Explorations on Action Depth in Video Games

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Abstract

In video games, human interactants and computational systems may act and interact at different depths of the game system's structure, traversing the narrative and influencing it through the generation of new structures or the reconfiguration of previously existing ones. This paper focuses on these different depths, proposing an overview on the behavior of the subjects of their actions (actors). It explores the players' actions regarding the functions that they are developing at different depths of the game system's structure when dealing with the actors and their different behaviors. It relates with the work of Marie-Laure Ryan regarding the "layers of interactivity" (2011) with the aesthetics, dynamics, and mechanics layers presented by the MDA framework (Hunicke *et al*., 2004; LeBlanc, 2005), and concepts from cybertext (Aarseth, 1997).

Keywords: Action, Actors, Depth, Structure, Video games.

Introduction

Playing a video game is a cybernetic activity that involves the game system and its human players. Their actions may project consequences into specific layers that constitute various depths of the game system's structure, influencing the course of events and even altering the initial possibilities presented by the game itself.

This work is focused on the exploration of the abilities to induce structural changes in the game that are granted to the interactants when they dive deep into its structure. We are connecting the works of Marie-Laure Ryan (2011), Stephen Wolfram (2002), Robin Hunicke (2004) and Marc Leblanc (2005), and Espen Aarseth (1997), in order to establish an initial theory applied to video games, aimed at the exploration of structural changes that interactants may originate in the game when interacting with the game system.

1. Actors

A game's state changes according to actions developed by the game system and its interactants. Their actions are manifested through a variety of elements that are both their

vehicles and targets: avatars, objects, vehicles, weapons, power-ups, etc.. We may call these elements *actors,* since their behavior is driven by the actions of human interactants and/or of the system. Actors' activities may affect other actors, and the effect they have on each other is what determines the course of events and shapes the game. Actors may assume different behaviors and can be manipulated in different ways by the interactants. We can divide them into four classes according their behaviors and goals.

1.1 Class 1: uniform behaviors or goals

Objects that serve as floor or walls, architecture or certain parts of the scenery, for example, may be considered class 1 actors. Although these seem static and part of the spatial configuration of the game, they serve to constrain other actors in a defined space. So, one may argue that as long as they have an effect on the behavior of other actors, as their properties interfere with them, they are actors. According to Alexander Galloway, "non actionable objects are inert scenery." (2006: 24) Here the word 'scenery' is meant for objects that do not exert influence on others and this is not the case.

The actions of class 1 actors are not related to the achievement of goals. They *do not have embedded goals*. They have a *uniform, deterministic* and *predictable behavior*, and may occasionally be *controlled or activated by other actors*. We may think about 'power-ups' and 'power-downs', such as the 'speed boosters' found in *Wipeout* (1995) or the mushroom and the flower power-ups in *Super Mario Bros*. (1985), as class 1 actors. We may also find them as weapons and equipment or as movable objects around the set, for example, such as the giant blocks of stone that the player has to move in *God of War* (2005), or even the asteroids in the eponymous game (1979), or the blocks in *Tetris* (1985) and *Arkanoid* (1986).

They may also be combined with other class 1 actors in order to create alternative behaviors and effects or to be bound together into a single actor. For example, in *Deus Ex: Human Revolution* (2011) the player can customize their weapons, adding extra features by attaching a silencer to shoot silently, or a laser aiming device to improve the targeting, etc..

1.2 Class 2: periodic, nested patterns of behavior

This class refers to actors that *may have simple, unique and specific goals*, although *they are unable to devise strategies to achieve them*. They act according to simple nested patterns of behavior that can be perceivable according to the time that their cycle takes to restart. Usually the player has to understand these patterns—sometimes by trial and error—in order to interact

with them. In *Metal Gear Solid* (1998), in order to traverse unnoticed several areas of the game, the player has to learn the behavior patterns of patrol guards, surveillance cameras, etc., observing their movements, their courses, their actions. In this moment they are in a state in which they may be considered class 2 actors. If the player is discovered, the patrol guards' behavior may however change to a more complex class.

