Assessing Emergence and Progression in Games

Daniel Marques Maranhão* Artur de Oliveira da Rocha Franco† José Gilvan Rodrigues Maia‡

Federal University of Ceara, Virtual University Institute, Brazil

ABSTRACT

Among the many structures that can be explored by Game Design to pose challenges to the player, two structures are usually perceived as opposites: Emergence explores game complexity derived from the different interactions between the game's rules; in its turn, Progression revolves around pre-made challenges that are serially introduced throughout the gameplay. However, it was observed that both structures can be used together in order to improve the overall entertaining quality of the game, as Emergence offers creative freedom to the player whilst Progression allows a development focused on experiences which are previously defined in clear manner that frequently yields cinematic interactions. These gameplay structures are blended in the game by means of structural attributes, such as the specific game mechanics that are made available to the player on a given level. This paper represents a first step towards determining a trade-off between Emergence and Progression. First, we enumerated and evaluated the characteristics and attributes of existing games exploring Emergence and Progression. Hence, those games are classified accordingly to how these supposedly antagonistic structures present themselves and are balanced in the game.

Keywords: Game design, challenges, progression, emergence.

1 INTRODUCTION

Digital games have frequently tried to find interesting ways to present challenges for the player. With the advent of computers, games could not only have their rules being enforced by algorithms, but this new tool could soften how the player is introduced to the game world by making it a more pleasant first session.

The nature of most games is to present different situations to the player, so these situations emerge from the games' rules. This structures is known as *Emergence*. However, it is possible to use computers to create games that focus on *Progression* more than in Emergence, that is, games that have a strong focus in a story-like ambiance and consequently guides the player's steps through a cinematic experience. These two structures, emergence and progression, can be better scrutinized to achieve a deeper understanding of how games can structure the player's experience and present them with challenges that have different, or even balanced focuses.

This occurs because the game designer needs to have a clear understanding of the inner workings of both structures, and to be able to better judge when to prefer using each structure and where, and how to use them. Also, these structures do not necessarily need to be separated at all times and can be combined sometimes to create a possible emergent progression.

In this work we delve in obtaining methods for actual assessment of these structures. The contributions of this paper are as follows:

- A unified approach for assessing emergence and progression structures in electronic games.
- The proposed analysis approach is applied to various games.
- We strive to determine whether and how games can, in fact, combine progression and emergence.

The remaining of this paper is organized in the following manner. Fundamental definitions necessary to the development of this paper are presented in Section 2. Our analysis approach for assessing emergence and progression is presented in Section 3. Games are then analyzed in Section 4 using our approach. Discussion about the results obtained are then presented in Section 5. Finally, conclusions about this work and future research are in Section 6.

2 RELATED WORK

The following section will show how different authors frame the importance of emergence and progression in game design, with each one having a different objective with their work, such as defining the terms, finding ways to integrate both structures, and also creating forms of categorizing and identifying these structures.

2.1 Defining Emergence and Progression

The subject of emergence and progression in games arose with a paper from Juul [4], defining these terms and conceiving ways to identify them in different games. His work was matured by different authors and then several objectives and intentions were proposed.

2.1.1 Riva et al. (2016)

Riva et al. [6] are psychologists that presented how progression and emergence can be used in games to for building experiences that help improvement of human qualities, such as mind strength and resilience. The authors believe exploratory games can help people to understand some different systems in real life. It may be pointed out that this idea is closely related to constructivism. Moreover, they assume that, when a player improves theirs skills in game, then she is going to experience fun, i.e., they define fun as "the process of mastery itself".

Therefore, according to these authors, the main idea in a exploratory sandbox is to satisfy curiosity and to master the system game. When playing this kind of games, some players perform impulsive actions to see what can occur: sandboxes are essentially an environment for an emergent game play, so there may exist situations and events in the game that act like a whole unexpected experience even considering expectations from the game's own game designer.

Riva et al. [6] state that progression games are the opposite of emergence games. Progression is focused in content. Emergence is focused in processes which are focused in application of knowledge to combine rules in order to turn the tables in players' favor.

