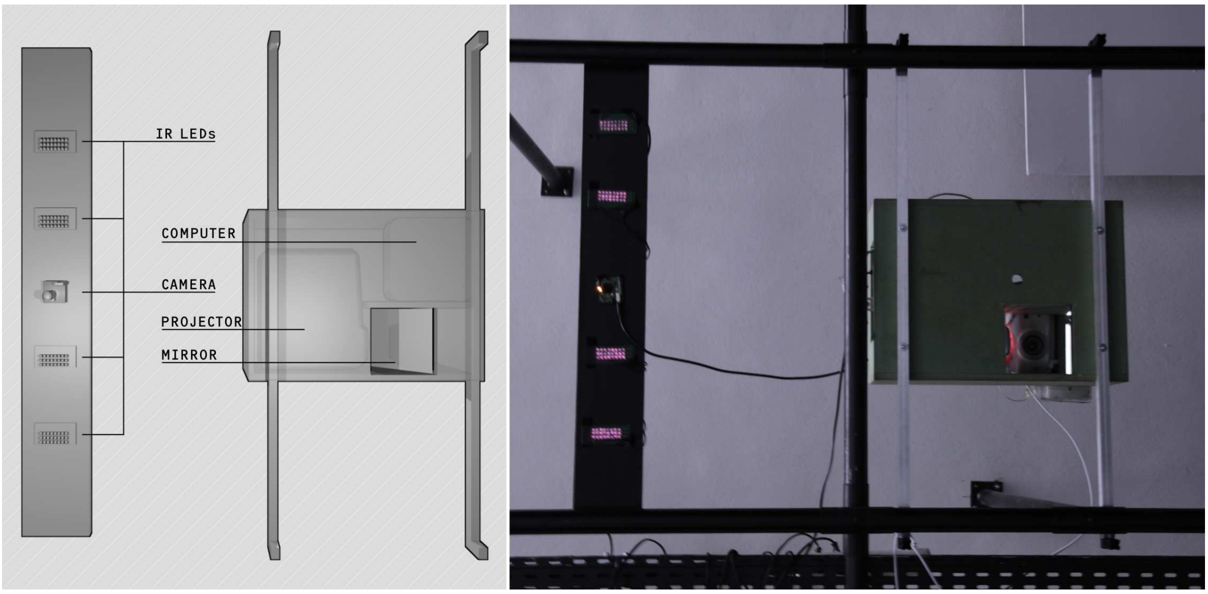


**Figure 29 – Left: Schematics for both platforms. Right: Implementation of the second platform. Note that the IR LED light is only visible because our photo camera was unfiltered – it is not visible with the naked eye. (Images by the author)**

Instead of using the studio's lighting system, we fell back to our tried and tested alternative: the very LED array we had used on our tests[52]. This array was made up of four connected boards, each fitted with twenty-four IR LED's, and was capable of a very significant light output. Its modularity allowed for flexible light distribution, and the sheer amount of light sources was more than enough for very good detection conditions. Now, coupling the need to position the camera aligned with the projection with the need to position our IR light sources,

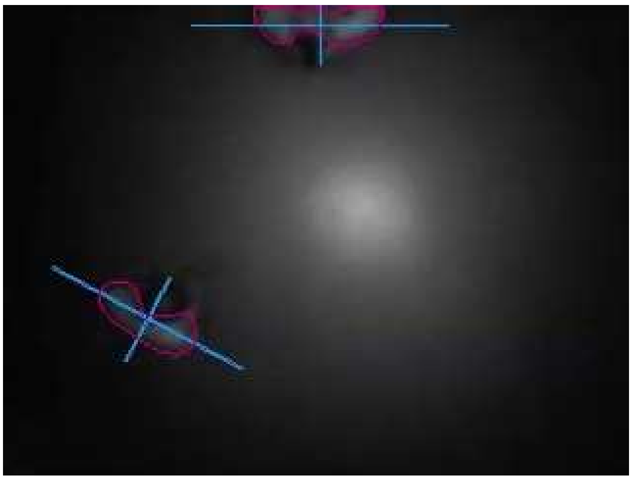

**Figure 30 – Screenshot of our camera's feed. The blue and purple lines are *Community Core Vision*'s (a software tool we will introduce and explain ahead) indications. Note that this screenshot was taken with ambient lighting and the projection on the floor: both invisible because our camera was sensitive only to IR light. (Screenshot)**

[52] We should thank Joana Gomes for unknowingly supplying the LED array. They were salvaged from now unused equipment from a previous project of hers.

we decided that the best course of action would be the use of a second platform (figure 29).

Arguably, maybe the ideal positioning would be setting the light sources around the projection area facing its center so that light, although weaker in intensity, would be uniform from all sides. But in our tests, our method of concentrating all the LED's straight down on the projection area yielded very efficient and reliable results (figure 30), with the added bonus of keeping the wiring and setup much more manageable.

After this lengthy explanation of the visual aspects of the installation there is just one more feature that we must explain before moving on to the software component of the project. Apart from the projection, the installation also features a strong audio component. In this last section, we will describe the sound hardware we used.

#### 4.1.3 Audio Setup

Up until now, we have described the issues we faced and the solutions we found regarding the visual side of the installation: the projection and the video tracking. But the installation also includes an important audio element. In accordance to what we've been doing, here we will only mention how we implemented it physically, and in the next subchapter, about the appearance and functionality of the installation, we will explain in more detail how we approached sound effects in our installation.

In *Balance* we opted to include positional sound, meaning that we wanted to provide an aural experience that allowed participants to identify the physical origin of sound around the projection. To that effect, we needed various audio sources on different locations. Weighing the desired effect and the implementation difficulties, we decided that four speakers would be enough.

Many problems arose because of this decision, though. One of them is the physical difficulty of setting four speakers around the projection area: all the speakers had to be powered and connected to the computer, and that required long cables, access to a power source and an audio interface[53]. Furthermore, all this material would also have to be inconspicuous and small, in order to maintain the discretion we tried to achieve with the whole installation.

We started addressing these problems with the interface issue. A simple external USB sound card, a Trixes External Sound Card, worked perfectly[54]. We chose it because of its small size and affordability. The fact that it features three jack outputs means that we could connect up to six speakers. Next, we needed to think about the speakers themselves. Because of the significant distances, it was impractical to use regular pairs of computer speakers, since typically these have relatively short wires. And apart from the audio cable's length, we also had the power cord's length to worry about, which would result in an unwieldy amount of power extensions. Fortunately, we were able to provide a solution that solved both problems at the same time. By using four X-Mini v1.1 Capsule Speakers we could easily provide proper sound from four different sources. These are portable speakers that in spite of their small size

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[53] We remind that our computer was an Apple Mac mini that only features one combined jack and optical audio output. In order to connect more than two speakers, there has to be an external interface of some sort.

[54] Thanks to Alexander Thomas' (http://www.dr-lex.be/software/cm6206.html on 30/08/2012) sound output activator. Thomas' software allowed for the use of the sound card, despite the fact that it is not officially supported under Mac OS X.

provide adequate sound quality and volume for our purpose. Besides, since they have internal batteries, we were able to overcome the need for power supply[55].

Having now an audio interface and appropriate speakers, we now only required a means of connecting both, which was easily achievable with regular 3.5mm jack cables. Each sound output on the sound card carries two sound channels. Since we required four channels, we would have to split each output into two separate channels. This means that, for example, from the front output, we need to extract the front right and front left channels independently, and connect each to a separate speaker (figure 31).

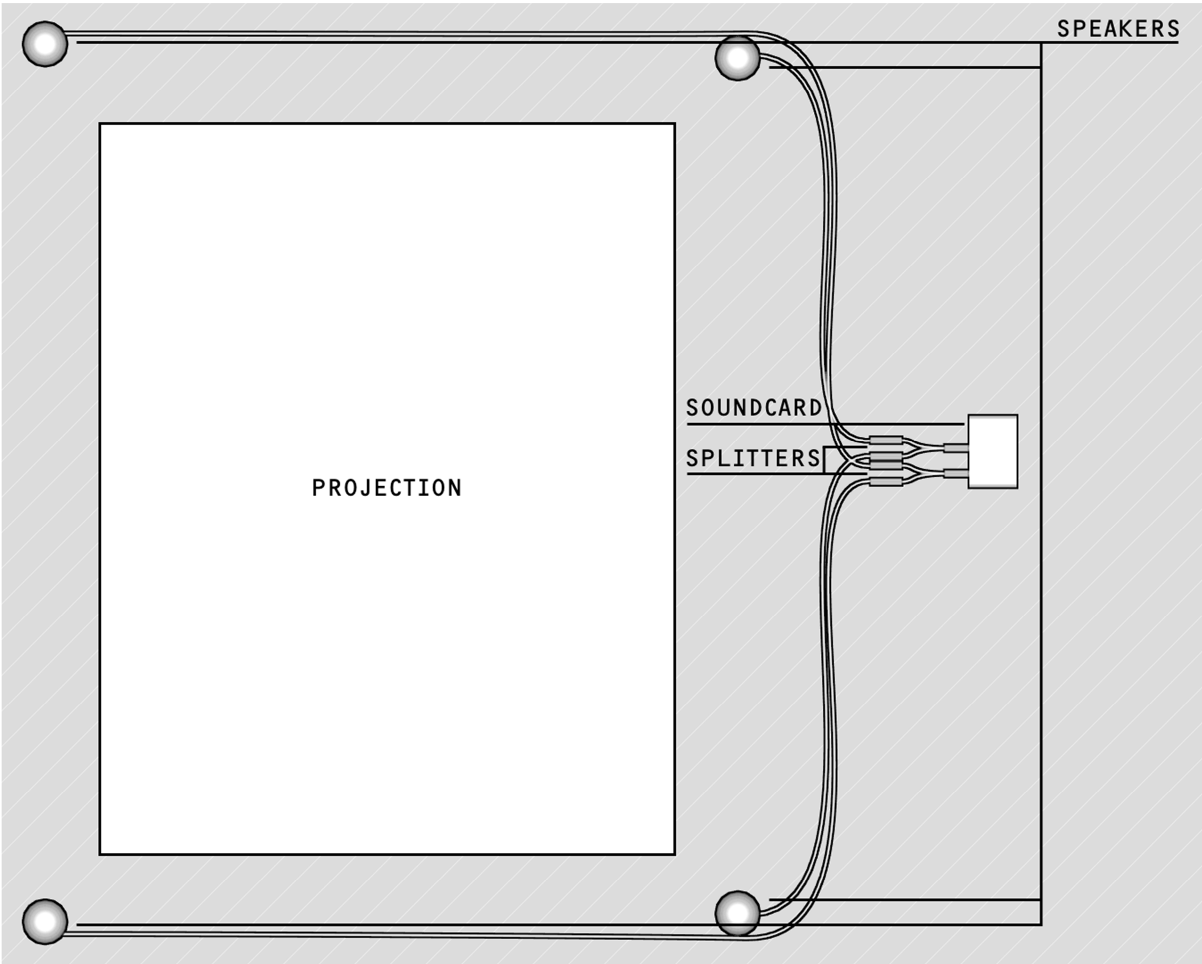


**Figure 31 – Schematics for the sound setup. (Image by the author)**

In order to accomplish that task, we decided it was more cost effective to make our own splitters and cables: two male stereo jack plugs connect to the sound card and each of them splits into two left and right female jack plugs. To each female plug we connect a male to female jack extension, and finally to each female we connect a speaker. Since we were making the cables, we were able to adjust their length to prevent too much clutter. Finally, all that was left was securing the speakers in their respective places: a task made easy again because of the lighting grid.

