A Methodology Proposal for MMORPG Content Expansion Analysis

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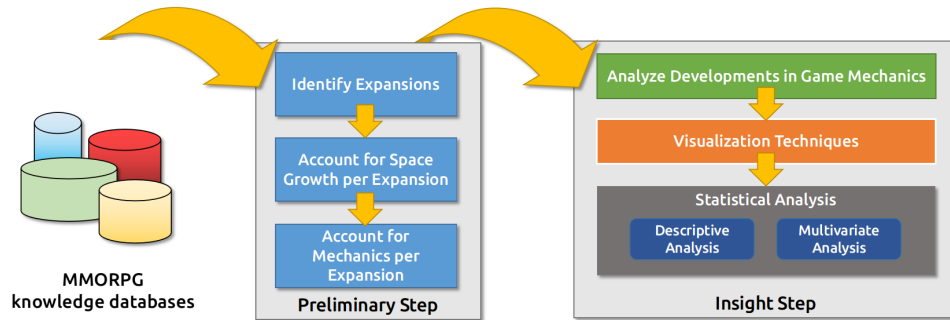[2]Federal University of Ceará, Computing Department, Brazil

Figure 1: Overview of the proposed methodology for MMORPG content expansion analysis. Knowledge databases found on web communities (left) is fed into a Preliminary Step for examination (middle) providing organized data to the Insight Step (right) resorting to visualization and analysis methods.

ABSTRACT

Massively Multiplayer Online Role Playing Games (MMORPGs) are intrinsically complex pieces of software in terms of both development and maintenance effort since titles of this game genre demand financial resources in order to provide a computational infrastructure to support their execution. Recent studies point out that MMORPGs are dying. Such hypotheses largely reflect the establishment of a repetitive gameplay format that reduces the interest of players in this genre. That said, it is important to understand and to analyze success cases in order to identify development and content expansion strategies that possibly help to maintain the player community engaged and *paying* to play the game. In this paper, we propose a methodology to analyze how MMORPG content evolves with time in order to grasp the aforementioned insights. We introduce the concepts of horizontal and vertical growths concerning both level design and game mechanics. Results arising from the application of the proposed approach to the long-living title Ragnarök Online as a case study are also discussed in this work.

Keywords: MMORPG, Game Design, Analysis.

1 INTRODUCTION

Massive Multiplayer Online (MMO) games are intrinsically complex pieces of software both in terms of development and maintenance because these titles demand a considerable infrastructure in

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order to become actually playable.

Recent studies suggest that MMO Role-Playing Games (MMORPGs) are dying [4]. This is mainly reflected in the establishment of a format that presents itself in a repetitive experience in the medium and long term, which in turn has reduced the audience's interest in this genre. That said, it is important to understand and analyze the actual feasible development, expansion and maintenance strategies that contribute to keeping a player community active and pivoting around MMORPG titles.

Digital games managed to move about 27.6 billion in exports of physical games in 2008. In 2014 the gaming industry was twice as big as the music industry [8]. Revenue from games requiring Internet connection accounted for about 19% of the market in 2012, amounting to 20 billion USD [10].

The definition of a "Bussiness Model Strategy Trade-off" for MMORPGs should be viewed as a product to be maintained as a service. Such a service requires investments in technology, design, and supporting organization to be maintained as a service. The best strategy to dispose of these investments varies from game to game. The common sense suggests is that companies should tries to minimize their infrastructure cost, and increase or maintain the number of players [10].

The search for a better recipe in MMO games forces companies to seek for a deep understanding of the player audience [6]. So, it is important to achieve an understanding of the patterns of the fun and engagement not only in the short term but in the long term since this game genre usually is consumed, from a business perspective, as a service. Therefore, generating a loyalty relationship with subscribers is fundamental to keeping the business minimally viable and provide a game that is, in its turn, attractive.

Starting from this premise it must be observed that human beings are highly specialized in perceiving patterns. The typical player likes to figure out the pattern, but she does not like the pattern to repeat itself (too much). Thus, a player tends to feel rewarded by dis-

covering new patterns within the game, so mastery of the elements and absence of new patterns to be exploited makes the experience of the game boring. On the other hand, too much news can be a noise to which the player can not associate a pattern. According to Koster, in this case, the player feels frustrated and abandons the game[11].

Given the problem statement, this work aims to analyze MMORPGs to identify strengths and weaknesses in the expansions of digital games from the point of view of *game design*. It is observed that maintaining the design of an MMORPG game is somewhat delicate, requiring high investments in the medium and long term in order to maintain gameplay balanced and compelling [10]. MMORPG are essentially large virtual spaces that grow with time in term of mechanics and playable field area.

Since a game can grow on other content and concepts already used in the game, allowing experienced players to delve into it, such growth is called *vertical*. The expansion of a game can be seen as a *horizontal* growth, it is expected that in the perspective of the player this type of growth will bring more options for the player which has the potential to serve as the basis for other expansions.

The analysis of the game Ragnarök Online[TM] by Gravity[1][2] was carried out as a case study on the methodology we propose in this work for MMORPG content expansion analysis. Data subject to analysis was collected from the Brazilian official website, the main portal of the Brazilian players bROWIKI[3], and the rAthena Project[4] which is an open source clone of the original servers. The collected data correspond to the updates hereafter referred to as "episodes" and that expand the game experience in terms of character classes, cities, dungeons, features, quests and other elements.