*e-mail: daniel.josh002@gmail.com
†e-mail: arturoliveira@virtual.ufc.br
‡e-mail: gilvan@virtual.ufc.br

2.1.2 Schell (2014)

According to Schell [7], actions are what the players are capable of doing. There are two perspectives on actions, the first one being basic actions. They are the base actions a player can take, like moving a checker forward in a game of checkers. The strategic actions are only meaningful in the larger picture of the game and have to do with how the player uses basic actions to achieve a certain goal. Generally, a game offers more strategic actions than basic actions. In a game of checkers, an example of strategic action is to protect a piece by placing another piece behind it. The strategic actions are not part of the rules, but emerge naturally as the game is played. In this way, emergent gameplay happens when, from a certain number of basic actions, players have the possibility of executing a greater number of interesting strategic actions. Some ways that the author present to increase the chance of emergent gameplay appearing in a game are:

- Add more basic actions
- Allow the basic actions to interact with more objects
- Include goals that can be achieved in different ways
- Increase the number of objects controlled by the player
- Include side effects to each action that change the games constraints

2.1.3 Juul (2002)

Juul [4] states that digital games, throughout the history, can be seen as the product of two basic structures: emergence and progression. Emergence is the primordial structure, in which a game is specified by a small set of rules that combine themselves and make possible a great number of variations to the game, to which the players create strategies to deal with them. Emergent games tend to be replayable and nurture tournaments and strategy guides. Progression is a newer structure that was inserted in the computer games through the adventure genre. In games of progression, the player must do a set of predefined action in order to finish it.

As the game designer controls the sequence of events, this is the kind of game that has cinematic and storytelling ambitions. Progression games have walkthroughs, which are guides specifying the exact sequence of actions necessary to reach the end of the game.

The author states that, according to Holland [3], "emergence occurs only when the activities of the parts do not simply sum to give activity of the whole. For emergence, the whole is indeed more than the sum of its parts."

Classic examples can be seen in life as a bunch of molecules and in conscience as the result of interactions between brain cells. He also states that Smith [8] uses emergence as a term to situations or behaviors that were not expected by the game designers. However, Juul considers this definition flawed, as emergence is independent from this *"unexpected novelty"* criterion, because it can be foreseen to some extent.

Juul [4] proposes a way to classify emergence in three different kinds:

- Rule interaction: the simplest form, which is not really emergence. An example can be the rocket jump in Quake.
- Combination: the potential different game sessions that can be derived from the rules. The quantity of possible current states and overall game sessions in a strategy game like Starcraft is virtually infinite.
- Emergent strategies: emergent properties that are not immediately deductible from the game rules. An example can be the strategic team work in a game like Dota 2. The rules do not state that they are possible, yet they still emerge.

The progression structure is, to the author, less interesting than emergence in many ways. In this structure, generally there some freedom afforded to the player to roam an ambient in which the only interesting experiences happen in a single way. Another feature of the game of progression is that they have an extremely low replay value.

In a general way, progression structures are heavily precontrolled by the game, while the emergent structures allow much variation and improvisation that was not anticipated by the game designer, nor is easily derivable from the game rules. Even then, this does not mean that the players have complete freedom to do what they want or that their behavior is devoid of patterns or regularities.

Even in a game of emergence, some event can be determined or are very likely to happen. A way to comprehend this phenomenon is that players tend to respect the game contract, that is, as they agree to pursue the main objective of the game, they tend to take certain actions. As they try to reach this objective, they will search for a good strategy. If the game allows for a good strategy that leads to interesting interactions, then it is a good game. If the optimal strategy leads to dull game sessions, then the game will be considered monotonous.

Even in a game with strong emergent properties, the game sessions can follow very regular patterns. An example is that, in sessions of the game Counter-strike, confrontations between the two teams will almost always happen. This is due to the fact that, even though these patterns are not explicitly stated in the game rules or its occurrence is not defined in the game code, they are the best way found by the players to reach the objective at stake.