This class may be also frequently found in common enemies in other games such as *Pac-Man* (1980), *Donkey Kong* (1981), *Manic Miner* (1983), *Super Mario Bros*. (1985), *Alex Kidd in Miracle World* (1986) and *R-Type* (1987) in which many opponents move in a mechanical fashion, mostly in patterns with short-term cycles[1]. In *R-type*, when a group of them appear on screen they even seem to be synchronously dancing. But this class may be also present in some bosses in games like *Streets of Rage* (1991) and *Dead Space* (2008). Here they do not necessarily resort to that kind of mechanical movement, but to a predetermined sequenced set of actions that runs in loop. In both cases, the player has to learn and memorize their behavior in order to defeat them.

1.3 Class 3: confusing behaviors, random outcomes

Class 3 actors' output may present random or pseudo-random results. Although their behavior is somehow unpredictable and not necessarily 'fair'[2], they are usually accepted by the players as one of the characteristics of the game, as being part of the challenge it represents. The player cannot base her actions on these actors' behaviors because they are rather intricate. She can only try to make sense of some structured patterns that may eventually emerge. As an example, we may find this class in the 'mystery blocks' on *Super Mario Kart* (1993)—the ones with the question mark on—that randomly (or seemingly randomly) choose and give the players that hover them one of the available power-ups/items. Another example may be found in the random enemy encounters[3] used in Role Playing Games such as *Final Fantasy VII* (1997) or *Dragon Quest VIII* (2005), with roots all the way back to Dungeons & Dragons dice-throws to determine the behaviors or skills of opponents or to affect the effectiveness of attack and defense of non-playable and playable characters, which is something that was also adapted to the aforementioned games.

1.4 Class 4: gnarly behaviors

The original meaning of "gnarl" was simply "a knot in the wood of a tree." In California surfer slang, "gnarly" came to be used to describe complicated, rapidly changing surf

conditions. And then, by extension, something gnarly came to be anything with surprisingly intricate detail. (Rucker, 2005: 112-113)

This class encompasses all the actors that are able to make a variety of decisions and to plan various strategies to accomplish their objectives. They also have the ability to negotiate, to ponder and to evaluate between several goals. It is important to note that these actors have a structured but not necessarily deterministic behavior, which may even become somewhat unpredictable due to the complexity of their behavioral structure. This class may be used to simulate humans, as in the case of the numerous guards found in *Farcry 2* (2008) that resort a complex artificial intelligence engine, although they are not class 4 actors all the time. "In every case, the gnarly zone is to be found at the interface between order and disorder." (Rucker, 2005: 116)

Some class 4 actors may be directly controlled by the interactants, thus serving as their embodiments in the game. Consequently, they may be seen as avatars, benefiting from the intellectual and physical abilities of the players that control them. They allow the player to have a role as an actor in the game. When this is true, any action that is not conveyed by the player is usually purely aesthetic.

2. Depth Levels

These levels were divided concerning the layers presented in the MDA framework (Hunicke *et al*., 2004; LeBlanc, 2005), the corresponding positions of human-machine collaboration (Aarseth, 1997), and the position that players may assume in each of these three levels.

DEPTH LEVELS	POSITION IN THE MDA FRAMEWORK	COLLABORATION POSITION	PLAYERS' POSITION
1	Aesthetics	Post-processing	Observer
2	Dynamics	Co-processing	Interactor
3	Mechanics	Pre-processing	Designer

Table 1. Depth levels and their characteristics according to the MDA framework, the human-machine collaboration position, and the players' position.

From the players' point of view, **level 1** this is the *surface layer*. It consists in a non-interactive moment, positioning the player in the role of *observer*. She is not exerting any action other than observing, listening, or sensing somehow the system. This level is therefore related to

a phase of contemplation and inspection of the game's *aesthetics*, in a stage at which *information has already been processed* by the system. At **level 2** the player and the system establish an effective communication feedback loop, *co-processing* data, operating in tandem with the system. The player assumes the role of *interactor*. **Level 3** is aligned with the *mechanics* of the game and with a *pre-processing* stage of data. This is the point where the *actors* are designed or programmed and created, and where the player may assume the role of *designer*. Changes applied here affect all the other layers.

