Gaming as Performance: Sound as Conductor and Sound as Agent in Videogames: two case studies

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ABSTRACT

The inclusion of game elements in non-game systems provides great potential and challenges for artistic works. In this paper we study conceptual aspects of action to understand the relationship between player and game system. We study videogames as musical instruments for a performance approach admitting that the relationship between musician and instrument is close to the relationship between player and game system, from an operational point of view. This research aims at an understanding and to explore the potential and artistic challenges that emerge from this. Two case studies were created that explore two ways of playing, or performing with games as musical instruments. These were submitted to experimentation tests with musicians and non-musicians in order to provide us with feedback on the experience of playing them and on how players related with the game system, considering these aspects for future work.

ABSTRACT

Videogames;
Action;
Music;
Performance;
Instrument.

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1. INTRODUCTION

Games have been pervasive in several other areas with different objectives, music being one of those. Music is present in all levels of society and accompanies our daily life in a very close and constant way. There is a common feature to games and music: a similar relationship between actor and system, i.e. the relationship between musician and instrument is consistent with the relationship between player and game system. With this in mind, this paper is centred on the affinities between playing a video game and playing a musical instrument. We intend to reuse very particular components of videogames to create an audio-visual instrument that enables artistic expression. On the first part of this paper, we focus on the concept of game and non-game; on a second moment, on the relationship between action, player and game system; and then on videogames as musical instruments in a performance context. At the end, we describe two case studies of prototypes of game-instruments we created: *Instrumental Space Invaders* and *Pac-Music*, the former using sound as a controller and the latter exploring game elements to generate music in real time.

2. GAME AND NON-GAME

David Parlett (1999) states that the word *game* is used for so many different activities that it may be pointless to insist on any particular definition. Although it is a term that refers to a wide variety of perspectives. He distinguishes between *game* and *play*, designating a game and a child's play as *formal* and *informal* games respectively. An informal game refers to an activity that is not directed by rules, that lacks a fixed structure, whereas a formal game takes on a double structure with rules and goals, where the rules define a way to attain goals. Thus, for a game to be formal the player needs to comply with a set of rules and procedures previously determined to produce a winning situation. Katie Salen and Eric Zimmerman (2003) also report that a formalized set of rules and a competition to win take the form of a game. Clark C. Abt (1987) proposes a definition of game that adds new components: an activity where players take an active and decisive role, an achievement of goals and rules that govern the game. Salen and Zimmerman (2003) also refer to interaction as a way by which rules are manipulated to achieve objectives. Johann Huizinga (1955) indicates that a game is a free activity that absorbs the player intensely and no profit can be obtained by it. A game progresses resorting to fixed rules within its own limits of time and space. With a similar perspective, Roger Caillois (1961) states that playing a game is a free activity, isolated, defined, uncertain, unproductive and unreal. Many authors refer to the rules of the game as essential to define the game it-

self, with Jesper Juul (2003) stating that the rules of a game add meaning and allow actions to happen. Elliott M. Avedon and Brian Sutton-Smith (1971) consider a game to be an exercise of voluntary control systems, where there is a power struggle confined by rules to produce an unbalanced outcome. With this in mind, Salen and Zimmerman offer a game definition that combines most of the elements already mentioned: "A game is a system in which players engage in artificial conflict, defined by rules, that results in a quantifiable outcome" (2003, 80). And Juul brings together six game features in a clear and concise definition: "A game is a rule-based formal system with a variable and quantifiable outcome, where different outcomes are assigned different values, the player exerts effort in order to influence the outcome, the player feels attached to the outcome, and the consequences of the activity are optional and negotiable." (2003)

But are these the only ways to define a game? If Parlett (1999) indicates that the game is a word that assumes diverse typologies, is it possible for a game without rules to be denominated as such? Can a game not be confined to rules and goals and still be considered a game? We are not calling into question the grounds of these authors, but if a game that does not worry about rules nor objectives, can it still be considered to be a game? It is in this way that the term *non-game* arises, contradicting some considerations previously defended.