2.1.4 Dormans (2011)

According to Dormans [2], Games are complex rule based systems that exhibit many emergent properties on the one hand, but must deliver a well-designed, natural owing user experience on the other. Emergence can be achieved through the rules and mechanics of a game, and Progression through the level that will structure the experience and show the challenges in a specific order. Most games have elements of both emergence and progression, and this leads to the question: how structured level design and emergent rule-based play can be integrated? Clever level design can be used to structure the complexity of the game, allowing the player to learn the rules in easy to handle chunks. An interesting form to combine emergence and progression is to have a single element possess a dual utility, both to control the progress of the player and also as a mechanic through which it is possible to acquire mastery, such as an item that is both a key and a weapon. The author states that, according to Fromm (2005), the emergence of a system can be defined by the nature of its feedback. Feedback is an effect created when changes in a certain element of a system will directly or indirectly affect the state of the same element later on. This feedback is positive when these effects strengthen themselves, and negative when these effects dampen themselves. The author says that emergent behavior starts to appear in a game when it presents two to four feedback loops.

The first way the author proposes to fuse emergence and progression is to insert feedback loops to mechanics that regard the progress of the player. For example, a player needs 25 keys to get past an area. However, the player can spend 5 keys to increase the key harvest rate, and enemies will spawn to try to grab the keys. So, positive and negative feedback loops control the players progress, as they are directly related to the keys. In this way, the player will have to alternate between three activities: harvest keys, upgrade the harvest rate, and defeat enemies.

The second way is that the progress in a game can actually change the mechanics of such game through feedback loops, in order to fuse emergence and progression. An example can be seen in space invaders, as the more enemies are defeat and more progress is obtained, the faster the remaining enemies get. This way, emer-

gence and progression can be combined to create compelling game experiences that offer great freedom to the player at the same time.

2.1.5 Adams (2012)

Adams [1] explains Juul's concept of emergence and progression, but explains that a game of pure progression or a game of pure emergence is something rare nowadays, as it is an extreme case. Most games use a hybrid model, mixing elements of both structures. A common model, for example, is the model of action-adventure games like Half-Life, in which the story dictates where the player must go (progression), but the tactics and strategies to defeat enemies during combats can have many variations (emergence).

In a game of emergence, complexity is generated by various connections and interactions between the rules, instead of a big number of rules. A big probability space renders the game more replayable. The complexity of the gameplay leaps after reaching a certain point in the complexity of the rules. Adams compare the complexity of Tic-tac-toe and Connect Four, illustrating this inflection point denominated by the author as *complexity barrier*.

Despite emergence and progression being considered two different forms of creating challenges in games, many games have elements of both. Integrating emergence and progression, it is possible to combine the best of both worlds: freedom and openness of play through emergence and the structured story like experience through progression. Progression is normally used for storytelling, but it is hard to create a coherent story if the player has too much freedom of action, as in games of emergence. In practice, these two elements generally alternate themselves. There are moments that give great freedom to the player, which characterizes emergence, and there are very structured moments that rigidly explicit what the player must do, which characterizes progression.

The author cites many different structural qualities of emergence and progression, which allows us to analyse why a game would show a more emergent behavior or a more structured, less emergent one. For example, games of emergence tend to be replayable, because they have a large and wide probability space, thus offering the player many different choices and possible outcomes for the game sessions. Because the games of emergence have so much variation, they tend to have a steep learning curve, making it possible that the first game sessions turn out to be overwhelming if not structured and facilitated somehow. Games of progression have a low replay value because their probability space is small and deep, so the experience tends to be long but with few choices at a given time. As the situations are predefined and the player does not have so many choices, he will not often be lost, so the learning curve tends to be gentle. These differences are represented visually through a chart.

STRUCTURE	EMERGENCE	PROGRESSION
Number of rules	Low	High
Number of game elements	High	Low-high
Iteractions among elements	High	Low
Probability space	Large, wide	Small, deep
Replay value	High	Low
Designer control of game sequence	Low	High
Length of gane	Tends to be short	Tends to be long
Learning curve	Tends to be steep	Tends to be gentle

Figure 1: Structural differences between emergence and progression in games [1].

The behavior of complex systems, that is, systems that are compound of many parts that are generally simple individually, can be classified from ordered to chaotic and anything in between. Ordered systems are simples to predict, while chaotic systems are impossible to predict, even when there is absolute comprehension of the way of working of the parts that constitute the system. Emergence prospers somewhere between order and chaos. There are two stages between these extremes, which are the periodic systems and the emergent systems. Periodic systems progress through a distinct number of stages in a continuous and easily predictable sequence. Emergent systems are less ordered and more chaotic than periodic systems. They generally exhibit stable patterns of behavior, but the system may alternate from a pattern to another suddenly and unpredictably.