But this model cannot be applied lightly. According to the type of game, the player may develop different ways of experiencing and playing it as well as alternative perspectives on how to influence it. So, when the player performs an action she is also developing a function, and this is why we need to cross these levels with the player functions.

3. Player Functions

In *Cybertext* (1997) Espen Aarseth defines the mechanical characteristics of a text by presenting concepts as *scriptons* (sequences of signs as they appear to the reader), *textons* (sequences of signs as they exist in the text), and the *traversal functions* (the mechanisms through which *scriptons* and *textons* are presented to the user). The way these elements behave and are structured in a text originate different types of cybertext. Aarseth presents seven dimensions in his analytical model, of which the *user functions* are of our interest. In the omnipresent *interpretative* function a user is only concerned with the meaning of the text; in the *explorative* function the user decides which paths to take along the traversal; in the *configurative* function they choose or create the *scriptons*; while in the *textonic* function they may permanently add *textons* and traversal functions to the text. Although "textonic" is a term adequate to textual artifacts, we prefer the term *structural* (Carvalhais, 2010; Carvalhais, 2011) that points to the manipulation provided by this function in an artifact that is not solely constituted by text but rather by a variety of media.

The concept of *user function* seems at first to be rather close to what we have been describing as *depth levels*. So much so that, when crossing them, we arrive to interesting results and considerations. If we consider the player and the user as the same, we may cross the data and establish at which depth their actions may reverberate.

On the other hand, in a theory more influenced by narratology, we have also found that Marie-Laure Ryan's *layers of interactivity* (2011) applied to digital narrative texts reflect close

considerations on the subject at hand. She presents four levels of interactivity regarding the way it allows to shape the story of the text. She defines the first level as "peripheral interactivity": "Here the story is framed by an interactive interface, but this interactivity affects neither the story itself, nor the order of its presentation." (2011) The second level is defined as "interactivity affecting narrative discourse and the presentation of the story": "On this level, the materials that constitute the story are still fully predetermined, but thanks to the text's interactive mechanisms, their presentation to the user is highly variable." She defines the third level as "interactivity creating variations in a partly pre-defined story". Here she affirms that this type of interactivity is typical of computer games (although we believe that it is not the only type). Here the interactant is granted "some freedom of action, but the purpose of the user's agency is to progress along a fixed storyline, and the system remains in firm control of the narrative trajectory." Level four concerns "real time story generation", "stories are not pre-determined, but rather, generated on the fly out of data that comes in part from the system, and in part from the user."