[55] The speakers lasted around twelve hours with each charge, which was more than enough for our one night exhibition.

And here we finish the hardware description of our project. But before moving on to the software side, it is important to briefly review what this hardware analysis consisted of. We started by the very practical side of how we could secure the material needed for the installation – namely the projector, computer and the camera – in their appropriate places. The projection offset issues prompted us to explain how we employ computer vision in our project, and the construction of the second platform. Finally, we described the components of our audio setup.

In order to finish the technical description of our project, then, all that remains is to describe our approach to software: the tools we used in conjunction with the hardware.

#### 4.1.4 Software

After having finished the explanation of the hardware side of the project, in order to finish its full technical description it is necessary to focus on what lies within: the software that puts this technology to use[56]. We already dipped our toes on this subject when we explained how computer vision is used in *Balance*, but as we will see, that is just a subset of the project's components[57]. In this section we will start by analyzing the several stages of our project, and explain the different layers of software we required for each one – a list that was fortunately very short, since the fewer tools used, the more time and familiarity is possible to create with each of them.

As we did on the previous chapter, we will try to approach this matter with a very functional point of view: instead of focusing on the tools, we focus on the task for which we need them. We will start, then, by trying to look at *Balance* with that in mind.

First and foremost, since we are talking about an interactive installation that attempts to apply a game lens to digital art, it is a given that we are going to need programming to manage events and behaviors, as well as keeping scores and measuring performances. To this layer we shall call the logic layer. Next, in *Balance* we have a platform, seen from above, where marbles fall. While the platform is projected in the floor – a two dimensional surface – and the marbles movements occur only horizontally and vertically relative to that plane, participant's weight is applied on a third axis: from above. Sense of depth and perspective is fundamental to understand the tilt of the platform. As so, we will need a three-dimensional graphics engine to depict them. Functionally, we will also need the marbles behavior to be as accurate as possible. Animation and movement are much more important than graphic photo-realism in our project: if the installation reacts as expected, it will be much more intuitive for the participant to understand how it works. So we will require a realistic physics engine: a software layer that simulates physical forces like gravity and drag, as well as collisions between objects. As we've seen before, proper sound effects and virtualization also help the

[56] It is important to acknowledge that apart from the technological aspect of the installation, several other tools were used for the content production: graphics editors and 3D modeling software, for example. We refrain from mentioning them here for organization purposes: as mentioned in this subchapter's introduction, our concern here lies with the technology present in the installation itself, in the artwork. In the next subchapter we will explore the content production and logical inner workings of the installation, and there other tools will be referenced as needed.

[57] And as we will soon explain, a fairly unimportant one for this document, since because of its complexity we didn't approach this task at all, relying instead on an already built tool.

participant in perceiving what's going on in the installation, so we need a positional audio engine as well: a software layer that modulates and distributes sound for several speakers around the room. Finally, we have the interaction layer: as we explained before, we need computer vision software that detects player's positions.

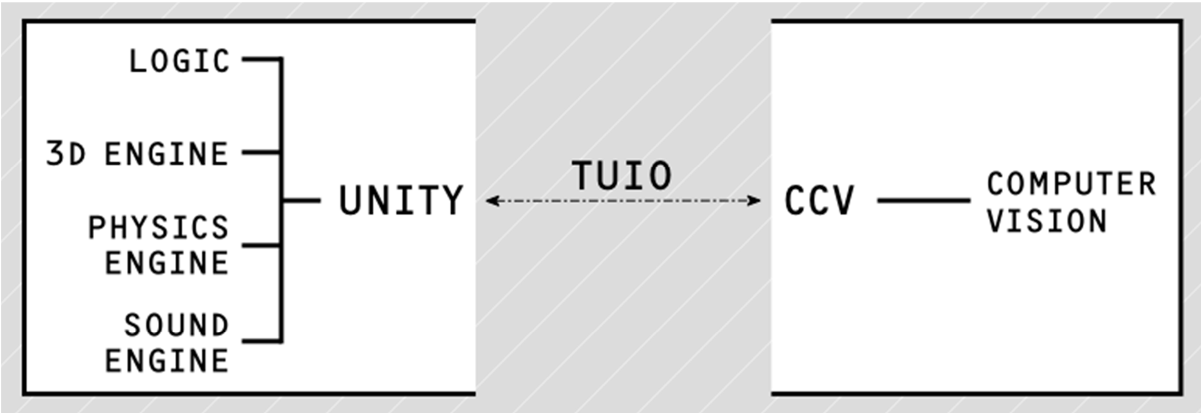


**Figure 32 – Diagram of the different software layers we are using. (Image by the author)**

In this quick analysis, we realize that there are five different layers of software that we'll have to think about, as well as a means for them to communicate with each other. But even though all these stages of planning and execution may seem very diverse and complex at first sight, truth is we chose a tool that provides an answer to almost all of them. Appropriately, as our theoretical process started with a game lens towards art, so the practical component of this thesis is based on a game tool. *Unity* (Unity Technologies, version 3.4) is a game engine, meaning it is a software tool designed specifically for making games (figure 33).

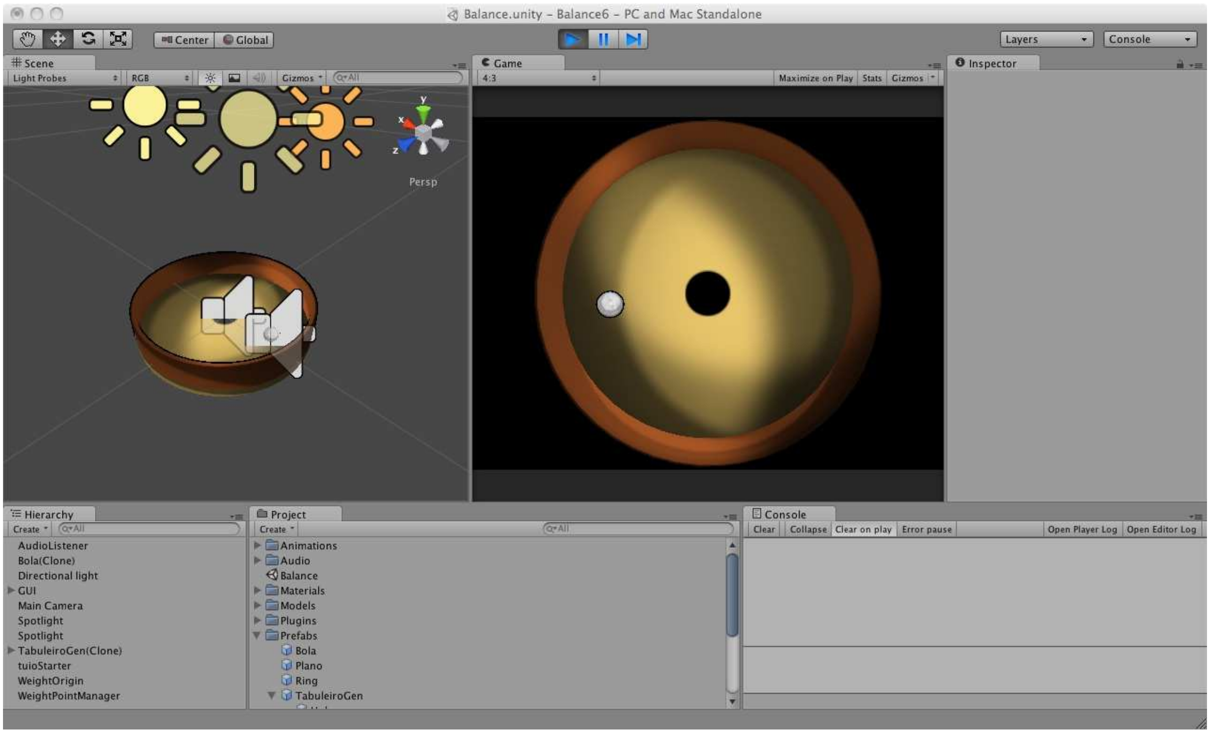


**Figure 33 – *Unity*. (Screenshot)**

Because *Unity* is aimed for professional-level game design, it already includes most of the software layers we need: *Unity* can handle the logic[58], 3D graphics, physics simulation and positional audio layers. And because all these layers are handled by the same tool, there's no need for external communication: for example, the physics engine calculates marbles movement in 3D space, and their position is used to calculate the sound modulation.

But we still need an answer for the interaction layer. We needed to find an external computer vision solution and a communication protocol that allows that information to be sent to *Unity*.

Building our own computer vision tool was a challenge we never saw fit to attempt to overcome. Not only it would be too time consuming and overly complex, it would also be very redundant. Resorting once again to the similarity between the detection system we require and the one used in optical multi-touch surfaces, it seemed logical to use the same software tools as well.

As was the case with the hardware part, our approach was based on the same tools as optical multi-touch surfaces: we relied on *Community Core Vision* (figure 34) – a popular open-source computer vision software also known as *CCV*, or previously as *tbeta* (http://ccv.nuigroup.com/ on 30/08/2012) – for participant detection, and the *TUIO* communication protocol it uses to integrate it with *Unity*.