Non-games don't necessarily have a goal or rule-based structure. Dave Szulborski (2008) states that most games we know possess elements that can be divided into four basic categories: 1) a set of defined rules; 2) a set of elements through which the game is conducted; 3) a set of winning or loss scenarios that define the end of the game; and 4) a set of goals for the players. Non-games, which the author prefers to designate as *alternative reality games*, do not feature some of these elements and therefore do not look like games. But, Szulborski also states that this does not mean that non-games cannot be successful and enjoyable experiences. In fact, in our perspective, non-games can be a way of expression in performance and in other arts, as considered by Michaël Samyn (2010) who tells us that non-games are an artistic and a design challenge. He describes them as an activity that provides a virtual experience that allows us to travel to other worlds when our bodies merge with the system, without a competitive factor hindering that experience.

In *Surround* (1977) each player controls a constantly moving wall, and the goal is to trap and force the opponent to crash into a wall. In addition, there is a video graffiti mode which allows players to draw on the screen, being an example of a non-game.

Fig. 1
Surround's video graffiti mode (1977)

In *Alien Garden* (1982), the game world is covered by 24 different types of crystalline flowers that alter their behaviour as the player controls an embryonic life-form while it grows, survives and reproduces through 20 generations. It is considered to be a non-game because it is a videogame based on experimentation without a structured challenge, a set of rules, nor goals.

Fig. 2
Alien Garden (1982)

Moondust (1983) is an experimental game that fuses a complex control mechanic with a musical score generated by the player's movement, the goal is to cover the bullseye at the centre of the

screen with *moonjuice*. It can also be considered a non-game because it is an experimental videogame where the player can play freely without rules and goals, worrying only about the visual and sound results.

Fig. 3
Moondust (1983)

Biophilia (2011) is a musical project and album of the singer Björk. It includes an application with generative music videogames. These focus on the generated sound and can be considered non-games because each is centred on exploration of the game space, on which the player is able to explore the game world by interacting with game elements that promote the creation of musical patterns, roaming without worrying about game goals.
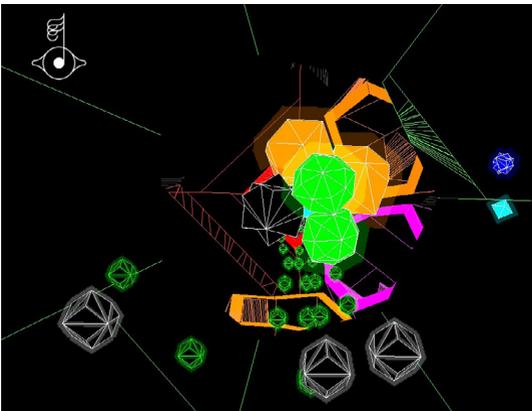
Fig. 4
Crystalline (2011) from the album *Biophilia* (Björk 2011)

Initially, *Minecraft* (2009) was an exploration non-game, that could be used as a creative tool, allowing the player to create constructions by stacking blocks. Currently this videogame has become a more conventional game with game objectives.

Fig. 5
Minecraft (2009)

Games and *non-games* are different, but they have elements in common. Jesse Schell (2008) proposes a way of organizing the basic elements of games into four categories – The Elemental Tetrad –, as a way to balance all parts of a game in order to create a satisfying experience: mechanics, story, aesthetics and technology. *Mechanics* consist of the procedures and rules that structure the game. *Story* is the sequence of events that unfold throughout the game. *Aesthetics* relates with the players' experience. And *technology* refers to the materials and interactions that make the game possible. Some elements are more visible than others, while others are not present at all times, such as *story* – as evidenced in *Pong* (1972), *Asteroids* (1979), *Pac-Man* (1980), *Tetris* (1985), *Flappy Bird* (2013), *2048* (2014), etc.. However, all of these elements contribute to the overall experience of games and non-games alike.

3. ACTION, PLAYER AND GAME SYSTEM

In early videogames, graphical capabilities consisted mainly of two-dimensional figures without visual effects due to the technical limitations of computers. Priority was focused on gameplay (Rollings and Adams 2003, 292).