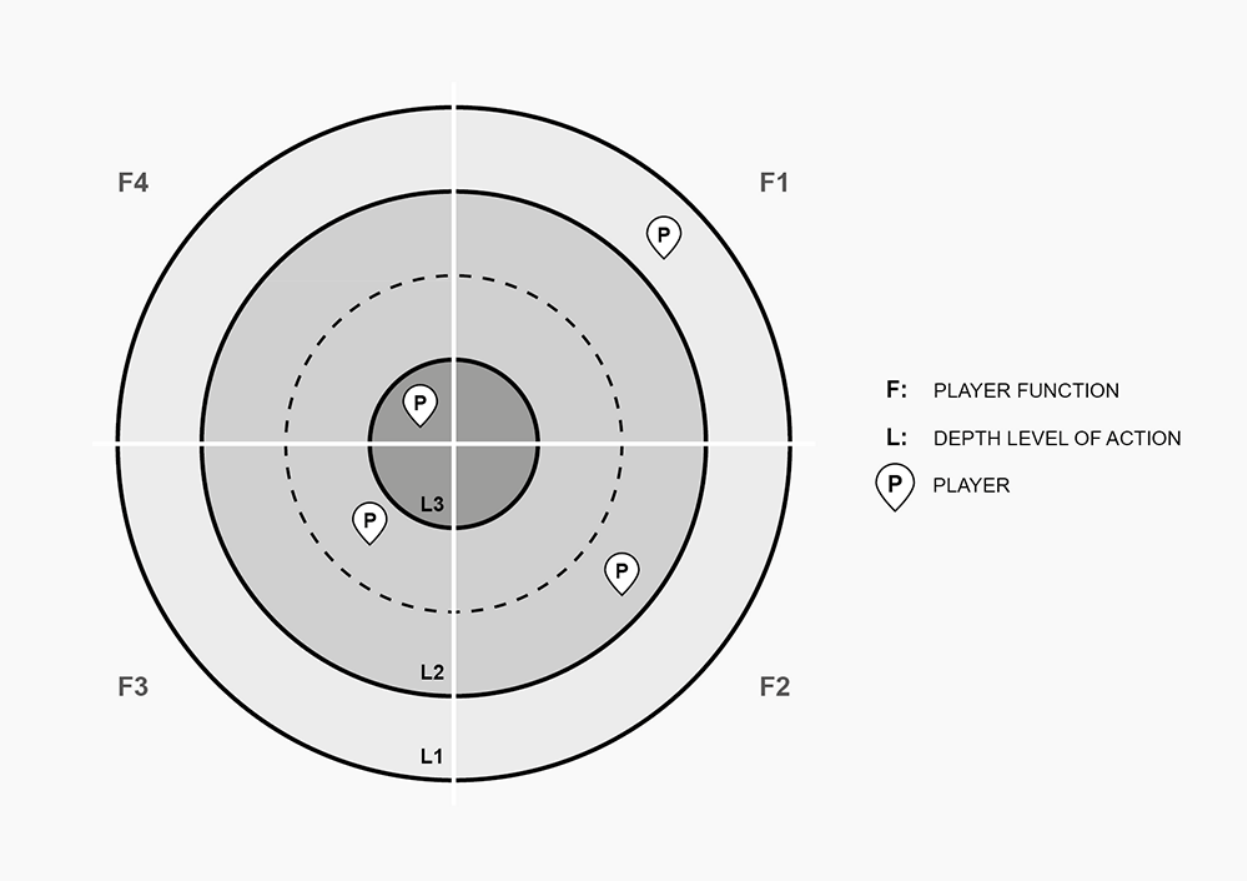
Due to the proximity of these four levels of interactivity or user participation in digital narrative texts with our perspective of the depth in player action and the function she develops in each level, we have also crossed this model with Aarseth's data. Although there is not a direct correlation between these last two perspectives, they allowed us to achieve the following preliminary conclusions, regarding the functions that a player may develop while playing a game.

DEPTH LEVELS	**PLAYER FUNCTIONS**	**LAYERS OF INTERACTIVITY**	**USER FUNCTIONS**
L1	Function 1: Learning the Rules, Learning Actors' Behaviors	Level 1: Peripheral Interactivity	Interpretative
L1, L2	Function 2: Following the Rules, Exploring Actors' Behaviors	Level 2: Interactivity affecting narrative discourse and the presentation of the story	Explorative
L1, L2	Function 3: Molding the Rules, Configuring Actors' Behaviors	Level 3: Interactivity creating variations in a partly pre-defined story	Configurative
L1, L2, L3	Function 4: Changing the Rules, Adding New Actors and New Behaviors	Level 4: Real time story generation	Textonic

Table 2. Depth Levels, Player Functions, Marie-Laure Ryan's Layers of Interactivity, and Aarseth's User Functions.

Here the changes that are made at the inner level affect the outer levels. So, if we change something in the level 3, those modifications will cause changes in level 2 and those will

reverberate to level 1. But changes in level 2, for example, will only affect level 1 and not level 3. Such as Hunicke and LeBlanc suggest that the aesthetics emerge from dynamics and these emerge from mechanics, but not the reverse.



Picture 1. Player position in the game system's depth according to the functions being developed.

3.1 Function 1: Learning the Rules, Learning Actors' Behaviors

While developing function 1, the player is only concerned with watching, listening, sensing, on interpreting the game. This moment is essential for the player to interpret the meaning of the actors' activities, that not only provide the ambience of the game but also may interact directly with her. It is based on the information collected and deduced from these moments that she will act and react afterwards. One may say that this is the first function that the player exerts when encountering the game world and the first phase of learning it. The player must observe and interpret the game world to be able to meaningfully act on it. In fact, that learning process is developed through an iteration of observation and experimentation, interpretation and correction

activities. Consequently, function 2 (which is described next) also plays an essential role in this process.