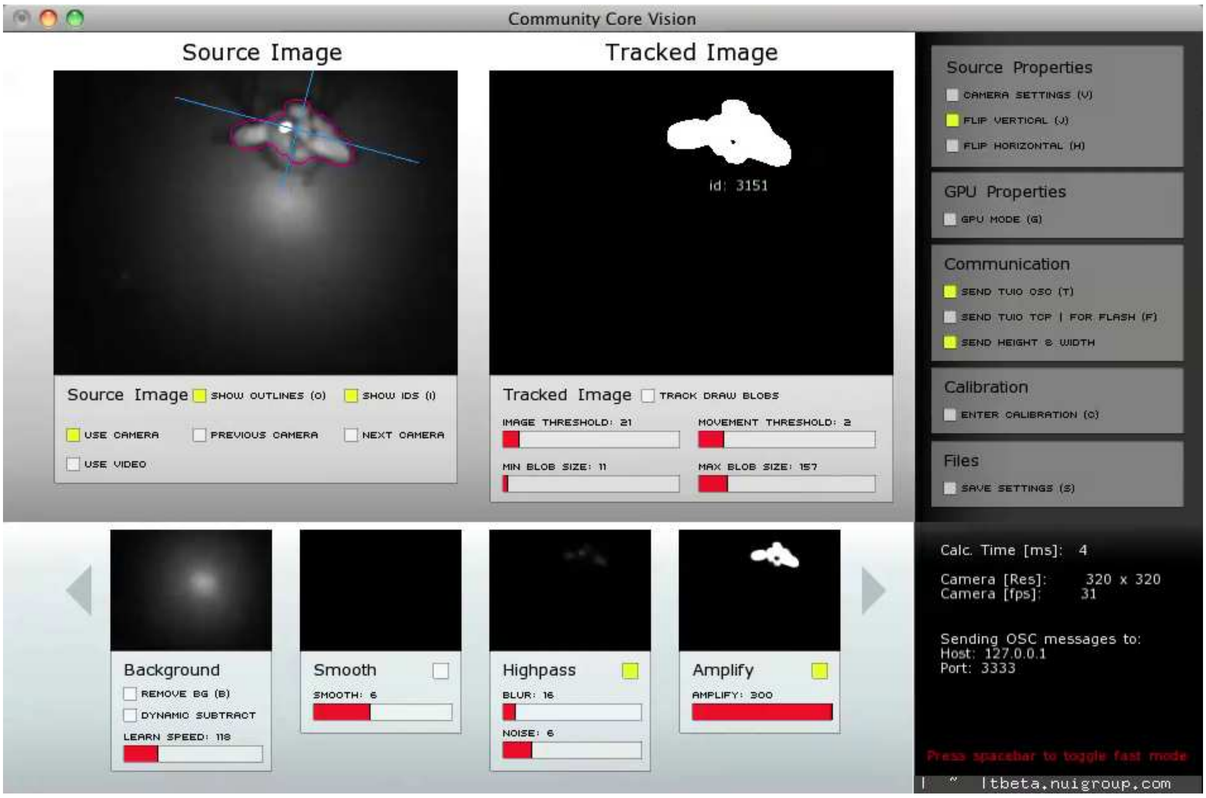


**Figure 34 – *Community Core Vision*, or *CCV*. (Screenshot)**

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[58] *Unity* allows scripting in JavaScript, C# or Boo with no performance impairment (http://unity3d.com/unity/engine/programming on 30/08/2012). At first we started implementing *Balance* using JavaScript. Because it is, in our opinion, a simpler and more forgiving language, it helped in early stages while still building up familiarity with *Unity*. At a later stage, though, we ported our JavaScript code to C# in order to conform to the external libraries we used. This decision was not motivated by technical problems, but because it was easier to understand and maintain the project if it were all in the same language.

The *TUIO* protocol is an open framework designed to transmit touch events from a video-tracker to a *TUIO* client (http://www.tuio.org/ on 30/08/2012). In essence, the *TUIO* protocol specifies a set of *OSC*[59] messages that carry parameters like blob position, velocity or size from a *TUIO* tracker – the detecting program – to a *TUIO* client – the program that will receive and treat the information. In our case, we are using it to transmit blob information from *CCV* to *Unity*.

But while *CCV* already supports *TUIO* natively, *Unity* doesn't. Fortunately, there are open-source *TUIO* implementations[60] available on the official *TUIO* website (http://www.tuio.org/?software on 30/08/2012). After testing both *uniTUIO* (http://www.xtuio.com/index.php/projectsmain/utuiomain on 30/08/2012) and *unity3d-tuio* (https://code.google.com/p/unity3d-tuio/ on 30/08/2012), we opted for the latter; as we will explain in the next subchapter, we had to edit the library in order to add some functionality, and Mindstorm's *unity3d-tuio* was, in our opinion, more organized, thus facilitating this task.

And it is at this point that we finish explaining the different software layers that make up our project. We started by evaluating the project's software needs, and choosing tools that could cater to them. For the video-tracking component we chose *Community Core Vision* that in turn uses the *TUIO* protocol to communicate participant position. Resorting to *unity3d-tuio*, we were able to put the *Unity* game engine on the other side of the communication line, and thus have participant information integrated with all the remaining software layers.

This subchapter finishes with this software analysis, and thus concludes the explanation and justification of the technological and physical aspects of our interactive installation. After describing the challenges we faced with the physical installation and the tools we chose to tackle the software part, we will now move on to looking at our work from a different perspective.

The next subchapter will concern a very different topic, and be organized in a very different way. Instead of describing technological choices, we will focus on aesthetic and functional choices: how the project looks, sounds, feels and behaves. And we will also finally fully explain how we applied the theoretical component of the thesis on its practical component: how we used technology to create relation.

## 4.2 Functionality

Tools are used to accomplish tasks, and up until now we have been talking more about our toolbox than the tasks we are using it for. That will change in this subchapter. This section will focus on *Balance*'s content: on one hand its graphical and aural components, and on the other the way it responds to users. We chose to treat these two modules independently because in the context of the installation they served very distinct purposes. The project's appearance had the main purposes of inviting the participant to the installation, providing a welcoming first contact and teaching him how the project works. Its mechanics, on the other

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[59] "Open Sound Control (*OSC*) is a protocol for communication among computers, sound synthesizers, and other multimedia devices that is optimized for modern networking technology." (http://opensoundcontrol.org/introduction-osc on 30/08/2012)

[60] *TUIO* implementations act like external libraries that allow the reception of *TUIO* messages in a given software or programming language. Both mentioned *Unity TUIO* implementations are written in C#.

hand, were thought more to maintain this initial engagement and provide unobtrusive ways for other people to join in. Of course this separation should never be understood as absolute, and as such, we will clarify how both modules complement each other as we explain them. With this in mind, the same way that a participant of our installation would start by seeing and hearing it, we will start by explaining the creation of the visible and audible aspects of *Balance*.

#### 4.2.1 Appearance

We have stated many times before that we wanted to hide the technology behind *Balance* in order to better focus on what we actually want to show. That decision finds reasoning on our wish to present a simple and clean interface – one that would make the project immediately accessible and understandable to everyone. This is why the only clearly visible component of the installation is the big projection on the floor. But this decision obviously also extends to the content of the projection itself; it is, as we said before, the first thing participants see. We need to display a platform with a hole, marbles that are dropped on it, and obstacles to make dropping the marbles in the hole more challenging. The very first decision we took right from the beginning was to use a circle instead of the square shaped platform that can be seen in the Lauenstein's *Balance* (Balance, 1989). A circular platform allows for people to gather around it more easily, thus enabling and inviting a higher degree of participation and engagement. And since the weight calculation is radial[61], it also ensures an homogenous weight distribution; if it were a square platform, standing on a corner would apply an exceptionally stronger weight than in any other place along the rim. On a circular platform the whole rim is at the same distance from the center, producing more predictable results when affected by the weight, making it easier to understand the interface. It was also set from the beginning that there would be no other visual elements, like a score counter or a background color: as we will better explain when we discuss the project's mechanics, score counting is a feedback system that we think is inappropriate for our project, and using a black background hides the projection's limits – only the platform is seen on the floor – further contributing to hide the technology used.

But while the general appearance was quickly decided, how the platform would be depicted wasn't. In spite of seemingly simple, the graphical style to follow was an area we struggled with in early stages of development. It was difficult to foresee exactly how understandable the project would be, seeing that throughout most of the work process we could only see our results on a computer monitor or, at best, projected on a wall. We already knew that the final projection on the floor would be easy to find and look at, but noticing the projection is something very different from understanding how the project works. Initially one of our main concerns resided on depth perception. Since it is projected on a flat surface, we were thinking of ways to make the fact that the platform could tilt in three dimensions obvious, and after that, ways to provide meaningful feedback on how much it is tilting, so as to be intuitively controllable by participants. Our first experiment ended up being an exaggeration of visual aids, precisely to try to understand which ones worked better (figure 35).

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[61] The farther away from the center the person stands, the greater the downwards force to be applied on the platform.