According to the author, there are three structural qualities that contribute to a complex system to present emergent behavior:

- Active and interconnected parts: relatively simple rules can generate a complex behavior, as long as there are enough parts, activities and connections. Most games are built in a similar manner. Games consist of many different elements that are ruled by relatively simple mechanics. Generally there are many possible interactions between the individual elements of a game. The player is an important source of activity inside the system, but emergence can occur even without input from the player.

- Feedback loops: they are created when the effects of a change in a part of the system return and affect that same part later on. Feedback loops that work to maintain a balance in a system are called negative feedback loops. An example can be seen in the game Civilization, where the population of a city demands for more food the more it grows. This makes the city grow to a stable size that is supported by the terrain and by the player's technological level. The positive feedback loop, on the other hand, instead of creating a balance by acting against the changes that activated the feedback loop, strengthens the effects that caused these changes. An example can be seen in Chess, as each piece defeated by a player makes defeating another piece easier, with the difference between the pieces of the players growing more and more. Negative feedback loops work to maintain a balance in a system, whilst positive feedback loops can destabilize the system.

- Different behavioral patterns: in complex systems, the most interesting behavior does not occur at the scale of individual parts but to the scale of groups of parts. An example is the behavior of ghosts in the game Pac-Man. The ghosts do not collaborate in fact, but their collective behavior appears to be much smarter than it actually is. They are simples machines that follow simples rules. The behavior is implemented in a little different manner for each ghost. One follow the player directly, while another one follow the position to the front of the player, and another one only follows the player if he is afar. This combination of simple behaviors give to the players the feeling that they are being hunted in a collaborative manner, when the enemies simply have complementary strategies.

The author explains about one of the most common progression mechanics, which are the lock and key mechanisms. Games that have many different levels often rely on the lock and key mechanisms as a way to control the progress of the player through each level. Many times these mechanisms are actually composed of keys, like the silver and gold keys available in Quake, but not necessarily. It can be anything that blocks the player progress and is unlocked somehow by something, like obtaining an explosive that allows to blow up a wall. Generally it is a good idea that the player finds the lock before the key, for three reasons:

- He will try to find the specific key instead of grabbing everything.

- If the key does not look like a key, he will formulate its intention and feel smart.

- If he finds himself able to go through a place previously blocked, he will experience progress and accomplishment.

One of the benefits of this mechanism is that it allows the designer to better use the game space. The player will not necessarily traverse the space in a linear way, and can go back and forth between different places to collect keys and unlock locks. A way to make the lock and key mechanism be more dynamic is to add feedback loops to it. Also, a good way to create emergent progression it to treat the progression of the player not as the proximity to a specific location, but as proximity to a certain game state. This allows the keys to be treated as a resource that can be gained and lost, and so it can interact with the other mechanics in the game. Experience points, for example, can increase the player's power and at the same time unlock his access to certain high level locations. It works as a lock and key mechanism and it directly affects other mechanics, such as the player damage, health and skill points. This way of handling progression also adds replay value to the game.

3 Proposed Analysis Approach

We investigated definitions from different authors in the previous section. Schell [7] talks from a creative, artistic standpoint that does not advocate in favor of either progression or emergence. In his turn, Juul [4] embraces how emergence can be used to make better games, i.e., he claims that better experiences are molded by means of cautiously crafted emergence. This is statement is supported to a certain degree by psychologists [6], that argue exploration provided by emergence can even contribute for building up personal qualities that reflect on real-world situations. Adams [1] advocates that there does not exist a rigid structure supporting absolute progression, therefore emergence can fit into virtually any game.

It is also clear that progression rely on extensive and controlled content exhibition whose sequence may be predefined by game designers, even on games adopting non linear storytelling.

We propose a unified approach for assessing progression and emergence that relies on a wide set of characteristics suggested by different authors. This can contribute for achieving deeper analyses since various characteristic measurements are estimated when a game is scrutinized. Moreover, our proposal also allows for a direct comparison on the effectiveness of different approaches found on [1], [4] and [2] for this task.