It is important to emphasize that this work is not about using data that a game studio or publisher already has at its disposal about their titles, but to provide means to analyze the relationship between games, communities, and development based on an representative actual title.

Our analysis procedure is based especially on the mechanics proposed by Schell [16], but we also take into account its context. The appointments found in literature [13] were taken as a basis for for the sake of contextual analysis. Analyses are carried out over data generated or extracted by means of: subjective classifications evaluated throughout the work; other data are drawn directly from the counting of certain elements or values presented by the game, to soften the subjective load some descriptive statistical analyses on the data are applied. Among these we have: histograms, correlations, and a Principal Components Analysis (PCA) application.

These are the main contributions of this paper:

- We propose a methodology for the analysis of content expansion in MMORPG titles.

- We introduce the concepts of horizontal and vertical growth in order to provide clear insight for designers and developers.

- We perform experiments using real data from the game Ragnarök, which is a title of remarkable success in the controversial Brazilian market.

- We present results that point out the design decisions behind the expansions made on the game.

This work is organized in the following manner. Section 2 presents a preliminary discussion about the technical background regarding this work. Similar investigations are discussed throughout Section 3. The proposed methodology and detail about its underlying steps are explained in Section 4. Experimental evaluation

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[1] http://www.playragnarok.com/

[2] http://ragnarok.uol.com.br/

[3] http://browiki.org/wiki/P%C3%A1gina_principal

[4] https://rathena.org/

on collected data about Ragnarök Online and discussion about the obtained results are the matter for Sections 5 and 6, respectively. Finally, conclusions about this work and future research directions are pointed out in Section 7.

2 TECHNICAL BACKGROUND

2.1 Games

Computer games are fascinating people since its conception in the late 1950's. How can we define what a *game* actually is in a broader sense? First let us analyze definitions found in literature in order to pick a working definition for our investigation.

According to Elliot Avedon and Brian Sutton-Smith [2] "*Games are an exercise of voluntary control systems, in which there is a contest between powers, confined by rules in order to produce a disequilibrial outcome*". So, these authors advocate that games are essentially built on top of rules defined beforehand which influence what are the possible means players have at their disposal to achieve situations of clear advantage configuring the end of a match. In chess, for example, such a clear advantage is denoted by curbing the king piece's escape movements leading to checkmate or a draw. So, the end of the match takes place according to a certain criterion of "domination".

Salen and Zimmerman [15] introduced a definition in that a game has 6 primary ideas: System, Players, Artificial, Conflict, Rules and Quantifiable outcome. These ideas, together with those of other authors, give rise to the following definition: "A game is a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome". This definition enhances the concept introduced by Avedon and Sutton-Smith. First, the imbalance intended as the result of a game must be made explicitly quantified, therefore making it possible for players to realize the process of building this imbalance. In addition, the game is characterized as a set of interrelated elements that play an overall specific role when the combination of these elements determines how players interact with each other.

According to Ernest Adams [1], "a game is a type of play activity, conducted in the context of a pretended reality, in which the participant(s) try to achieve at least one arbitrary, nontrivial goals by acting in accordance with rules". This definition resorts to concepts of clear objectives and alternate reality. In fact, Maranhão *et al.* [13] developed an extensive literature review on the subject, and pointed out that most definitions of what a game are built on top of *Rules*, *Objectives*, *Activity* and *System* as fundamental characteristics of a game. Moreover, it is worthy to observe that games present a remarkable property that other kinds of media does not: mechanics "encoding" the underlying rules applied to player interactivity [16]. So, we will consider the game definitions from Maranhão *et al.* [13] and Schell [16] in this work.

2.2 Computer Games

The first definition of a digital game was given by Crawford in 1982 [7] and aimed especially at machines in the context of his time. In any case, Crawford included the entire computer infrastructure [7], which in the current context would include mobile games, other consoles and the like. Computer games are interesting because they are self-contained in rules and management of their worlds [7].

When digital games began to emerge, the classical "analog" games such as chess and tic-tac-toe were kept, but with the computer acting as the opponent [16]. In the mid-1970s, the games began to be improved as a new form of medium, thus giving rise to games with histories, being of strategy and adventure [16].

To make any kind of art, one must master the technology that will be used, and know how far they can go by adopting the underlying tools [7]. It's no different with computer games: gamer designers must understand how far machines can perform their tasks, otherwise, games can become quite limited or even unfeasible. Each de-

velopment technology has its strengths and weaknesses, and some will even give more options than the game designer can use, but at the same time will take away benefits that other technologies could have provided in the interactive experience for players [7] [16] [1].

So, what will be the advantage of using a computer to create a game, instead of building the same using cards or a board? Not that board games or cards are bad, but they have limitations on the number of players [16] [1]. It would be very difficult to create a card game using a deck for 52 people when there are only 52 cards in the deck, for example [7].

Thus, it is concluded that board games are very difficult to keep on digital support [7]. Over time, great games were appearing by merging the narrative and gameplay [16]. Board games may also contain narratives, but thanks to the computer's great real-time interactive capabilities and the dynamism it can bring to the game [1], it can support building unique experiences to the player.