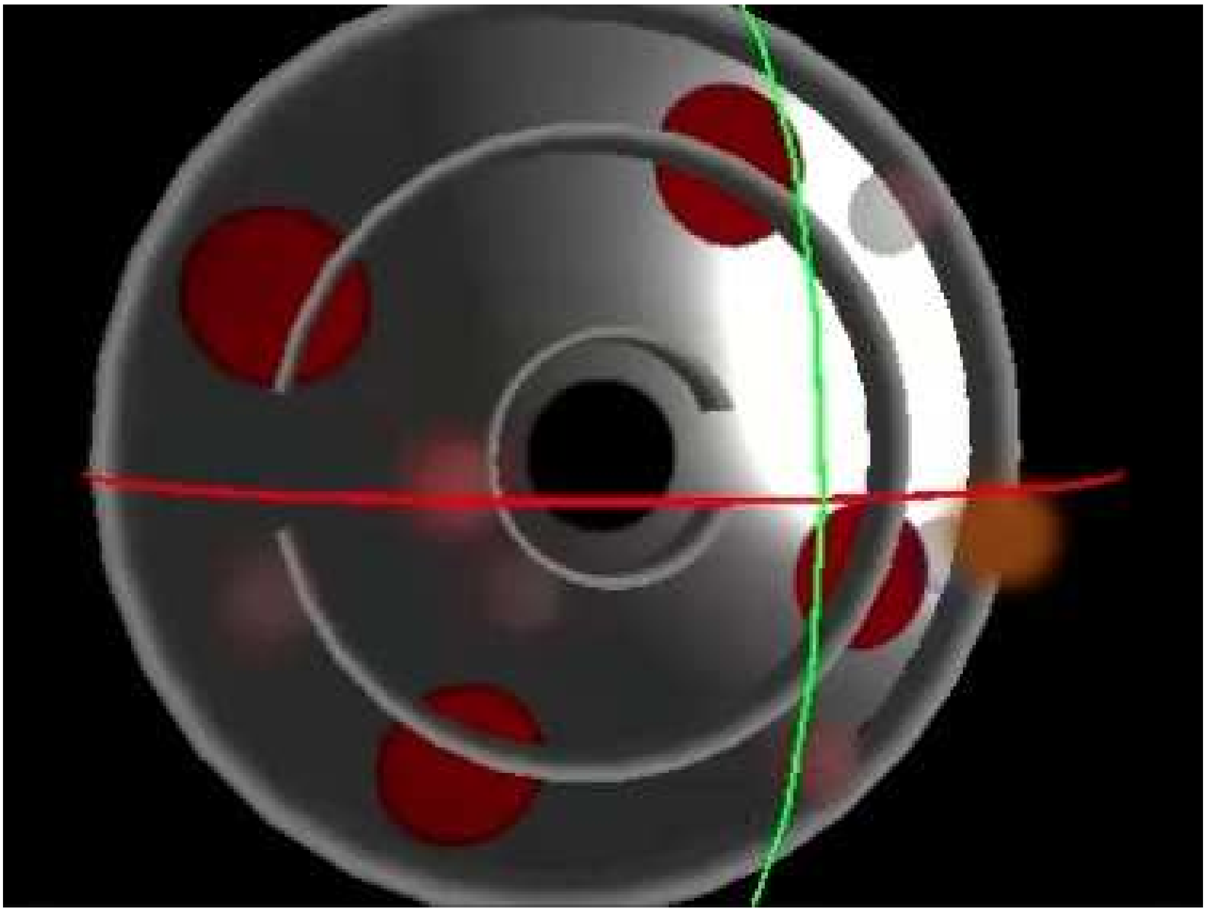

**Figure 35 – Early experiment on *Balance*'s visuals. (Screenshot)**

The first of such visual aids was applied to the marbles. At first we tried to depict a glass marble with a pulsating light source within it, expecting the light variation to draw attention, and thus make it more visible. As it turns out, the pulsating light made it hard to understand the marbles' size and shape, making it harder to control.

In regards to the platform, we mainly experimented with three components, the first of which was the lighting. We position two spotlights above the platform, lighting it from each side at an angle. We also applied a very shiny material to the surface, in hopes it would help understanding how light was hitting it, and consequently in understanding its rotation. The second component was the usage of drawn shapes on the surface itself, so that perspective deformation could better convey which side of the platform is further and which is closer. Finally, we went as far as to draw two arcs to represent the rotation axes the platform rotates by; since they cross directly above the center of the platform, if the platform rotates it would cause the crossing point to offset from the center of the projection. We quickly realized, though, that in fact almost all our attempts resulted in an excessive amount of information – excessive to the point that even individually these elements made the interface too confusing. The axis introduced more visual confusion than functional simplification; because they were visually distracting, they actually made it more difficult to understand the platform's movement. The same happened with the shiny texture; not only it didn't seem to contribute significantly for depth perception, the contrast between light and dark was so pronounced that it actually decreased visibility, making the marbles harder to notice. Finally, the circular shapes on the platform also proved excessive; while the perspective distortion was noticeable (although not very much), it was in no way more helpful than the perspective effects present in the walls. In fact, the shadow and perspective variations on the walls were by far the best visual indication; because it's such a natural consequence of the platform's movement, it didn't seem to cause any confusion, being intuitively understandable.

After realizing that the use of realistic phenomena – in this case, lighting and perspective – greatly improved the platform rotation's readability, the first decision we took was making these effects more noticeable by making the walls taller[62]. The second decision was trying out the same approach for the platform's static appearance as well – mimicking real wood by using wood textures, as is done in our reference *aTilt 3D Labyrinth* (FridgeCat Software, 2011) and can be seen in figure 36.

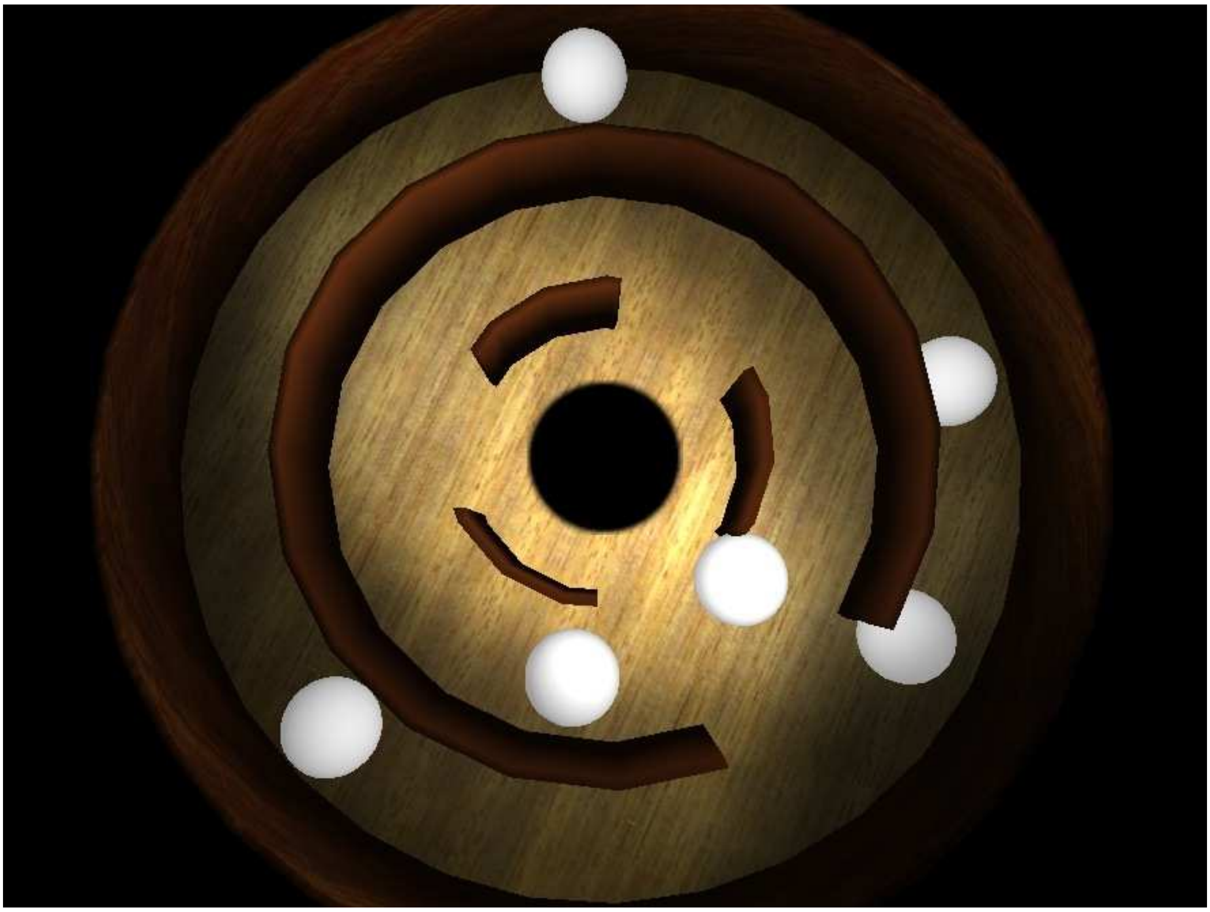

**Figure 36 – *Balance*'s second graphic iteration. (Screenshot)**

As expected, the use of realistic textures made the platform easier to understand as a wooden platform, making its function more obvious. But there were some interesting surprises when we addressed our issues with the marbles. As we experimented with realistic metal materials, we discovered a very artificial but more interesting way to depict them. By heightening the material's specular reflex, the marbles could be made to appear much brighter, more visible, and with stronger profile, thus solving all our previous visibility problems – because they would reflect more light, they would be perfectly visible even in the platform's darker spots.

[62] Note that at this point we were still experimenting with the polygonal resolution with which the walls would be depicted. We chose not to needlessly optimize geometry before striking a final graphic language. That's the reason why in the first two graphic iterations some walls don't seem round at all, but do in the last one.

But while we were satisfied with how the project was looking when it was still, this solution still presented some flaws when the project was running and all these elements were moving. The lighting worked well with the walls and surface to provide good depth perception, but the added detail of the wood textures proved to be slightly too distracting. The same way, the marbles were now perfectly visible and thus enabled functional and perfectly understandable interaction, but because of their uniform surface they did not look as if they were rolling, but instead sliding. The attempt to solve these problems culminated in the final graphic installation we went through (figure 37).