"Even in contemporary videogames, image is constantly sacrificed in favour of action – despite the increasingly mesmerizing graphical capabilities displayed by contemporary game-dedicated hardware, with all visual resources having to be strictly, optimized to favour its performance" (Cardoso 2016, 56).

The player can imagine the visual details, but it is imperative for action to be conveyed (Wolf 2001, 30). Without action, a videogame becomes passive entertainment, since the main prerogative of a game is to be playable. With this in mind, players are required to act in order to influence the game world in several ways. Thus, they participate actively in the game's events instead of being mere spectators (Cardoso 2016, 56). "Action is then the means by

which the player is able to alter game states" (Bjork and Holopainen 2005, 20). Players thus assume an active role in the game system, but they are not the only ones able to change the state of the game. Alexander Galloway (2006) states that when players move their hands and their eyes, the machine also acts in response to those actions, distinguishing *machine actions* (those performed by the software and the hardware) from *operator actions* (those performed by the player). Therefore, the experience of the game arises when both the machine and the operator work together, changing and/or maintaining game states (Cardoso 2016).

With this in mind, it was possible for us to explore various behaviours in the relationship between the player and the game system, something that was fundamental for the creation of the two prototypes we present next, which are focused on exploring notions of musical performance.

4. GAMES AS INSTRUMENTS AND PLAYING THEM AS PERFORMANCE

Playing in 7D: Considerations for a study of a musical instrumentality in the gameplay of videogames (Cardoso and Carvalhais 2014) proposed that the relation between player and system is similar to that of a musician and his instrument, without stating that games are equivalent to musical instruments, but that their relationship is similar from an operational point of view, a perspective in which "an instrument is seen as an artefact that it is used to produce or to perform something". With that into consideration, we suggested a notion of "instrumentality" applied to videogames and characterized by *dialectical ability, freedom of expression* and *actors*.

Dialectical ability refers to the fact that the player and the game system act in opposition to each other, e.g. when the player is constantly challenged by the presence of enemies who populate the game world. Crawford (1984) calls it "a *conflict* that arises naturally from interaction with the game where the player pursues some goal", stating that conflict can only be avoided by eliminating the active response to the player's actions and that there is no interaction without this active response. Therefore, to eliminate the conflict of a game is to destroy it, because conflict is an intrinsic element to games, despite the many forms it may take. However, some contemporary videogames do not have win or lose conditions, because the focus is on the experience itself, on the narrative, etc. Notwithstanding, the dialectical ability is still present as a force opposite to that of the players' as they struggle to change the course of events and consequently their experience. "This is a type of conflict that the game system constantly presents to the player, through various means and nuances." (Cardoso and Carvalhais 2014)

Freedom of expression is a term that refers to games that allow players to manipulate diverse the elements in the game and to reconfiguring its structure, instead of just following a predetermined path or set of predetermined paths.

Finally, with *actors* we refer to the entities that have the capability to act in the game world. They can influence the course of events and change the game states. Anything that is capable of acting in a game is considered to be an actor, be it a character, an enemy, a power-up, etc. From this perspective, the player and the game system are also actors, albeit with some differences. The game system is an actor because its components operate in a network that contributes to the game's execution. The player, if human, can also be seen as a set of simpler actors who act together, allowing the player to receive and process information, e.g. with the eyes, ears, and all elements of the body that allow the player to process information and express himself physically.

Having this established, we need now to understand the relationship between performance and videogames. According to Richard Schechner (2003) there are five basic qualities of performance that are featured in videogames as well: 1) a special ordering in time; 2) a special value attached to objects; 3) a lack of productivity in terms of goods; and 4) a set of rules and spaces of action.

Let's compare these basic qualities between performance and videogames and understand how they relate with each other – the following table is based on this definition.