Presence of Progression and Emergence structures in games are then measured using the following attributes, each of them assuming values ranging from 0 to 10 within the scope of this work:

- Number of rules.
- Number of game elements.
- Number of interactions among elements [1].
- Probability space length [1].
- Probability space depth [1].
- Replay value [1].
- Designer control of game sequence [1].
- Length of the game;
- Learning curve (difficulty) [1].
- Predefined challenges [4].
- Emergent strategies [4].
- Feedback loops [2] [1].
- Structured level design [2] [1].
- Lock and key mechanisms [2] [1].

4 Analysis

In this section, we discuss how progression and emergence is applied on number of games from different genres, ranging from real-time shooters to puzzles. The following games were chosen to be analysed using the approach that we proposed previously:

- *STASIS* ®[1].
- *Starcraft* ®[2].
- *Half-Life* ®2 [3].
- *Starcraft* ®II [4].
- *Left 4 Dead* ®[5].
- *Killing Floor* ®[6].
- *The Witness* ®[7].
- *Legend of Grimrock* ®[8].

An argumentative exposition covering each game is presented along this section to support a coherent estimation of values associated to each attribute. Such discussion is built on top of qualitative research by means of a focal group. Obtained results are summarized in Figure .

The games and all their contents in terms of art, trademarks and characters displayed in this work serve solely illustrative purposes. These images were taken from the Internet by accessing the official website for each game. Copyrights relative to these elements belong to their respective owners.

4.1 STASIS

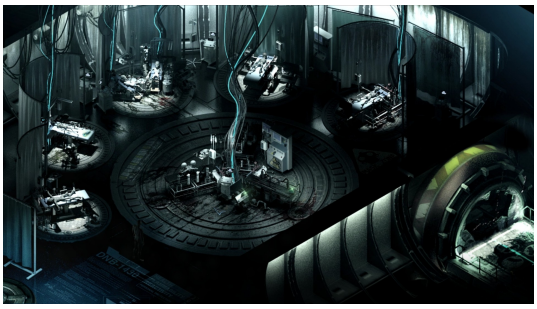

Figure 2: Image of the game STASIS®.

STASIS is a point and click adventure game, which can be considered a clear example of progression. The premise of the game is about trying to flee an abandoned place, while interacting with objects and collecting, using and combining items throughout the journey. The ambient is strongly premeditated, as all possible interactions have been previously defined by game developers. In this sense, there is no freedom of choice to the player or such freedom can be considered minimum. Exactly for this reason, the game has a strong narrative structure, favoring a rich story and creating a storytelling ambiance. Mental and cognitive skills are required from

[1] http://www.stasisgame.com/
[2] http://us.blizzard.com/pt-br/games/sc/
[3] http://orange.half-life2.com/
[4] http://us.blizzard.com/pt-br/games/sc2/
[5] http://www.l4d.com/game.html
[6] http://www.killingfloorthegame.com/
[7] http://the-witness.net/news/
[8] http://www.grimrock.net/

the player since there is generally a single solution for each challenge. This game may seem preachy once it is finished and then played again.

4.2 Starcraft

Figure 3: Image of the game Starcraft®.

Starcraft, which is a real time strategy game, can be seen as a clear example of emergence. The premise of the game is to build a base, develop an economy, train an army and annihilate the enemy species. Each element of the game, like the units, buildings and technologies, is individually simple. However, the possible interactions between each one of these elements are so many and so strategically complex that the game can achieve an extremely high level of complexity, specially in case the players are skilled.

Players have great freedom of choice as in other games of emergence. Players can choose the order they produce units and buildings, how many units are produced and of what kind are those units. Players he can favor short, middle or long term strategies, and they can also opt for an infinity of military tactics to subdue their opponents. Finally, as the myriad of situations available in the game could not possibly be predefined by game developers, how each match flows is a direct reflection of each player's decisions.

4.3 Half-Life 2

Figure 4: Image of the game Half-Life®2.