After this preliminary discussion we hereby developed about the potentialities and limitations of games that adopt the electronic medium as support technology, it is necessary to discuss what games and mechanics are for the intrinsically analytic purposes of this work.

2.2.1   Games Accoording to Schell (2014)

Jesse Schell, a veteran designer of the game development industry, describes a rich, comprehensive game design conceptual framework he proposes which is essentially analytic [16]. Schell's approach is described almost metaphorically in a number of perspectives he calls as "lenses" which are composed of different aesthetic qualities to be considered by game designers.

Schell searched for keywords in other definitions of what a game is to make his own. The features he found are summarized by the following statements: Games are entered willfully; Games have goals; Games have conflict; Game have rules; Games can be won and lost; Games are interactive; Games have challenge; Games can create their own internal value; Games engage players; and Games are closed, formal systems;

Schell then presents his own definition of what a game is: "A game is a problem-solving activity, approached with a playful attitude". At first look, the definition may sound shallow but it also synthesizes an understanding that can be shared to some extent by many professional segments of the gaming industry.

2.2.2   Games According to Maranhão *et al.* (2016)

In a recent, exhaustive study, Maranhão and his collaborators [13] analyzed a dozen definitions about games and, a result, the following characteristics were obtained considering a decreasing order of estimated importance, for building a potentially consensual definition of what a game is: *Rules*, *Objectives*, *Activity*, and *System*.

According to these authors, a game has as its main activities to understand and interact with its mechanics in order to accomplish objectives within a system that is limited by rules. In fact, despite ignoring the "playful attitude" pointed by Schell, this definition sounds more technical and actually may fit what a game developer probably think the result of her effort is.

On the other hand, this definition brings to light a crucial aspect of what a game is about: players should *understand* the inner workings of the game, so these mechanics can be used in order to accomplish something as an interactive problem-solving activity.

2.3   Game Mechanics

Game mechanics are in fact the central part of a game, it is where we have the construction of all the relationships and interactions that the player will have at her disposal for actual gameplay. Even if technologies, narrative, and aesthetics are modified during development of a given title, the game mechanics tend to be an indepen-

dent element which can be kept closer to the concepts planned in advance for the game [16].

Maranhão *et al.* [13] also developed a definition of what are game mechanics based on an analysis over definitions found in literature. The authors once again highlight the importance of user perception for a building a working definition of game mechanics. It is worthy to observe that such definition could be incorporated into software and artistic development processes as it may provide valuable insight about the importance of features being implemented in the product. However, concerning this work, we resort to the definitions of game mechanics proposed by Schell [16] for the six corresponding categories he classifies mechanics into.

These definitions are important because they are fairly clear as a working paradigm for carrying out this investigation. It is important to note that the definition of mechanics. and their corresponding categorization, as proposed by Schell is not necessarily better or worse than the other definitions found in literature: we simply consider it more appropriate to the specific purposes of developing this research.

2.4   Schell's Game Mechanics Categories

Schell [16] classifies game mechanics into six categories. Some of these definitions do not fit the understanding found in literature about mechanics [1] [2] [15] [13]. However, let us examine each of these categories we found useful for developing analysis.

2.4.1   Space

The author states that all games take place in some sort of space, which he defines as the magic circle for gameplay and also relates to an abstract still intrinsic mathematical representation. According to Schell, game spaces that states can be continuous or discrete; are assigned a given number of dimensions, just like vector spaces from Linear Algebra; and display connected (or not) bounded areas.

For example, in a card game, the space could be the number of cards in play and the locations for it would be the decks, the hand and the discard pile describing its areas. Such space is clearly discrete and the corresponding connection between areas is subjectively defined. Schell advocates that ignoring all visual representation aspects is useful to understand more clearly the properties of a given game's space. Finally, the author also provides stereotypes of game spaces in order to explain how spaces can be designed effectively and does so by resorting to the properties of living structures proposed by Christopher Alexander.

2.4.2   Objects, attributes and states

Objects are all elements within the representation of a game world. Objects have measurable properties called *attributes* associated to them. These attributes may assume different values over time, so a given configuration of these values describes the current state of an object.

For example, in a game, you will have to take care of the health of your pet. Not being able to do so causes him get sick. The object in the case would be the "Pet", its attribute is "Health", and the state would be whether he is well or not based on the current value assumed by "Health".

2.4.3   Actions

Schell considers *actions* as a mechanics, defining them as operations that the player can perform in order to achieve his goals in a game. These are usually associated with verbs, such as, attacking, jumping, and blocking.

The author builds an analogy of actions, objects, and states to the elements found in phrasal structure: game objects are "nouns", their attributes defining state are "adjectives", so a game also demands "verbs" refereed to as actions.

A combination of multiple actions in different contexts give rise to unusual, remarkable strategies and effects known as emergent gameplay [13] [1]. Following that line, actions are classified into two types: *operative actions*, which are performed as the simplest level, and *resultant actions*, which, in their turn, involve situations deriving from operative actions handled by means of strategic reasoning.

2.4.4 Rules

Rules are considered as the most fundamental mechanics found in games. Schell states that rules actually define the space, the objects, the actions and their corresponding effects, a the constrains operating over actions and reactions. Also, the goals found in games are fundamentally defined in terms of rules.