Function 1 is a crucial function that the player must constantly develop. It is essential that the player understands the game, and is able to make sense of what she is facing or interacting with, so she must always be willing to learn it, to learn the behaviors of the actors that are present in it. So, this function is about making sense of the game world. We call this the surface level due to the fact that this is the way the players have to sense the game world. It is a function exclusively developed in the first level that the player encounters when she starts playing.

It is also through this function that the player feels changes in the system that may be caused by the actions of other actors that are controlled by the system itself or other players, or even by her own actions when she develops the functions described next.

3.2 Function 2: Following the Rules, Exploring Actors' Behaviors

Here the player's actions dive deeper into the game's structure, all the way to level 2, where she and the system arrive to a co-processing state. The player that is developing the function 2 is more active than the one in the previous function and is able to send information to the system, by choosing her actions from within a predetermined set. This moment happens when she decides or is prompted to make decisions in the game. These decisions result in alternative paths that she may travel while gaming, she gains the freedom of exploring alternative predefined options but is not able to modify the structure of the system (game) itself.

3.3 Function 3: Molding the Rules, Configuring Actors' Behaviors

The actions of a player developing the function 3 penetrate a little bit deeper into level 2, but still remain in it. The player becomes a bit closer to the core (level 3), but she is not there yet. Here she is concerned and trying to master the actors' behavior and to constrain their actions to serve her will, for example. At a more superficial level, she may be trying to reconfigure some spatial arrangement in order to tame those actors, thus, forcing them to act in a certain manner, inducing certain behaviors. An example is found in *Lemmings* (1991) when the player makes a lemming drill the ground to redirect the others; and in *From Dust* (2011) when the player induces geographic and physical changes in the game world trying to tame matter such as water, lava, and sand, in order to save a nomadic tribe.

At a deeper level, the player is granted the abilities to generate actors from within a predetermined set of constitutive elements and to add them to the game. Depending on the

complexity and variety of this set, the player may generate new and previously unforeseen actors with also unforeseen and even unpredictable behaviors, as we may find in *Spore* (2008). Eventually, she may also be able to eliminate actors by disassembling them into a series of their constitutive elements.

3.4 Function 4: Changing the Rules, Adding New Actors and New Behaviors

The player that is developing function 4 is looking to change the rules, to truly add new actors and behaviors to game. While developing this function the player dives truly deep into the structure of the game system in order to change its core. We believe that this is the moment where there is a fundamental shift of positions and the interactant stops acting as a traditional player to start acting as a designer (in Hunicke's terms). She starts to alter or create the very essence of the game, defining truly new and initially 'unprogrammed' rules. Instead of merely acting within the constraints defined by the original set of rules, she expands or breaks the initial field of possibilities. We may say that the making of a mod[4] is an activity that consists in this function (such as creating a game from scratch).

This is usually the entry point of the game designer, opposed to the entry point of the player, which is in the level 1 (aesthetics) as suggested by the MDA framework.

4. Questions and Future Work

In this preliminary theory (still in an exploratory state) we propose four classes of actors (elements through which action is developed and conveyed), determine three levels for the structure of a game, and cross those with four player functions in order to explore the structural depths that the actions of the player may reach in a video game.

Up until now, we have thought that actions with the function 4 only happen in an exogame system situation, that it was something that was beyond the game itself. But one question has arisen from this research: Can an interactant develop this function while playing a video game, while actually being a player? Can the game system allow such openness to the player, permitting her to truly transform it at its core? Can a video game permit changes in its mechanics and still be playable? And can that still be an act of play?

In order to provide answers to these questions we are now developing an initial game prototype that aims at allowing the player sufficient access to its structure while playing it, and changing it at its core. Thus, we hope to be able to answer these questions by direct observation

and direct gaming experience, and by gathering the opinions of third parties. But further study and development is still needed in the development of this prototype.