In the case of *Half-Life* 2, both emergence and progression can be seen in distinct moments and sometimes even be mistaken for each other. This game's premise consists of traversing the levels while fighting enemies and solving some puzzles. The player has freedom for some situations inside the game, but she is also railed in the journey as a whole. The ambient of the game is expansive and detailed, giving the impression that the player is exploring scenarios with freedom, masking the fact that the route the player can follow is actually quite specific. In combat situations, it is possible to favor strategies that are more effective or that better adapt to the player's personal style. Examples of this are the weapons to be used, the enemies that are defeated first and also defining whether a more aggressive or more defensive stance will be adopted.

Even with this freedom offered to the player, combats tend to follow certain well-defined patterns, from which the player normally does not deviate much because she tends to follow the game contract. Furthermore, in the moments of storytelling, players can explore the ambient interacting with certain items and characters. Such interaction makes players capable of even revealing some secrets with interesting information, but even then, the story is fixed and the player has no real capacity to alter it in any way. However, the game does not necessarily get people bored when playing it repeated times.

4.4 Starcraft II

Figure 5: Image of the game Starcraft®II.

Starcraft II is a game that differs from its predecessor for the fact that it uses predefined challenges, a typical feature of progression. This contributed to give a more interesting and cinematic aspect to the game. While in the first game all the missions required the same sequence of actions from the player, that is, build a base to create an army and destroy the opponents, the sequel game offers unique elements in each mission, endowing the game with variety.

In a certain mission, it is necessary to use your armies to protect trucks along a route, giving gameplay a more defensive than offensive aspect. In another mission, it is necessary to collect minerals from locals that are eventually submerged in lava, what gives a bigger emphasis on the economic aspect of the game. In yet another mission, it is needed to destroy enemy buildings only during the day due the fact that they are better guarded at night, giving importance to an attack and retreat tactic.

From this, it can be noticed that each mission, although still being based in the same premise, displays new elements that constantly renew the player's interest. This rendered the game at the same time cinematic and replayable. Because campaigns in games are generally about storytelling, these predefined elements are important to make each individual level a novel and interesting experience.

4.5 Left 4 Dead

Left 4 Dead is a survival horror first person shooter, which tends more to progression. In this game, each mission is compound of five different areas, where the players must reach the end of each area to be able to, finally, evacuate the local of the mission. In this

Figure 6: Image of the game Left 4 Dead®.

game, there is little freedom afforded to the player. Each game sessions requires exactly four players, having absent players replaced as bots. It can be chosen among only four characters, and they cannot be repeated. There are only six different weapons, two grenades and two healing items. The strategies are very limited because of this. To add even more, from the only three types of special zombies that appear commonly in the game, two grab the player and render then unable to do anything until rescued.

The game is not completely limiting, because as has been said, there is freedom even though it is not much. Still, most of the situations in the game happen in predefined events, for example: turning on a generator to restore power, exploding a barricade and lowering a bridge. All of these involve waiting in a defensive spot while hordes of zombies come at the players. All this results in an experience that, when experimented for the first time, calls the player's attention for being a cinematic situation. However, By playing some game sessions, most of the game's situations can be discovered and the game can become dull. In short, each session has strong storylike ambiance, for consisting mostly of predefined events, but is not very replayable. The game tries to give a more emergent option with a survival mode and a versus mode, but they are not the focus of the game.

4.6 Killing Floor

Figure 7: Image of the game Killing Floor®.

The second survival horror first person shooter we analyzed, *Killing Floor*, is the opposite case of *Left 4 Dead*, as it tends more to emergence. In *Killing Floor*, each mission consists of surviving in a certain scenario while suffering a continuous onslaught of monsters. It is not necessary to get to a specific place to progress like in *Left 4 Dead*, instead it is needed just to stay alive and kill all the monsters. Except for the quantity and types of monsters that are thrown at the player in each wave, there are no predefined events.

However, there is extreme freedom at the hands of the player. Each session can have from one to six players, and the difficulty escalates to this quantity. The players can choose from a huge variety of characters, which can be repeated, in addition to many different weapons and items and, unlike *Left 4 Dead*, the player can specialize in an upgradable class, having prowess with a certain kind of weapon.