The author develops his definition on top of David Parlett's taxonomy of rules and highlights the importance of goals as rules. Therefore, adequate goals must be concrete, achievable, and ultimately rewarding in order to be effective in the game design.

2.4.5 Skill

As suggested by the definition found in dictionaries, Skills are related to abilities or talents that the player needs to have or obtain in order to overcome the challenges she faces in the context of the game. Skill mechanics are divided by Schell into three subcategories: *Physics* concerns what the player can control physically and relates to the real world. Physics skills depends on players' dexterity, motor coordination, agility, and muscle strength, for example; *Mental* refers to the player's intellectual problem-solving skills she uses to overcome challenging situations posed as problems and to make decisions; and *Social*, which at first look suggests refers to relationships and social influence, but actually it also reflects players' perception of opponents reasoning and acts, and also how she manipulates other players acts during gameplay.

Accomplishing objectives in a game requires the adequate skills. So, skill is closely related to the difficulty a player experiences when she plays a game. On the other hand, game designers shall balance player skill with game difficulty so that players stay engaged and in a state of flow.

Schell also discusses about how digital games introduce a dichotomy of real versus virtual skills. Virtual skills are related to the mastery which game characters' performs specific actions, so its experience naturally varies from game to game, since characters can change radically. Conversely, the player's very own skills are referred as real skills.

2.4.6 Chance

Schell also considers the random nature of possible phenomena happening in games as a mechanic. The author advocates that adding a chance factor is beneficial because an unpredictable gameplay experience may stimulate players to give a new try at the same game title. This also add balance when new players join experienced ones in matches.

Such a diverseness of gameplay introduced by chance also adds for a rich setup of configurations to explore. Players might, however, develop an ability to predict outcomes based on experience. The author cites notes that such ability is in fact an skill, so the game may be handled by designers assuming such skill in order to produce an enthralling experience.

3 RELATED WORK

In his book, entitled "Theory of fun for game design", Raph Koster [11] states that instanced spaces found in massively multiplayer games are a designer's attempt to maintain control over the puzzles that players are solving in their gameplay. As can be seen later in this work, Koster's statement closely relates to the concept of horizontal growth we introduce.

These spaces are like a Goldberg Rube Machine built on top of the "physical" mechanics that are available for the game. The limits of this creativity challenge what is proposed by game designers. For example, let us examine how Minecraft players built computers [5], calculators and even printers [6] on top of the "redstone" mechanics.

On the other hand, he also states that larger minimum feature sets developed for use in in online worlds are useful to increase the possibility space by permutations. This allows for a new look over existing problems, that might be solved by means of unprecedented gameplay experience using emergent mechanics. Similarly, Adding new features, content, and mechanics translates into our concept of vertical growth.

Alessandro Canossa [5] defined the analysts' challenge as to establish categories and finding patterns by essentially imposing order in chaotic data. He proposed an strategy to aid gameplay Analysis concerning the selection of variables, their measurement, and the treatment given on the resulting features extracted during analysis in order to obtain meaningful models. In particular, these authors state that variable selection determines which analyses and corresponding inferences are possible.

Tondello *et al.* [17] warns that Bartle's taxonomy for Multi-User Dungeons players [3] was widely adopted into other contexts without even being validated. These authors proposed a conceptual framework of player preferences by adopting *game elements* and *gameplay styles* as dimensions. As a result, they proposed a taxonomy of nine groups of game elements and five groups of game playing styles, which they claim may be better-suited for targeting specific audiences.

Assuming psychological perspective, Yee [19] developed an analysis which revealed achievement, social, and immersion as the three outstanding elements for player motivation. The author also presents insights found from analysis on the relationships between motivations and demographic variables. However, these results do not include assessments on out how game contents may be maintained over a product's lifetime.

Given the context of building an understanding about phenomena, game-related visualization tools are also being a field of research and development, as denoted by recent works [18] [9]. Feitosa *et al.* [9] discuss about how useful a web-based exploratory visualization tool might prove to be for both e-sport audience and teams. For readers interested in the specific details regarding techniques, Wallner *et al.* [18] present an extensive literature survey enabling a comprehension on visualization-based analysis of gameplay data.

In his recent article, Bartle [4] says that MMOs are experiencing a decline because of the following reasons: high development budget; titles are so similar they almost look like clones; imbalanced audience on player profiles; players' high expectations; lack of immersion; and, mostly, lack of understanding of game designers about the aforementioned reasons. The author also explains why he did not mention other problems: these were considered the six most important, and therefore worthy of focal attention.

One of the points on which Bartle discusses the lack of understanding of the Designer is that there is insufficient study on this area. Aiming at this, Bartle does not comment on how this study should be done so designers could have more freedom to express their creativity in their content generation in an "industry-safe" way.

Therefore the investigation is an important step to understand a little better the challenges found in the MMORPG development universe. Moreover, we advocate that is reasonable to assume the case of "Ragnarök Online" can provide important insights in the matter. This is a long-lived title of remarkable success, even in a complex country such as Brazil [6]. Ragnarök world has been

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[5]https://www.youtube.com/watch?v=aQqWorbrAaY
[6]https://www.youtube.com/watch?v=jby2go7ZCKY

maintained throughout a long period of time, and managed attracting new players and keeping the veteran players. So, designers can get a sense of how they can achieve success or failure in future games.