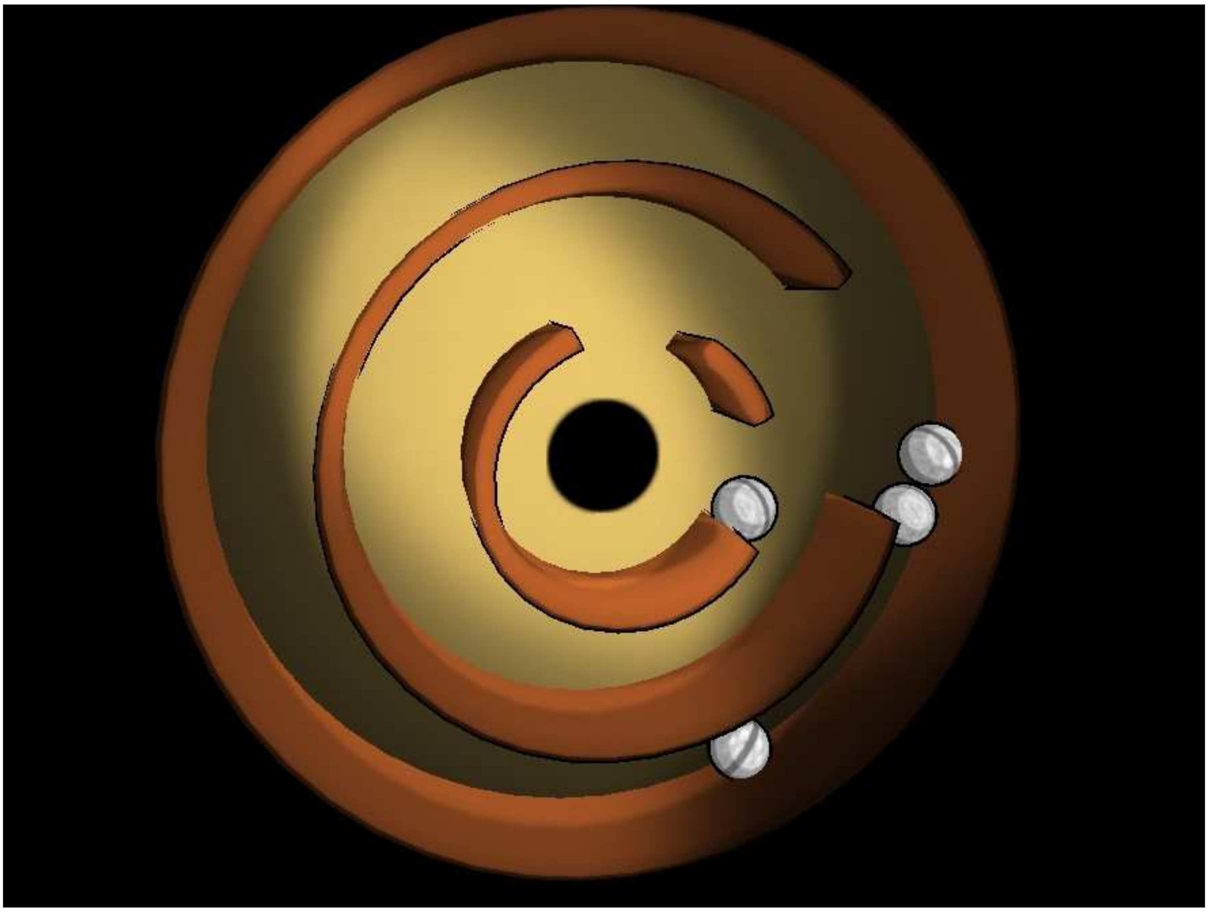

**Figure 37 – *Balance*'s final appearance. (Screenshot)**

*Unity*, the game engine we were using, includes bundled toon shaders[63] that proved perfect for our purpose. Using such shaders it is possible to simplify the light shading, leading to much simpler but still understandable lighting effects. It is also possible to outline the graphical elements as if with a pen stroke, contributing very positively for their apprehension. So instead of realistic textures, we opted for smooth surfaces and brightened the overall platform look[64], while still using a wood related color palette. It is true that the platform's material was slightly less identifiable now, but the sacrifice was worth it, since it resulted in a much simpler and pleasant appearance that remained consistent regardless of the platform being moving or still. Lastly, we also changed the marbles' appearance to include a slightly rough

[63] In computer generated imagery, a shader is a piece of software that affects how the image rendering is made. Toon or cel shaders are specific types of shaders that attempt to emulate a hand painted cartoon style.

[64] Both by brightening the materials and by adding a third low intensity directional light.

texture and most importantly, a longitudinal stripe. Although with a different approach, we still used a very bright and visible material, and the added graphical indications made it perfectly clear that they were round and rolling, which intuitively made their behavior much more realistic, and as such, also easier to understand and predict.

These last changes were the final graphical revisions the project underwent, so it is here that we finish explaining the visual appearance of *Balance*. But yet before moving on to its functionality, we will talk about the other component of *Balance*'s appearance: its audio component.

The audio component of our project was a very interesting and surprising aspect because at first we underestimated its strength. It was set from the beginning that we would include positional sound, but up until the first actual installations tests, we thought of it more like a complement to the project than – as it turned out to be – a fundamental component of both interface and functionality.

Fortunately, the first experiments we made with sound quickly led to our final approach. We started by isolating the situations for which we would require sound within the project: when marbles are rolling, when there is a collision between a marble and the platform or a wall, and when there is a collision between two marbles. Even when we first started considering sound, we knew we wanted it to be very simple and realistic. This stance became even more important when the latest graphic iteration was completed: the visual side was moving away from a realistic representation, so we decided to use real recorded sounds in order to balance clarity and immediacy back to the project. To this end, we resorted to the web-based sound database *Freesound* (Freesound Team, s.d.) to find sound samples that we could use for these situations[65], and from them we extracted several variations of sound loops for each event. On the logic side, these loops would be randomly selected when they were needed, to prevent the sound effects from becoming too repetitive. Also, taking advantage of *Unity*'s audio capabilities we could easily tie the sound intensity to its marble's velocity – the faster a marble travels, the louder it rolls or collides.

The first very interesting consequence of this method was that sound intensity provided a very intuitive feedback system for the player: the less successful participants are at getting rid of the marbles, the noisier and chaotic the installation gets, which provided the first fundamental purpose for the sound. We acknowledged the second and most important aspect when we finished setting the installation in place with all the hardware: in our first tests we noticed that because of the already mentioned projection offset, participants' shadows were bigger and more intrusive than expected. But thanks to the four speakers that we set, it was almost possible to guide the marbles to their goal just by inferring their position from the sound. That means that even when participants don't have direct visual contact with the projection, they can still fulfill their goal. Furthermore, people can more easily participate together in the installation without their shadows getting prohibitively in each other's way. We only realized at a relatively late stage of the project how invaluable positional sound was to compensate for the projection's occlusion, and once we saw this potential, we decided to add one more sound effect for when a marble successfully enters the hole. We wanted to differentiate this event from others – guiding a marble to the goal is the participant's goal and the very purpose

[65] We used two samples: *marble.wav* by scotru (http://www.freesound.org/people/scotru/sounds/34732/ on 30/08/2012) and *Bowling Ball.wav* by driftworks (http://www.freesound.org/people/driftworks/sounds/128969/ on 30/08/2012)

within the installation, so it makes sense its feedback system is also different – and as such instead of a real sound, we are using a synthetic sound based on a sine wave that resembles early 8-bit videogame sound effects, and thus constitutes a meaningful and understandable way of informing participants they are doing well.

Simple as it is, as we saw the addition of sound to our project greatly enhanced its functionality and participatory potential. And after finishing the explanation of the audio and visual aspects of our work, we are going to move on to the next step of its description: its inner workings, the rules that govern the events that take place within the installation. In this next subchapter we will explain the steps we took to make this installation functionally interesting and potentiate engagement and relation between visitors.

#### 4.2.2 Rules

In the previous subchapter we described how the installation presents itself to a visitor. In some instances we even hinted at ways the installation responds to its participants, but we haven't properly explained how the installation behaves yet. It should be clear by now that the installation's goal is to join several participants within the same context, collaborating towards the same objective – guiding marbles towards a hole on a platform. And in this chapter we will clarify how that process is led to fruition, and what devices we have employed to motivate and explain participants how they can achieve their goals.

The first of the devices that we will speak about has been previously mentioned several times, although not as clearly as it will now be explained – the tilting mechanic. After that, we shall overview the sequence of events that take place in the installation, from its inactive state until when participants leave it, explaining the reasons behind each phase. Finally, we will finish this subchapter by explaining in further detail how we treated the difficulty of the puzzles in our project: how we tried to balance difficulty to prevent both too intimidating and too easy scenarios.

The tilting mechanic is the most fundamental feature in *Balance*, and the only means the participants have to affect the installation. We have already established that in our installation the goal is to guide the marbles to the hole, and in accordance with our main reference – *Balance* (Lauenstein & Lauenstein, 1989) – instead of pushing them towards their objective, we chose to create a system where a platform is tilted, indirectly guiding the marbles. As we explained before, we detect how the platform should tilt by watching where participants are stepping with an overhead camera that then relays that information through *CCV* and *TUIO* to the main application. By using this system, we receive the normalized position of each participant: if a person is standing on the top-left of the projection, his position will be (0, 0), on the bottom-right it will be (1, 1), and any number in between for every other position. By summing up and making an average out of all the positions, we extract the estimated point where the weight is applied. Using this method, if two people stand on opposite sides of the platform, the average weight will be on the center, and so the platform doesn't move. Conversely, if two people stand on one side of the platform and another stands on the other side, more weight will be applied on the two people's side.

The average weight position information is then used to calculate the weight to apply on the platform[66], and thus tilt it. Since we let *Unity*'s built-in physics engine calculate the marbles behavior (handling gravity, collision between marbles and between marbles and the platform or the walls), having a way to tilt the platform was enough to set our project on a working state, so this system was ready even for our first prototype. Still, there was an important question regarding the detection system that was only answered on the installation's first tests: how to handle participant's body mass[67]. At first we thought that by taking participant's body mass into account (which we could access through the detected blob's size) we would introduce too much complexity on an otherwise very straightforward system. Since before actual tests we couldn't be exactly sure just how accurate the detection would be, we decided not to take participant's figures into account. This decision was also taken so that all participants could start on an equal footing: both people with different body builds and of different ages could affect the installation in the same way, providing an accessible and consistent experience for everyone. But when we were able to conduct our first installation tests, we realized that this was not an option: people's hair wouldn't show up on our camera, so it was very common that instead of a single blob, two independent blobs were detected – one for each shoulder.

Without considering blob sizes, this would cause the system to interpret each of these two small blobs as an individual person, applying an excessive weight to the platform. Conversely, another typical problem would be the case that two people stood too close to each other, causing the camera to detect a single big blob that was counted as a single person.