Table 1
Basic qualities of performance and videogames, adapted from Schechner (2003)

BASIC QUALITIES	PERFORMANCE	VIDEOGAMES
Time	Time can be determined according to a series of steps to be completed. It can also be designated specifically when there is something predetermined, or symbolic when the activity is represented by another period of time.	Time in a game can be reflected in two ways: *play time* when we refer to the time the player takes to play, and the *event time* when we refer to the time of the game world itself (Juul 2004).
Objects	In performance, objects don't acquire the same value as they do in real life.	In videogames, the value of an object is also only related to the value it has in the game (Fernández-Vara 2009).
Non-Productivity	Performance does not produce goods or monetary value, unless someone pays to witness the someone's performance.	Several authors define games as non-productive like Huizinga (1955) and Caillois (1961), however, in the same way, some games can challenge this, e.g. serious games.
Rules	A performance is a rule-oriented activity, in which said rules specify its course.	A videogame is also guided by rules that define the final result and regulate the functioning of the game, despite of how strange and even apparently absent as they may be, such as those found in in non-games.
Performance Spaces	A performance is a shared, regulated activity and experience that happens within a particular space.	In videogames, the separation between game space (where the game occurs) and player space (where the player is actually located and acts/ performs) is also not clear, as these spaces often overlap (Cardoso 2016).

Through this comparison, we can say that videogames can also be analysed as performance, as they seem to be somehow closely related. It was having this in consideration that we have developed two prototypes presented in the following sections.

5. INSTRUMENTAL SPACE INVADERS: SOUND AS CONDUCTOR

This prototype, called *Instrumental Space Invaders*, is an adaptation of *Space Invaders* (1987), in which the player controls the avatar by means of sound, i.e. by playing a musical instrument as a game controller. It functions as a musical structure to improvise or to explore an instrument that arises from the actions of the video game.

Fig.6
Instrumental Space Invaders

The algorithm employed in this prototype is able to analyse a particular sound and relate it with certain mechanics in the game. I.e. it determines what should be performed on the musical instrument so that the system can respond: each action on the instrument triggers an action in the game. Ascending musical notes move the avatar to the right and descending musical notes move the avatar to the left. Perfect octave intervals[4] allow it to move upwards and the absence of sound allows it to descend. The player can fire when playing a variation of notes within a range of values that represent the height of the sounds.

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[4] The interval between one musical pitch and another with double its frequency.

The system supports a range of sound emitters, even the human voice. The simple mechanics that we have implemented allow the player to have a certain *freedom of expression* in accordance with the rules of the game, i.e. the user can improvise without rules and can combine musical dynamics to fulfil some goals of the game.

Here, sound acts as a conductor, as that is the only way to control the player's avatar, i.e. the way to change game states is by emitting sound to conduct the actors in the game. Although the player is free to combine different sounds and even different timbres (giving voice use, for example), the game only changes when it recognizes the musical patterns executed by the instrument, responding accordingly. In this way, in a performance setting, the audience can perceive and relate what happens in the game system with what they see from the musician and hear from the instrument. The audience is even able to predict particular actions the player will have to enact to achieve certain goals.

6. PAC-MUSIC: SOUND AS AGENT

Pac-Music is an adaptation of *Pac-Man* (1980), capable of generating music in real time. The player explores the space and the game elements to manipulate an already determined sequence of notes. The space of the video game consists of a maze divided into four equal parts with white and pink dots for the playable character to eat. There is a two-note sequence at the beginning of the game (a perfect fifth),[5] and when the avatar eats a pink dot, the system generates a random note on the natural minor scale.[6] Each quadrant corresponds to a harmonic transposition.[7] In addition, we have implemented the intensity of the attack of each random note, which allows the player to obtain a melodic interpretation, because the intensity of the notes tends to lower gradually as the player is inactive – that is, without eating a pink dot.

[5] A perfect fifth is a musical interval that corresponds to the distance between two musical notes with a frequency ratio of 3:2, or very nearly so.

[6] A natural minor scale consists of a sequence of determined musical intervals.