4 OUR METHODOLOGY

4.1 Horizontal and Vertical Growth

MMORPG's are games that tend to be enduring. Many of these last for years before its lifetime ends since there is usually have a large audience of players who are interested in the game and finance it so that they continue to play.

So, the expansions have the key role of making the game public keep engaged playing. Expansions are usually downloaded software packages bringing new contents in to play, such as: maps, mini-games, monsters, items, missions, bosses, etc. Consequently, adding elements to the game causes its universe to expand. However, in what direction(s) does such universe expand into? Our answer to this question assumes that a game's universe essentially grows over two directions, i.e., the game expands horizontally and vertically, respectively. Let us now present these growth definitions.

4.1.1 Horizontal Growth

When new content which the community has never had the opportunity to explore is added to the game, the universe is expanding horizontally. An entirely new map, adding new levels on an existing dungeon, a new quest or a new item are examples of how the universe can grow horizontally.

4.1.2 Vertical Growth

When there is already a content in the universe, but there is some change of the same increasing or decreasing its difficulty (*i.e.*, rebalancing the game), we assume the universe is being shaped vertically. An already existing monster that is now able to cast spells, a mission that needed to grab only 15 items now needs to pick up 20, and an already existing cave that can now be played on 2 or 3 different levels of difficulty are just a few examples of how the universe can grow vertically.

4.2 Growth Directions and Schell's Mechanics

When oneself refers to growth, she is stating that the universe of the game is expanding in some way, either vertically or horizontally. For it to expand, the universe something needs to be perceived as an addition to the game [13].

Game mechanics, in their turn, show us what a given title really is [16]. That said, every new content added into a game corresponds to the addition of some kind of Schell's mechanics perceivable for players. By having this mechanics content expanded, the game universe is being modeled in some way, whether it is expanding vertically or horizontally. In some cases, the game actually shrinks.

However, *Chance Mechanics* does not fit our analysis methodology. We observe that *Chance* is the only mechanics which demonstrates a negligible perception on the contents expansion over the abovementioned dimensions. We are not saying that this game mechanic type has no relation to the types of growth we analyze. Instead, in our case study, this relationship could not be found and, besides, even pose as noise source hindering our analysis from succeeding.

All other mechanics have at least one characteristic that clearly relates to vertical and horizontal growths: *Space* mechanics correspond to horizontal growth; *Objects, attributes and state* mechanics matches both horizontal and vertical growths. However, there is a minor correspondence to the latter; Conversely, *Actions* and *Rules* mechanics are more related to vertical than horizontal growth; and finally, *Skills* relates to adjustments made on challenge, thus it rarely corresponds to horizontal growth.
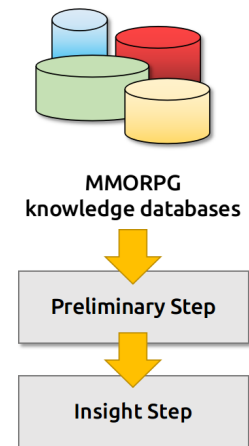
4.3 Overview

Figure 2: Overview of the proposed methodology for MMORPG content expansion analysis.

Our analysis methodology can be summarized as follows (Figure 2). Entries from knowledge databases extracted from on communities found on web is fed into an examination procedure serving as Preliminary Step. This results on organized data which is then provided as input to the Insight Step. This last step is more sophisticated and may resort to many tools, including visualization techniques and analysis methods.

Let us now describe in detail how each step is performed using Ragnarök Online as background example.

4.4 MMORPG Knowledge Databases

MMORPG Knowledge Databases comprise available information describing the contents of each game expansion. Oneself may adopt hacking tools to inspect files from installed copies of the game, considering Desktop platforms. We recommend using websites and communities since valuable information might be found about how engaged players react to updates. Unfortunately, we could not find such information four our case study in time for writing this paper.

We adopted the BroWiki site as a Knowledge Database in this case of Ragnarök. The BroWiki project aims to bring complete and accurate information written in Portuguese about the Brazilian server of Ragnarök Online and its effluents *Thor* and *Valhala* servers.

4.5 Preliminary Step

4.5.1 Identify Expansions

The purpose of this step is to identify which expansions have been introduced over time. It is necessary to extract attributes describing the contents of each expansion [5], which may include structured, semi-structured, and even textual data. Typical attributed are: number of character classes; information regarding cities, dungeons and levels; quests; allowed XP level; items; and, monsters, among others.

Moreover, this step aims to bring data to a convenient and probably tabular format, such as *comma-separated values* (CSV) text files, which is the most widely accepted by the tools used in visualization and analysis.

4.5.2 Account for Space Growth per Expansion

Based on studies found in literature [4], game space tends to grow much more by the horizontal side than by the vertical side. It can be seen from the 31 expansions we studied from Ragnarök, we had

53 elements that made the universe of the game expand horizontal, while only 5 new contents helped to maintain the game in a *vertical* way. This suggests that Ragnarök's developers realized that players were more fit as explorers types (Figure 3). Also, from developers' perspective, players likely preferred a game with fewer challenges and more forms of exploration.
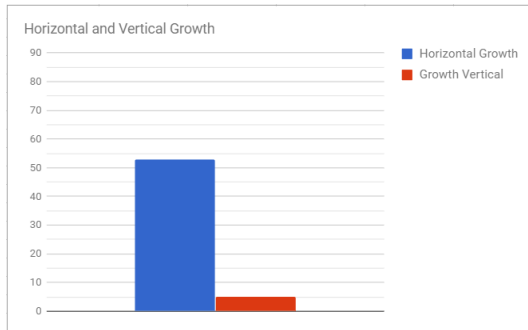

Figure 3: Horizontal and Vertical Growth.