Taking the blob size into account doesn't make the computer recognize whether it's detecting one or more people, but it can mitigate the consequences by enabling the system to apply more or less weight depending on that. Going back to our previous examples, instead of counting full weight for each of the shoulder's blobs, it would apply two smaller weights. In the same way, the big blob formed by two people's silhouettes would weigh more than a regular sized blob. In both cases, this simplification was enough to provide a meaningful and accurate feedback from the platform. Unfortunately for us, the size of the blob is not used by default neither by *CCV* nor by the Mindstorm's *unity3d-tuio* library for *Unity*. *CCV* provides a way to send blob size (width and height) along with the position (figure 38), but *unity3d-tuio* provides no way to receive that data. Fortunately, due to the fact that this implementation is open-source, we could add support for these parameters ourselves, and make them easily available to *Unity* and our project.

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[66] It might be important to point out that in order to make results more consistent, we are not using *Unity*'s built-in physics engine to calculate the weight on the platform. Instead, we are mapping the average weight's position directly to the platform's rotation so, for example, if the weight is applied on the (0, 0) position, the platform will rotate -20 degrees on both the "x" and "z" axis.

Good physics engines are usually very robust and reliable, but sometimes they introduce randomness and unwieldy values on the system, which can lead to unpredictable results. Since for the platform tilting in our project it was much more important to have a responsive interface than physical life-like accuracy, we opted to implement this solution that not only is much simpler, it also yields very predictable results.

[67] Perhaps unknowingly, it was Doctor Cristina Sá that first mentioned this problem early on in the project. After being explained what the project was about, Doctor Cristina jokingly remarked that, since she was pregnant, the weight she would apply on the platform would be greater than everyone else's. It was only at this point that we realized participant's position only might not be enough for a plausible depiction of the platform's tilting.


**Figure 38 – *CCV*'s interface detail. (Screenshot)**

Basically, with the appropriate option on, *CCV* sends two extra parameters along with the regular *TUIO* messages: the width and height of the blob, normalized to the camera's resolutions[68]. On the *unity3d-tuio* side, all that was needed was to add support for these extra two message parameters so that they can be received and used in our application.

This final explanation completes what we have to say about the tilting mechanism we used in *Balance*. Now onto a less technical approach, we will proceed to explaining how the installation behaves throughout its lifecycle.

As we can see in figure 39, the installation has two main states: suspension mode and active mode. If there are people participating in the installation, it is in the active mode. If no people are detected for more than ten seconds, the installation reverts back to its suspension mode.

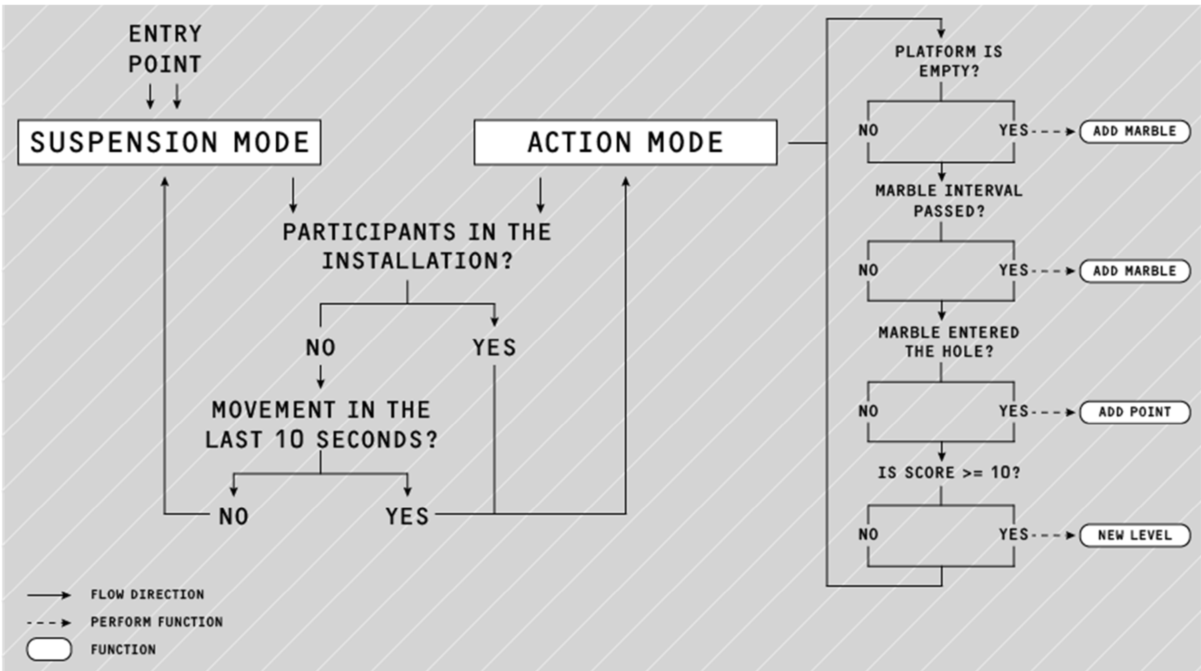


**Figure 39 – The installation's flowchart. (Image by the author)**

When participants first see the installation, it should be in suspension mode, where it presents the platform with no obstacles and no marbles. The lack of movement and sound shows the participant nothing will happen unless he affects the installation. As such, the installation

68 Meaning that in order to obtain the blob's size in pixels, we just need to multiply each value by the camera's resolution.

switches to its active mode the moment a participant steps on the platform, immediately responding to provide a very clear feedback: a marble falls from above and produces sound as it hits and rolls along the platform. The platform also starts immediately moving with the participant's applied weight – as the participant moves, the platform tilts and the marble rolls, quickly and intuitively teaching how the interface works. Either by accident or because they aim to do so, when a marble enters the center hole in the platform participants are rewarded with a sound, which will clarify their goal in the context of the installation. Whenever ten points are scored, a difficulty level is calculated and a new level is generated in accordance to the participant's performance[69]. Note that this is an important stage of the project's description because, as we said before when discussing the project's graphical appearance, there is no indication of the current score; participants don't explicitly know how close or how far they are from the next level. While at first this might seem a complete disregard towards the definition of "feedback system" we are using (McGonigal, 2011, p. 21), we remind that we establish our goal as being "getting rid of the marbles", and not "score points". In that sense, score keeping becomes a simple arbitrary method of making the installation progress and provide easier or more difficult challenges in accordance to its participant's performance: not relevant at all as a feedback system. Resorting back to our main influences for this project, we explained how in *Tetris* (Pajitnov & Gerasimov, 1986) the gameplay clutter acts as a feedback system on its own: if the player just carelessly drops pieces, the play area will soon become too confusing and scoring lines will become an increasingly difficult objective. We used the same principle in *Balance*; when participants reach a new level, all the marbles that weren't led to the hole are dropped on the new platform – if too many marbles are accumulating on the platform[70], it's a sign that participants aren't doing very well. Conversely, the fact that a platform is clean and uncluttered[71] is a good indication that participants are handling their task successfully. The number of marbles present on the platform is then our main feedback system – it is the best indication that participants are working together towards their goal of disposing of the marbles. We've briefly mentioned this before, but it is important to note that when a level is passed and the marbles drop, there is a possibility that they won't fall in the bottom platform at all, instead tumbling away and disappearing. This is a natural consequence of the use of a realistic physics engine, and while we weren't anticipating it, we made no effort to reverse it. In our opinion it adds an important layer of unpredictability to the project that has the benefit of disposing of some extra marbles that might be on the platform, eventually facilitating the main goal.

The installation has no ending state: it keeps on generating new levels for as long as there are people participating. If no participants are detected for ten seconds, the installation resets its parameters and goes back into suspension mode.

We finish explaining the installation's lifecycle back where we started: its suspension mode. Indeed, the installation is inactive when no participants are detected, but whenever it is in the

[69] This process will be explained right after we finish the installation's lifecycle description.

[70] In order to prevent too much confusion, the maximum amount of marbles allowed is twenty-five. After that point, no new marbles fall on the platform.

[71] It is important to mention that even when participants manage to lead all the marbles to the hole, the platform is never empty in active mode. As soon as all the marbles disappear, another one is dropped. On one hand, there is always something for participants to do, and on the other hand, this clearly marks a distinction between active and suspension modes: the first always has marbles, and the latter never does.

active mode, apart from managing the marbles and participant input, *Balance* is also measuring their performance. The last topic we will explain on this subchapter about the installation's behavior is how new levels are calculated. We have been stating that the level difficulty varies in tandem with player's performance, but until now we haven't explained how this measurement takes place. In this last section of this chapter, we will explain what parameters we use to calculate participant's performance and how do we generate levels taking them into account.

As with most if not all the components of this project, performance measurement was thought in a very simple and uncomplicated way. What we do is measure how long it takes participants to lead each marble to the hole. We then take these ten values (we remind that a new level is calculated when ten marbles are led to the hole) and find the average time participants took with each marble.

In order to provide variety and adaptability, instead of making a predefined set of levels and providing them in a fixed order, we opted instead in a more dynamic system that generates levels according to the collected information about participant's performance. We have five difficulty levels that we attribute to different time ranges, so for example if the participants take an average of forty-five seconds per marble, that will correspond to a difficulty level of three.

| Level | Average Time | Interval | Complexity |
|---|---|---|---|
| 1 | [90, +∞] | 10 | Just the outer ring. No obstacles. |
| 2 | [60, 90] | 10 | Two easy obstacles. |
| 3 | [40, 60] | 8 | Two obstacles. |
| 4 | [20, 40] | 8 | Two easy obstacles with possible linear rotation. |
| 5 | [0, 20] | 7 | Two obstacles with possible variable rotation. |

**Figure 40 – Difficulty levels table. Average times and intervals are in seconds. (Table by the author)**

As it can be seen in figure 40, each of the five difficulty levels provide a variation of two parameters: the time interval at which new marbles fall[72] and the level's complexity. It's easy to understand how the time interval at which marbles fall might provide easier or harder situations: the smaller this interval, the more hectic the level can become, as there can quickly be too many marbles in the platform for the situation to become easily manageable. What we mean by the level's complexity, though, is not so straightforward. To each difficulty level there are specific complexity parameters that are followed in order to generate the corresponding obstacles. These parameters are relatively broad, in order to allow a great variety of possible levels that, in spite of looking very similar and familiar, will provide very different experiences.

[72] For example, if the interval is ten seconds, a new marble will fall every ten seconds. Note that the exception about a marble dropping when there are no more marbles in the platform is independent of this interval: it may even happen that two marbles are dropped almost simultaneously – the first because all the others fell down the hole, and the second because the time interval had passed. We encourage this randomness in order to provide a more organic experience.