Besides the previously outlined questions, another has also emerged from this study that we also find particularly pertinent for a parallel study: If the player progressively dives deeper in the structure of the game, finding herself closer and closer to the position of the designer, how can the designer emerge as well through the layers reaching the moment in which she arrives to the position of the player? This is a question unveiled by this work that may be pointing to a similar study aimed at the designer's point of view, in order to try to figure out what could be the designer functions. Yet another question unveiled is the possibility of a similar study in order to discover the game system's functions.

Endnotes

1- One can speculate on how these mechanical elements have roots in the other mechanical elements from pinball games, that have been listed as one of the roots of computer games (Kent, 2001).

2- The term "fair" is used here to illustrate a situation in which players can be randomly rewarded or penalized, disregarding their effort and success, as it frequently happens in games of chance.

3- A random encounter is a feature that is used in some Role Playing Games consisting in encountering enemies at random (or at seemingly random rates) while traversing perilous areas.

4- A mod is a modification made to a video game in order to create new content to the original game, or even to make a whole new game. Mods usually need the original release in order to run.

Cited Works

Alex Kidd in Miracle World, Sega, 1986.

Arkanoid, Taito, 1986.

Asteroids, Atari Inc, 1979.

Dead Space, EA Redwood Shores, 2008.

Deus Ex: Human Revolution, Eidos Montreal, 2011.

Donkey Kong, Nintendo, Shigeru Miyamoto, 1981

Dragon Quest VIII, Level-5, 2005.

Farcry 2, Ubisoft Montreal, 2008.

Final Fantasy VII, Square, 1997.

From Dust, Ubisoft Montpellier, 2011.

God of War, SCE Studios Santa Monica, 2005.

Lemmings, DMA Design, 1991.

Manic Miner, Matthew Smith, 1983.

Metal Gear Solid, Konami Computer Entertainment Japan, 1998.

Pac-Man, Namco, Tōru Iwatani, 1980.

R-Type, Irem, 1987.

Spore, Maxis, 2008.

Streets of Rage, Sega, MNM Software, 1991.

Super Mario Bros., Nintendo Creative Department, 1985.

Super Mario Kart, Nintendo EAD, 1993.

Tetris, Alexey Pajitnov, 1984.

Wipeout, Psygnosis, 1995.

References

Aarseth, Espen (1997), *Cybertext: Perspectives on ergodic literature*, Baltimore: The Johns Hopkins University Press.

Carvalhais, Miguel (2010), *Towards a model for artificial aesthetics: Contributions to the study of creative practices in procedural and computational systems*, PhD, Porto: Universidade do Porto. Retrieved from http://www.carvalhais.org/txt/Carvalhais2010.pdf

Carvalhais, Miguel (2011), "Procedural taxonomy: An analytical model for artificial aesthetics", *ISEA: International Symposium on Electronic Arts*, Istanbul. Retrieved from http://isea2011.sabanciuniv.edu/paper/procedural-taxonomy-analytical-model-artificial-aesthetics

Galloway, Alexander (2006), *Gaming: Essays on algorithmic culture*, Minneapolis: University of Minnesota Press.

Hunicke, Robin, LeBlanc, Marc, & Zubek, Robert (2004), "MDA: A formal approach to game design and game research", *AAAI-04 Workshop on Challenges in Game AI*. Retrieved from http://www.cs.northwestern.edu/~hunicke/MDA.pdf

Kent, Steven (2001), *The ultimate history of video games: from Pong to Pokemon—the story behind the craze that touched our lives and changed the world*, New York: Three Rivers Press.

LeBlanc, Marc (2005), "Tools for creating dramatic game dynamics", In Eric Zimmerman Katie Salen (Ed.), *The Game Design Reader—A Rules of Play Anthology*, Cambridge, Massachusetts, The MIT Press, pp. 438-459.

Rucker, Rudy (2005), *The lifebox, the seashell, and the soul: What gnarly computation taught me about ultimate reality, the meaning of life, and how to be happy*, New York: Thunder's Mouth Press.

Ryan, Marie-Laure (2011), “Peeling the onion: Layers of user participation in digital narrative texts”. Retrieved from http://users.frii.com/mlryan/onion.htm

Wolfram, Stephen (2002), *A new kind of science*, Champaign, Illinois: Wolfram Media.

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