4.5.3 Account for Mechanics per Expansion

In this step, each mechanics found for each expansion are categorized according to Schell's classification. Moreover, we try to observe how these differ from others already found in the game.

In the case of Ragnarök, it is important to note that practically all expansions added some kind of mechanics to the game. We then decided to observe which types of mechanics appeared most often and how the number of them grew as each expansion expanded. The most recurring mechanic was Space. Of the 31 expansions we could observe, space mechanics appeared 28 times, which shows us that the game design was focused on providing a rich exploration experience to the player.

New scenarios, dungeons, forests, and landscapes were introduced for the player to know more about the game universe. According to the Figure 4 the other mechanics types appear with numbers much smaller when compared to the Space mechanics. But even these, in their vast majority, add levels of greater exploration for the player as seen later in charts (Figure 5).
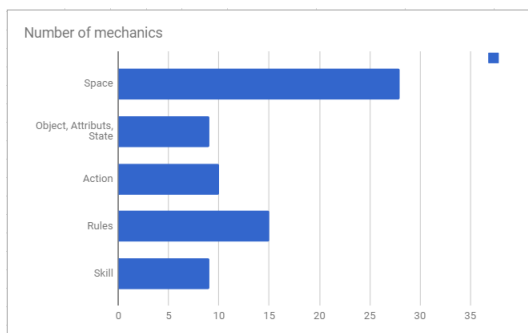

Figure 4: Mechanics growth observed in the title since its creation until 2016.

4.6 Insight Step

4.6.1 Analyze Developments in Game Mechanics

Given the preliminary observations over data, in this step we analyze how game mechanics evolve with time. Concerning the game Ragnarök Online, expansions were divided into two epochs defined by when its renewal was introduced. Renewal corresponds to comprehensive system-wide revamp in the game title as a new form of game design began to be incorporated. Given this, we observed how the mechanics were implemented in their "pre-renewal" and "post-renewal".

As can be seen from the table shown in the Figure 5, we observed that the mechanics of *Space*, *Skill*, and *Objects, Attributes and State* mechanics continued to be modified in a similar even after the game was reworked. However, *Rules* and *Actions* mechanics after the renewal were not drastically modified. This implies that, even after the renewal, in a general way, the overall game rules and the actions that the players could take in the course of it were not influenced by the renovation. We can conclude this kept the game format intact in order to retain service customers.

On the other hand, modifications on those three mechanics added depth into gameplay by means of a combination between emergent and progression-based gameplay. Such a design is known for allowing players to find their own ways of enjoying games [12].

After renewal		
Mechanics	frequency	% Approximate
Space	16	100
Objects, attributes and state	5	31
Actions	8	50
Rules	12	75
Skills	5	31
Before renewal		
Mechanics	frequency	% Approximate
Space	12	92
Objects, attributes and state	4	30
Actions	2	15
Rules	3	23
Skills	4	31

Figure 5: Mechanics corresponding to each of Schell's six categories before and after "renewal".

4.6.2 Visualization Techniques

Given the amount of game mechanics and how they have been modified in the course of the game according to the way in which the growth pattern of the universe has been modified, we must now observe the role played by the mechanics in this actual growth.

Previously it was observed that the Horizontal growth has a frequency of appendages much superior to the Vertical growth. Its main occurrences which made this number so superior, were in the mechanics types for space, actions, and objects, attributes, and state. This can be seen in Figure 6. On the other hand, rule-related mechanics kept the game growing vertically.

So, it is possible to realize that, despite a notorious focus on maintaining a gameplay pivoting around exploring the game world, developers sought to balance the game vertically so that eventual new player profiles could be given an adequate gameplay experience by means of deeper game systems.

Following a line similar to that of [5], we defined the following growth metrics which were observed for all game configurations: the maximum allowed experience level; the current number of character classes; the current number of cities. In particular, cities adds places where players can interact, buy items and explore new quests. So, we found this to be an interesting measure of how the game develops with time. The number of classes jumps, as seen in Figure 7 are followed by an organic increase of spaces. In its turn, two clear increases of the maximum allowed level of XP denotes a rebalance in the difficulty level by adding new monsters.
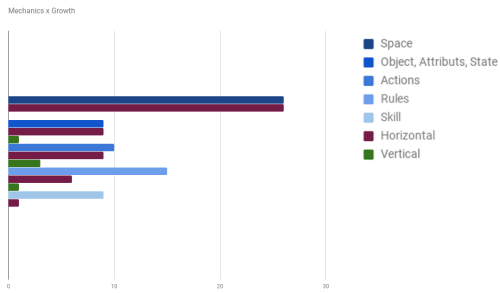
Figure 6: Mechanics growth regarding Schell's classifications *versus* horizontal and vertical growths.