**Figure 41 – The five types of obstacles in Balance. In the bottom row are what we considered the hard obstacles. (Image by the author)**

In order to make random level generation possible, we started by modeling a small library of five obstacles, and classifying them as easy or hard to overcome[73]. When a level is generated, the application will populate the new platform with randomly chosen obstacles. Furthermore, apart from the objects themselves, difficulty levels four and five also include obstacle rotation: the obstacles rotate around their center, making it more difficult to successfully maneuver the marbles between them. In level four, linear rotation may be applied to one or both the obstacles. With this we mean that either one or both obstacles will rotate at a randomly generated but constant speed. In level five, both obstacles will rotate, and this rotation can be either linear – as we just explained – or variable; at a fixed time interval, the obstacle will start rotating at a new randomized velocity.

Choosing and balancing the obstacles was not an easy task. We chose to use simple variations of the outer wall in order to simplify the participant's process of learning how to deal with each obstacle – their general shape and behavior is roughly the same, so the variations are easily understood. We also opted to consistently use two rings as obstacles: our tests led us to believe that there were no significant advantages in generating levels with a single ring[74]. Conversely, in the very beginning we considered levels with more than two rings, but quickly discarded that idea, since that would greatly reduce the platform's available area. By always using two rings we simplify and cement our interface even better, and as we mentioned many times before, we strove with *Balance* to provide a very simple and accessible way for people to unite in the same context, with the same objective. In the next subchapter that's precisely what we will evaluate: whether or not our installation was successful in fulfilling this goal. At this point we finished the description of the difficulty calculation and level generation in our

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[73] Our obstacles consist of concentric walls with a variable number and location of openings.

[74] An important advantage would be a greater visual variety for the levels, but between variety and consistency, we tended to prefer honoring the latter in our project.

project, and thus completed the explanation of what we consider to be the most relevant aspects of our installation. We started by explaining in depth how we calculate the platform's tilt from participant's position, then we moved on to an overview of the installation's lifecycle, and finally we explained how we measure participant's performance and generate new levels from that information. In this last subchapter, we will now analyze if all this effort so far was put to good use: if *Balance* actually succeeded in fostering relation between visitors of our exhibition.

### 4.3 Reception

After explaining all aspects of our installation, of going through its hardware and software modules, and of an analysis of its content – both audio and visual components and its functionality and behavior – we saved this last section to perform an analysis of our work's impact. In this final subchapter we shall attempt to evaluate our work's validity and its coherence to our proposed ideas and initial concepts.

Our most fundamental premise with our work and our thesis is the creation of participation and relation fostering contexts through digital art, to which we employ some select game characteristics we consider fundamental. And in fact, in our work the public is one of the most important pillars; without participants, our installation remains inert – it can't react and doesn't establish any kind of social context. When we acknowledge that the public comprises such an important aspect of our installation, it is only fitting to include an analysis of how participation actually took place in our work: if our exhibition's visitors connected with each other because of our installation, if unknown people could share playful and meaningful moments. Fortunately, the answer is "yes", and throughout this last subchapter we will write about some events that support or disprove our initial ideas, and why do we consider them relevant to our work and thesis. We will also attempt to evaluate our own work – our successes and shortcomings – based on participant's opinions, so as to provide a good reference for important issues we shouldn't overlook. With these objectives in mind, we will once again resort to our four defining characteristics[75] as a starting point to evaluate our own work.

Within our installation there is a simple goal that we already mentioned many times: lead all the marbles towards the hole in the platform. As expected, it didn't take participants very long to understand this objective: it was intuitive and simple enough that quickly people started communicating with each other in order to collaboratively achieve this objective more effectively. Interestingly, it was also common to see visitors that had already participated in the installation aiding newcomers with instructions and advice, adding an unplanned but interesting dynamic to the project.

Some of this success is also merit of the next characteristic: the rule system of our project. *Balance*'s rules are that it is only possible to move the marbles indirectly by tilting the platform. Also as expected, this behavior was very immediate and obvious to participants: generally no one showed difficulties with the project's way of working, and since the marble's movement was modeled after real phenomena, it was also very intuitive and easy to control. But while we generally consider our approach a success for our purpose, some

[75] That we remind are goals, rules, feedback system and voluntary participation.

younger participants didn't always seem to agree: children were much more fond of attempting direct actions like trying to kick the marbles than tilting the platform, even after being explained how the project worked. We stated before that in our installation we don't enforce or punish any kind of behavior; it is part of the project that the public finds their own way of being within the project, so while unexpected, we could never consider a child's attempt to have fun their own way as one of the project's shortcomings. And considering how naturally charismatic and expressive children can be, it's hard not to consider moments like these successful ways of fostering relation within the public. In fact, what we considered a significant problem regarding the rules was not related to the public at all, but with our detection system. The detection system was of course thoroughly tested before the exhibition, and for the biggest part, it worked perfectly. We had taken into account the fact that hair wasn't properly captured by our camera, and even tested the system while wearing different colored clothes[76], but there were still situations that we didn't predict: people with hair long enough to cover their shoulders couldn't be detected at all, and some leather jackets also absorbed infrared light instead of reflecting it back to the camera. While very robust and functional, our detection system had some limitations that – in spite of just affecting a very small number of people – had the potential to completely exclude some visitors from our installation. Fortunately, we could understand what the problem was during the exhibition and solve it by asking participants to take off their jacket or to tie their hair in a ponytail: an intrusive but effective solution. Although this also constitutes a healthy layer of social interaction with some predictably funny situations, we hesitate in considering it a successful outcome of the project since it was caused by a technical error instead of by the project itself.

Our next defining characteristic concerns the feedback systems we used in *Balance*. We mentioned before that the amount of marbles in the platform is our main feedback method: it directly informs participants how successful they are being at the proposed goal, and it was proved to be a good choice, since participants could easily understand that indication. One could maybe also say that a more indirect way to evaluate this success is the difficulty of the levels they are proposed: if players are quick, the levels will be harder, and if players are slow, levels will be easier. But in the end, we think that this distinction ended being too vague to be generally understood by the participants. In hindsight, on one hand we think maybe we could have balanced the levels in a different way, or provided more variety, but on the other hand this subtlety, the fact that all difficulty values generate relatively similar levels, also helps masking how successful participants actually were: levels are different enough for the participants to feel challenged, but not enough for them to immediately understand why, which we consider a positive result. The lack of obvious differentiation between participants helps leveling their perceived performances, doing away with possible awkwardness or fear of not being able to achieve as much as other participants[77]. In the end we consider our approach

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[76] We were afraid very dark or even black clothes wouldn't be detected by the camera, but in our tests they successfully were.

[77] In writer and videogame reviewer Tristan Donovan's (2010) *Replay: The History of Videogames* there is a section containing an overview of the Soviet Union's game scene during the 1980's. Donovan writes that, due to the Communist regime, "Unlike US, Japanese and Western European games, [in Eastern Europe's video games] there were no high scores, largely because such a feature would have been seen as encouraging a culture of competition rather than co-operation between players." (Donovan, 2010, p. 202). Although our motivation for not including clear performance measurements does not stem from political views, in the context of our work it made sense to hide participant's evaluations. After all, *Balance* is an attempt to create relation, not a device to evaluate participant's dexterity or athletic abilities.

of providing randomly generated levels a good idea, and although the differences between levels are generally subtle, participants seemed to respond positively to it. It was also very rewarding that visitors generally responded very positively to the transition between levels: the sense of vertigo provoked by the platform's movement became almost like an extra motivation to press on to the next level.

Finally, the last defining characteristic through which we'll look at our work is voluntary participation. One of the strongest ideas that prevailed since the beginning is that people can enter or leave the installation at any point without consequences: a feature that participants of course appreciated. We never intended to force participation or to prevent anyone from leaving: the fact that there are infinite levels and no visible scoring system also encourage detachment from the game aspects of our installation and a more significant focus on its social component, because the participant doesn't feel forced to stay just to see the next level, or to avoid losing a good score. But apart from providing a means for anyone to enter or leave at any moment, we also tried to make the installation easy and accessible to everyone: that's why we emphasized simplicity, consistency and adaptable difficulty. Theoretically, participants of all ages can participate in *Balance* – in our exhibition we had both children and adults of very different ages – and the formation of some dynamics and bonds between people who had never met made us consider an important question: up until now, we have been calling people that play in our installation "participants", as opposed to people that are just watching, "spectators". And in fact the installation had a strong performative aspect to it that we didn't recognize at first: while in the installation, the projection would shine from the top towards participant's heads, just like the spotlight in Marie Sester's *Access* (2003). If one would ignore the projection on the floor altogether and just focus on people's movements, the way people moved within the space even resembled a dance: an ad hoc performance for an audience of spectators. But watching the installation evolve from here would quickly prompt our conceptions of "participant" and "spectator" to be revisited and expanded. People that were just watching others play *Balance*, "spectators", were frequently just as important for the project as them. When considering our project within Bourriaud's (Relational Aesthetics, 2002) relational point of view, we ended up eschewing a more traditional way of considering public in an artwork, and thus at first failed to consider these spectators also as participants in our project: we didn't think at first that people that were just watching should be considered participants as well. But in essence, they too were part of this social bubble: not only because they were part of the ad hoc performance we just mentioned, but also because in fact they were seldom just watching. These "spectators", whether they were just watching others play, or were also actively communicating or directing them should, because of their impact on the overall perception of the work, be considered "participants" as well. And even more because the project's permeability for people to enter and leave frequently enabled former "spectators" to come into play.

In spite of already envisioning our work as a very open installation, it was only when it was exhibited that we truly came in contact with how deep the public was integrated in *Balance*. Although, as we saw in the first chapter of this document, *Balance* was not our first installation that strove to provide a relation fostering setting, it was in our opinion the one that met the most significant success.

Our goal with our thesis, our starting premise, is that it is possible to create digital art that strives to provide sociability contexts, that draws inspiration from what we called the game lens. We set out with the wish to create art works that would bring people together, that would use technology as a means to shorten physical distance instead of simply making it apparently smaller. We analyzed games and extracted some of their teachings in order to understand what makes them so engaging and how can we apply that knowledge to our purpose. And in the end, the result of that study was *Balance*, a digital interactive installation that is based on game theory and surpassed our initial expectations in terms of engagement and the creation of what we've been calling the social bubble. This subchapter was dedicated to evaluating our work's impact on the public. And while we can't absolutely know for sure, our analysis and participants feedback seem to indicate our installation was a success.