[7] A harmonic transposition means a change of pitch; in music, the pitch of a note corresponds to how high or how low the note is.
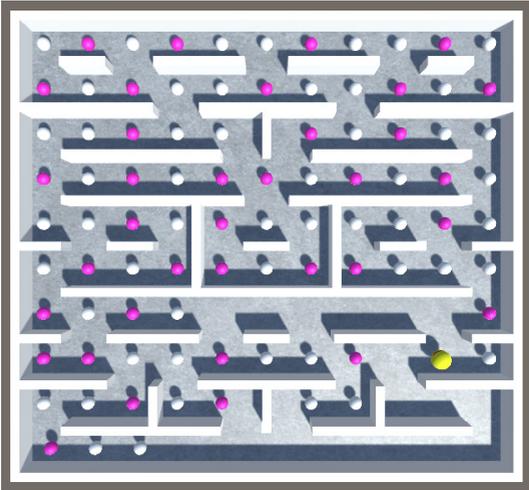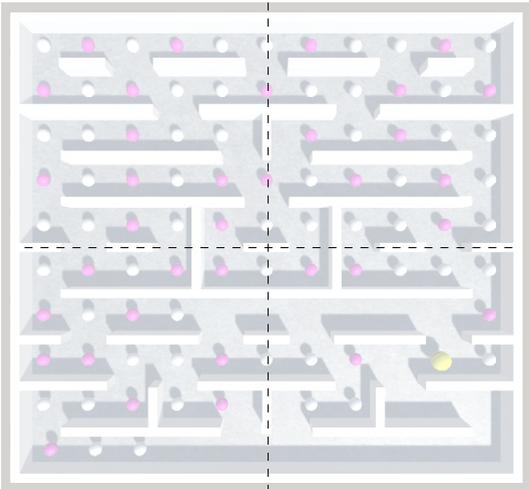
Fig.7
Pac-Music

Fig.8
The Quadrants in *Pac-Music*.

Sound agents are represented by the visual elements of the videogame that exist to change the initial sequence of notes that the player and the audience hear. For example, pink dots exist to produce a sound in a specific quadrant. Normally, in videogames the visual elements are the centre of attention, but here the auditory environment becomes the main focus due to the sonorous events that change several times according to the actions of the player.

During experimental tests, we have observed that the players were surprised by the different sound events that were appearing during the course of the game. After they understood the game's basic dynamics, their intentions were already premeditated to influence the sound.

In a performance setting, the concept of this videogame can be used to generate music, compose and mix in real time with other harmonies that can complement one another. Experimental music can be an interesting branch of music to apply this concept to, since it defies conventional conceptions of musical composition. Another very interesting aspect of this concept is the possibility that non-musicians can create music without previous knowledge or musical education, since the system generates random music within defined parameters, so that all actions can generate sounds that, in tune, form a harmony.

7. CONCLUSIONS AND FUTURE WORK

The main premise of this project was the research of conceptual elements that can give rise to a structured and organized system centred in the action and the development of an artistic performance. This work demonstrated the possibility of creating and applying two projects that act in the convergence of playing a videogame and of playing a musical instrument. Both projects revealed to be successful experiences and demonstrated potential for further research.

After some tests, we have conclude that videogames can function as music-producing artefacts; they can be both an instrument and a game. We can say that playing a videogame and playing a musical instrument are activities that share a particular set of traits from an operational point of view (artefact-operator) despite their differences.

We have observed the behaviour of the players in the two prototypes and we had an open discussion about their lived experience that revealed some considerations about future work, such as applying these concepts in the area of pedagogy and musical composition as a game system that works like sheet music for various instruments and a game to study musical education.

Many variations can be considered for these prototypes, e.g. in *Instrumental Space Invaders* it may be interesting to add recognition of diverse levels of sound intensity so that the player is able to manipulate the system also with musical dynamics; or creating a multiplayer game so players are able to articulate two musical instruments and play together, or even a videogame for a string quartet.

In *Pac-Music* the addition of new game elements that alter or allow the creation of new musical transformations may also be interesting, as well as the inclusion of other elements that increase conflict in gameplay, e.g. enemies, obstacles, etc.

Variations on any of these two prototypes are able to include new and different game goals, rules, gameplay from where very interesting

musical actions and behaviours are reflected or emerge.

Having accomplished this short study, we are able to recognise four major different areas where these games may focus: entertainment, music composition, pedagogy, and artistic performance. By considering these, the breadth of possibilities is extensive, where videogames promote new means of musical expression.

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