Moreover, by adding the current number of dungeons as growth metric, we could observe that introduction of these spaces usually precedes the addition of new classes. Adding new dungeons also relates to a potential temporary state of unbalance on the challenge level of the game. This hypothesis is corroborated by substantial increments observed over the maximum allowed XP, which suggests players should get their characters strengthened before facing new challenges.

4.6.3 Statistical Analysis

In this context of the statistical analysis, we sought to identify which changes could be explored with respect to the behavior of mechanics and growth already found, albeit preliminary, in the previous stage. We used both Descriptive and Multivariate analysis techniques.

Although they are limited for the purpose of qualitative perspective, descriptive analysis provides means to rapidly discard weak hypotheses by means of simple quantitative metrics such as average, standard deviation, and variance.

On the other hand, multivariate analysis provides means to analyze usually described by multiple variables. So, multivariate models are designed to capture complex, possibly non-linear relationships between available attributes and models. In particular, we resort to PCA [14] (Principal Component Analysis) as the basis tool for this purposes since it has been successfully used for many applications.

Concerning Ragnarök, The calculations of attack and defense were updated in the context of the battle system. Consequently, all the monsters already introduced as game contents were updated and redistributed due to renewal process, as commented below. Therefore, we can try to identify which changes are loaded with elements to suit the new gameplay experience within this context as possible modifications on the pattern found in new expansions.

Creature data is given by two sets of 927 Pre-Renewal records *versus* 1782 records corresponding to Pos-Renew, counting creatures that have been added in other expansions, and the fact that many creatures have received alternate versions due to instances. Results will be presented the exploration of some distributions with graphical representations like histograms, means and medians.

Although we could not perform an assessment of the whole database and its design goals, we sought ways of having a more general understanding over analyzed data. Unfortunately, each creature is represented in the database as a tuple of 57 values, therefore we only adopted 14 of those variables (*LV*, *HP*, *SP*, *STR*, *AGI*, *VIT*, *INTEL*, *DEX*, *LUK*, *mode*, *scale*, *race*, *speed*, and *mexp*).

Given the large amount of data, PCA suits the purpose of observing the attributes indicative and the Pearson coefficient to complement part of the analysis. Hence, this procedure allows the analyst to check components that explain most of the data variation, so we

can try to visualize a component that represents a subtended component of the data. The Pearson coefficient, returns values between $+1$ and -1 that indicate how two variables are correlated.

5 REMARKS ABOUT EVALUATION

5.1 Data used for Analysis

Data we present hereby were loaded from the rAthena project, which provides data on both the implementation of the game and its content. We sought to verify what existed in the project using it as another reference for the basis of our research. The related MMORPG server sub-project describes the use of game contents, but unfortunately, these data were not organized according to each expansion found in the original game. Consequently, we could not consider such data for analysis for the sake of avoiding interpretation errors.

On the other hand, there is a remarkable aspect within the rAthena project: the distinction of an expansion that promotes a large-scale refactoring of both contents and game code. Such episode is known as *Renew* occurred in Brazil at 2011 February. This "renewal" led to a remodeling of some calculations of the game in addition of the third classes, which promoted strong horizontal and vertical growths, besides changes in the user interface and group reservations [7].

5.2 Insights on Monster Design

Insights on monster design can be observed by distribution of pacifist and aggressive monsters, as highlighted by plots of *LV*, *HP*, *SP*, *STR*, *AGI*, *VIT*, *INTEL*, *DEX*, *LUK*, *mode*, *scale*, *race*, *speed*, and *mexp* attributes shown in Figures 9, 11 and 12.

It is necessary to emphasize that this expansion was introduced very close to the fall of several MMORPGs pointed out in the work of Komorowski [10] corroborated by Bartle's analyses [4]. So, this peculiar fact found in Ragnarök's lifetime is certainly worth our attention.

Figures 9 and 10 depict a data plot of monster levels before "renewal". The highest level was 117, the approximate average was 56, and the median was about 58. So, players are expected to have frequent encounters with monsters around these levels. This is due to the fact that, on a map that requires a higher level of training, players usually encounter fewer low-level creatures.

Figure 10 depicts level distribution divided by monster behavior. Aggressive monsters will attack players at first sight without any reason. This type of creature becomes more common as players evolves, as this reduces their risks and frustrations along with frequent deaths early in the game. There was subtle increase of peaceful creatures near level 100.

5.3 Insights on Gameplay Design

We observed how monster design changes the difficulty experienced by Ragnarök players. This seems to be planned beforehand. A class called *transclass* was introduced by the expansion of Heritgate on July 5 2006. A players' character must return to the level 1 after reaching the maximum level of the game, which was 99 at the time, in order to achieve transclass status.

The previous maximum level required players to accumulate 4,000,000 of experience points. This value is a considerable amount. In addition, the new transclasses demanded from level 1 to 99 a total 6,800,000 of experience points, totaling 10,800,000. Moreover, there is a penalty for hunting monsters of lower levels, so there was a need to extend the options suitable for players at this level.