This analysis concludes the description of our interactive installation, *Balance*, and the largest chapter of our dissertation. In the next and final chapter we will conclude our study, briefly summarizing and relating its contents and conclusions, and appointing possible outcomes and further work that the study enabled.

## 5 To Finish

Finally, we arrived at the closing section of our dissertation. Throughout this document, we strove to communicate a little of our position towards art and games, and how the common grounds between both worlds can be explored towards the construction of contexts, objects or experiences that address the social interstice between people. As the title of our document clearly states, with this dissertation we studied a way of creating relation resorting to the application of some game features, namely the four defining game characteristics, to digital contemporary art, here embodied in our interactive instalation, *Balance*. While we will never state that our approach is final, a definitive and optimized way of producing socially meaningful works of art (it is not, and saying so would directly clash with the infinite openness of themes, approaches and formats with which we ourselves see artistic production), it is because we saw value and relevance in it that we ultimately decided to pursue it, study it and make it into our masters dissertation. In this closing chapter, we will backtrack to the beggining of our document and summarize it, following a more personal stance in order to provide a final overview of our work. After this summary, we will attempt to find new questions that arise from our own approach, and propose future investigation topics and directions that our study prompts.

We started our dissertation by introducing our main problematic and our approach to it: the creation of contexts that deeply rely on technology and digital processes to provide ways for people to engage in meaningful social sharing. Looking at the success that games frequently have in fostering communication and togetherness, we chose to draw from them the main guiding line in our study. As it is hopefully very clear at this point, these two elements are fulcral throughout the entire document: we specifically say so right when we reveal our interactive installation and its objectives. But in order to further explain our reasoning and motivation towards them, we went on to show and explain how we had already attempted to integrate both video games and relational contexts in some of our previous works, namely *imagine*, *Pom* and *aB*.

Hindsight about these projects enabled us to draw important conclusions from them, and set the stage to begin explaining where *Balance*'s inspiration and roots lie. And diffuse as that answer might be, we came to realize that *Balance* is the result of abstracting the concept of game until it becomes more of a process. Instead of focusing on whether some artifacts are or not art, or are or not games (a question we dismissed right from the beginning), we proposed a way of analyzing and aprehending artifacts that is based on the contents and implications of the artifact itself. A way of seeing that is deeply based on game characteristics, since those are the ones we wish to imbue our work with. With this objective in mind, we went to the very core of game features: the four defining game traits – goal, rules, feedback system and voluntary participation. Features that reside in the very core of every game, to the point that an artifact that provides no answer to one or more of them cannot be a game. We proceeded to explain these characteristics individually, and attested the applicability of our approach by explaining each fundamental trait as seen in the context of both an art work and a video game. Following the description of the last trait, voluntary participation, we engage in a more in-depth analysis of how select artists have seen their public. We start with Duchamp's protest, trusting the audience to understand and give meaning to an otherwise meaningless object, follow on to Manciunas' role invertion, by making the audience entertain the artist, and opposed his view with Kaprow's, who merges the roles of the "artist" and the "viewer" by including everyone as a "participant". Finally, we clarify how Kaprow's ideas differ from Bourriaud's on his Relational Aesthetics; the art theory and view of participation we were mainly inspired by.

After the explanation of the two most important branches of our proposition – the game characteristics and the creation of social participation contexts – we proceeded to explain how both are integrated in our own installation, while also further explaining the most prominent references we drew from in the making of our work. And after this explanation, we moved on to explain the whole process of making our work. Starting in a very technical level, we described the creation and assembly of the physical, hardware and software components of the project. After that, we justified the appearance and functionality choices we made in order to make our project follow its initial objectives and propositions: how we applied what we learned in order to make our installation more engaging, in order to provide a more valuable social context. And finally, we attempted to evaluate our own work according to our own criteria: our game lens and our participation considerations. And according to that analysis, the project seemed to be a success: it accomplished the objectives it was set out to, and as such, so did we.

All the work that was made throughout the year that the dissertation and project took to finish was certainly our biggest undertaking so far, and as such it is quite satisfactory to see the positive results we were able to achieve. Providing meaningful, memorable socialization opportunities has been our main objective since we first started our artistic ventures, and video games being such an important part of our personal references, it was a very significant step to be able to analyze and integrate what we like the most about them and channelling it to our work – providing our own positive experiences to be experienced by other people. Still, we recognize and acknowledge the naiveté of our exploits: there are many other pressing affairs that should be addressed, affairs that are probably more legitimate and urgent than providing people with an opportunity to play. But to undermine our efforts would be to undermine the reasons why we make them, which are the wish to bring people together in a positive social context, to enable positive change. We would be very surprised if someone told us that *Balance* had changed their life – there is only so much we can expect to achieve in a one day exhibition – but we sincerely believe we made our exhibition's visitors life a little better by providing them with a context in which they could experiment something different and speak or play with someone new. In a TED conference, Jane McGonigal stated that studies show that we like people better after playing a game with them, even if we lose badly to them (McGonigal, 2010). And it is so precisely because of the levelling that voluntary participation provides for all players: every participant is set on an equal footing because they all abide to the same rules. One of the reasons why games bring people together is the large amount of trust needed from all players that all others will follow the same rules and pursue the same goals. This is what we mainly draw from McGonigal's (2011) book: that gaming has the ability to bring forth positive change by empowering people through togetherness, in order to provide solutions and sustainable growth.

During the making of this dissertation, we admit that the topic that most enthralled us was the possibility of using game theory in such a different way than its sterotype seems to enable. We admit to being contaminated by Jane McGonigal's optimist in the quest to legitimize the medium and its repercussions by chanelling its best outcomes to catalyse changes that we see as positive. But while our intentions are good, of course not every outcome of the integration of game theory in other aspects of life is necessarily positive. Tom Bissel comments directly on McGonigal's book by stating that "…*Reality Is Broken* makes the argument that games have become so enticing precisely because real life is so comparatively drab. Anyone who finds real life lacking when compared to video games has basically given up on life. (…) That is certainly sad. What it is not is any kind of a solution." (Bissell, 2011). Bissel is reacting to "gamification", of which he sees McGonigal as one of the most prominent proponents, but in our opinion gamification is only one possible outcome of what we understand McGonigal's message to be. Gamification is a catch-term that expresses the wish of making reality more like a video game by rewarding real life events with rewards typically associated with games, like virtual currency or experience points[78]. Jesse Schell (2010) in a conference at the DICE[79] summit in 2010 proposed that gamification is inexorably coming, and provides a myriad of possible hypothetical examples that range from receiving points for brushing teeth, to receiving points for showing tattoo ads, to receiving points from health insurance companies for walking more than a mile per day. Basically, to receive points by performing everyday tasks in such an addicted way that people would try to watch advertisements to earn specific brand points. Near the end of the talk Schell posits that the fact that all these records, all these score systems, will be permanently kept and available for future generations will intimidate people into bettering themselves: being more selective to the kind of products they consume, or watching their health habits more carefully. But he does seem to say that in an optimistic attempt to find some good in the dystopic reality he described. His final appeal is for game designers to embrace this oportunity: since in his opinion it's just a matter of time before mass gamification arrives, it might as well be led by game designers who know what they are doing.

The fact of the matter is that these ideas are a very long way from our own starting points. What we interpreted as a pure and perhaps naive attempt to bring people together through video games was interpreted by others in such perverted ways that game designer and critic Ian Bogost (Gamification is Bullshit, 2011) felt the need to coin the term "exploitationware" to fight what others are calling gamification: "I've suggested the term "exploitationware" as a more accurate name for gamification's true purpose (…). Exploitationware captures gamifiers' real intentions: a grifter's game, pursued to capitalize on a cultural moment, through services about which they have questionable expertise, to bring about results meant to last only long enough to pad their bank accounts before the next bullshit trend comes along." (Bogost, 2011).

There are several reasons for raising these questions in the end of our document. The first, is to make it clear that naive as our objective may be thought to be, it does not mean we see video games as a panacea for all the world's problems, or that we are oblivious to the fact that the integration of video games in other spheres of common life can also become perilous[80]: even in their classic form[81], video games are often very manipulative artifacts, hence the

[78] "Gamification, most basically, involves the constant, subtle incentivizing of everyday life, often in a digital or technological manner." (Bissell, 2011)

[79] DICE (Design, Innovate, Communicate, Entertain) is an annual summit led by the Academy of Interactive Arts & Sciences with the objective of discussing the state of the video game industry. (http://www.dicesummit.org/about/index.asp on 30/08/2012).

[80] Although simply integrating point systems in everyday tasks can hardly be seen as integrating video games at all.

[81] A regular console or computer game.

stereotype that they are inherently addictive and bad. As said right in this document's introduction, though, we don't think the issue lies with the choice of the medium, but on how it is used. In an already mentioned talk, Jonathan Blow (2010) speaks precisely on how manipulative games can be, and contrasts terribly devious and addiction-inducing game design practises to his own views on gaming: that players and their time should be respected, and not something to be taken advantage of. There is no reason why video games cannot provide quality and enriching experiences, and there is no rule that states that video games have to be fun, let alone be defined by it. And these last ideas guide us to the the second reason for these final questions and considerations. With this dissertation we feel like we closed a circle on the integration of game characteristics in digital contemporary art to foster participation. Not because we feel we have said everything there is to say about it, but because we believe we have established a base that is solid enough to enable other directions for future studies. As we said before, we were mainly captivated by the realisation that video game theory could be successfully applied to such diverse contexts, and conversely, how topics from the most diverse areas can be made into video games. From all the topics we approached, these realizations are the ones we feel the strongest about when considering possible future work. Although we interpreted the approached game theory in a very broad way, the reason for us to want to include it was a question of optimization – the ingredients that we can use in order to make participation more successful – but our studies opened our horizons towards other contents or utilities that video games can and in our opinion should strive to provide. We will certainly keep in mind our fundamental goal of providing meaningful experiences, preferably with social contexts that allow for sharing and interaction, but we now have a different, more clear understanding of those topics.

This is the point at which we conclude our dissertation and our document. We sincerely hope its reading has been fruitful, clear and pleasant.

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