In multiplayer mode, players can complement their classes to create numerous strategies to handle the enemies, contributing even more for the freedom and emergence of the game. Besides that, the quantity of different monsters and their different attacks is also bigger than in *Left 4 Dead*, what makes the variety of possible strategies to also be bigger. In addition, they spawn in different places at different moments, making every session different even if the players opt for the same strategy, and even more, requiring them to adapt their strategy to the situation.

As a result, in a first moment, the player can be overwhelmed by the many different elements and mechanics that she has and the learning curve can be very steep, but if the player continues to play and gets the grasp of the game, she will see that the replay value that the game offers is huge, due to its big variety of elements and also the strategic ways that all of them interact with each other.

4.7 The Witness

Figure 8: Image of the game The Witness®.

The Witness is a puzzle game in which you explore a vast island, where there are many puzzles with different mechanics that can be faced in any order defined by the player. All the puzzles are similar in the sense that it is needed to draw a line to the end of a maze, but each area introduces a new mechanic, for example having to separate colored squares, pass through dots, or make shapes with the drawn lines. However, at a certain point, there is a challenge that generates these puzzles dynamically. This means that these puzzles are not predefined: they emerge from game rules. This is a very interesting way of presenting the puzzles to the player, as it generates mental challenges on the fly, something that is uncommon on digital games.

While there are still very few or single solutions applicable for each puzzle, challenges are dynamic. Hence, even though it is basically a puzzle game, which generally are games of progression, the puzzles generated add a layer of emergence to the game. Even though the entire game can have a walkthrough, this particular part cannot because it is dynamic, and can have instead a strategy guide, because it is random but it obviously is not devoid of patterns, or it could be impossible. So, this particular part does not offer many game states, but it offers many game sessions.

4.8 Legend of Grimrock

The Legend of Grimrock is an RPG dungeon crawler game in which players descend through a mountain trying to reach the bottom, and it is filled with monsters and puzzles. This game can be seen as having both emergence and progression in a strong manner. The

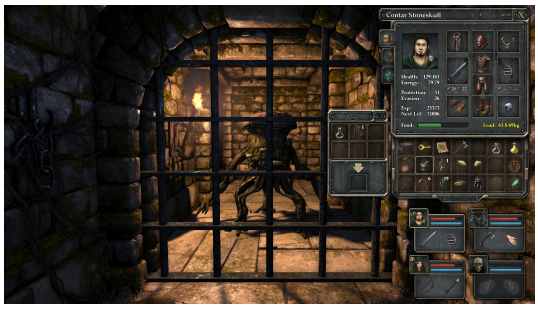

Figure 9: Image of the game Legend of Grimrock®.

player has the freedom to choose many features of its four characters, such as class, attributes, traits and skill points. This leads to much variety and a great replay value.

Even though the enemies are layered in a predefined way, which will lead to fights that may not look so different each time, the way players face enemies and develop their characters can change completely the way that the fights will occur. Moreover, there are many puzzles through the dungeon that have a predefined solution, requiring thinking from the player and adds a layer of progression. So, in the first time the game is played, the player is interested in all the different game mechanics but, generally, if they want to replay the game, it is to test different character builds because puzzles completely lost their surprise factor. All these elements together render the game replayable and also story-driven, even though the story is very open to interpretation.

5 Discussion

5.1 Overall Assessment Results

The results discussed in this paper were obtained by adopting the wide set of gameplay structures proposed in Section 3 under the light of the detailed analysis performed in Section 5. We resorted to a focal group to analyze these games in order to point actual values reported in Figure 10.

5.2 Analysis of Results

It is not possible to get a totally progression or emergence experience in a game. In fact, this analysis is subjective and serves to guide the structure of experience. If there is no progression in a game, then there are no objectives in the experience it provides. Thus, it can be possible to ask if that experience is a game. For example, in chess, game which many authors say is a totally emergence game, has one element of structure the condition about winner and loser, which is defined when he catches the king of opponent. Puzzles are considered to be progression games because they have a restrictive universe of solutions which frequently is a unitary set. On the other hand, interactive videos may seem like a game, but these cannot be considered to be games since users do not face any challenges.

A game tends to become an emergence game when its levels are too similar. The latter statement is partially supported by crossing data summarized in Figure 10 against analyses performed in Section 4 for games with emergence structure. We employed C4.5 binary decision trees [5] to assist our analysis. These trees are machine learning models which humans can comprehend through a visualization about how each attribute is used to define a boundary surrounding a pattern of interest. Such visualizations are even more handful for coping with shallow, pruned decision trees.

These games display an attribute ”Number of Rules” greater than 3, which indicates emergence occurs for games with few or many rules, so oneself can expect those rules to interact in order to provide a more sophisticated overall experience. This assumption does not discard progression, since new rules can be implemented by new elements appearing as the game advances.

On the other hand, emergence is discarded when ”Number of game elements” is below 6, suggesting that emergence structures may depend on multiple game elements crafted as rich interactions between basilar rules. Moreover, this suggests that game levels that are way too different from each other may bring forth a boring replay experience.

A comparison was also made between two games that share a similar theme, which is survival horror first person shooter. It was observed that *Left 4 Dead* tends to progression while *Killing Floor* tends to emergence. This reinforces the hypothesis that a specific genre does not imply on emergence: such structure of experience originates from the actual mechanics implemented in the game.

Regarding games in which both emergence and progression structures are present. Progression and emergence do not occur together in games with a wider set of rules plus diversity of both elements and their interactions where there is relatively limited probability space length, since the corresponding attribute is assumes values less than 5.

Interestingly enough, attributes defining progression were already clearly identified in literature. However, we conclude that progression games displaying a significantly small set of rules are also conceivable. Obtaining further interpretations about this matter may resort to further investigation considering a larger game set.

6 Conclusion

An analytical study of different authors helped to frame the most important aspects of emergence and progression in games. It was shown that these structures do not necessarily need to appear at separate moments, as they can be integrated. Finally, an analysis of games with different premises was conducted to perceive how their fundamental characteristics would make them tend more to emergence or to progression, making them display behavior such as re-playability or story-like ambiance.

While Juul [4] states that emergence is naturally more interesting, and in fact it can be agreed that computers are best at handling processes than randomly accessing memory, Adams [1] points out that progression is also a very important structure to achieve different kinds of experiences, and one structure is no more important than the other.

Through the analysis conducted assessing structures of emergence and progression in different games, it could be noticed that games with a stronger presence of one structure or another or even both displayed their features clearly. In games with strong emergent properties, freedom for the player actions was naturally a result and in games with strong properties of progression, there was a cinematic experience present. At games that showed many signs of both structures, freedom and also an interesting story were experienced by the player, generally at different moments but also possibly at the same time.

Our analysis shows evidences that ”Number of Rules” and ”Number of game elements” are deterministic for endowing a game with emergence, at least from the user’s perspective. Experimentations carried out considering a larger number of game dataset and a broad user database seems to be necessary in order to shed light over this question. A qualitative approach can be explored in order to provide other insights about emergence and progression, specially when it is possible to explore the underlying mechanics of games.

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Characteristic	STASIS	Starcraft	Half-Life 2	Starcraft II	Left 4 Dead	Killing Floor	The Witness	Legend of Grimrock
Number of Rules	10	4	5	5	7	4	6	7
Number of game elements	*3*	*9*	*5*	*10*	*4*	*8*	*5*	*9*
Interactions among elements	1	10	6	10	5	9	7	8
Probability space length	*3*	*10*	*5*	*10*	*5*	*9*	*2*	*8*
Probability space depth	8	4	7	7	7	2	4	5
Replay value	*2*	*5*	*6*	*8*	*4*	*9*	*4*	*8*
Designer control of game sequence	10	1	8	3	6	3	7	5
Length of the game	*8*	*7*	*9*	*8*	*7*	*3*	*10*	*7*
Learning curve (difficulty)	2	7	1	4	2	8	9	6
Predefined challenges	*10*	*0*	*3*	*7*	*7*	*2*	*9*	*5*
Emergent strategies	0	10	6	8	4	9	2	7
Feedback loops	*0*	*10*	*5*	*10*	*6*	*9*	*0*	*8*
Structured level design	9	4	7	6	7	2	9	7
Lock and key mechanisms	*10*	*2*	*5*	*3*	*7*	*1*	*8*	*7*

Figure 10: Resulting values for each attribute describing games analysed previously.

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