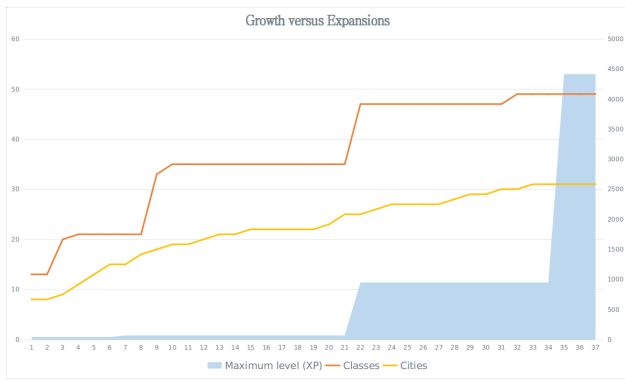[7]http://levelupgames.uol.com.br/hotsite-renovacao-ragnarok/novidades/novidades

Figure 7: Visualization of three chosen growth metrics over time: the maximum allowed XP; the current number of character classes; and the current number of cities.
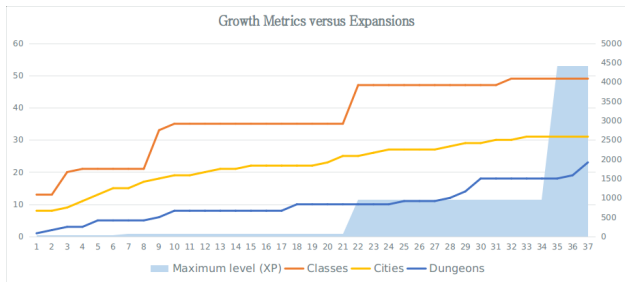

Figure 8: Adding the current number of dungeons as growth metric allowed to propose hypotheses on how the game difficulty was adjusted over time.

5.3.1 PCA analysis

The PCA data are presented below. Plot shown the Figure 14 denotes the grouping of the variables around 2 main components, which together explain about 45% of the variance on the data 13.

We observe the composition of physical attributes defining creatures like "tanks" in component 2 with *STR* and *VIT*, so component 1 seems to be an MVP indicative with high relation to scale, *mexp* (*MVP*, i.e., boss monster experience).
[8].

6 DISCUSSION

Once experimentation was carried out using data collected from web communities, let us discuss results obtained regarding Ragnarök Online.

Concerning the expansions identified in the analyzed title, it was observed that its universe grows in the majority majority in the horizontal direction. We affirm this based on the 53 occurrences of some kind of horizontal growth and only 5 times the vertical. Not only the growth types displayed a disparity, but also in mechanics we could find a big difference when space mechanics are observed. Space mechanics has 26 appearances, a little less than double the second most frequent ones, with only 15 occurrences. Previously, we have seen that space growth is highly related to horizontal growth because, by creating a new space for the player, there will be new forms to explore the game.

However, the reason for the horizontal growth is so superior to the vertical, is not explained by the simple fact that the mechanics of space is far superior to the others. In all mechanics, a higher number of horizontal growths is found compared to vertical ones.

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[8]https://github.com/rathena/rathena/blob/master/doc/mob_db_mode_list.txt
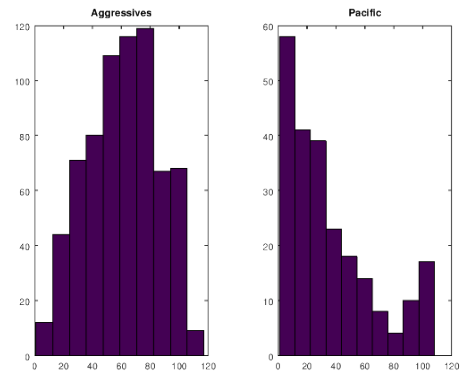

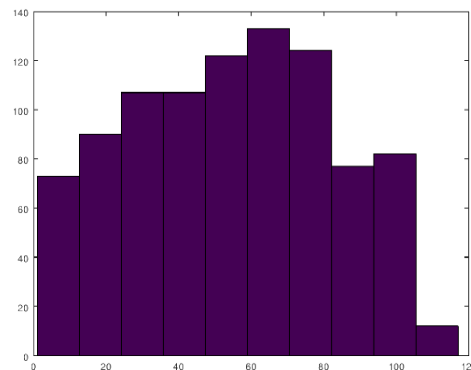Figure 9: Level histogram for pre-renewal aggressive and pacifists monsters.

Figure 10: Pre-renewal histogram of levels for monsters (*level*). At right, we can see that high-level monsters are rarely found. Post-renewal high-level monsters are more frequent, especially those found in the latest updates.

After the renewal expansion, there was a small change in how the mechanics were modified. Mechanics like *Actions* and *Rules* were given less focus on, thus not providing a new player experience regarding what he could do inside the game and the governing rules of such universe.

Much of the data indicates that the game grew in the form of exploration. Developers did not constantly keep up with the difficulty of the game so that they would call themselves new players and keep them. Based on evidence found in our analysis, we can assume, to a certain degree, developers chose to make a game where most of its new contents aimed to give ways for the player to know a new universe.

In other words, new stories, new places, new ways of playing have been introduced. These are no more difficult or easier than the previous ones already released, leaving the players in their comfort zone regarding the challenges they are expected to face during gameplay. Unfortunately, we have not yet been able to cross-validate the analysis with the feedback from the happy community.

7 CONCLUSION

A game universe can be molded in different forms, just like it was clay for the game designer and his work in turning it into diverse types of play experiences [16]. Our investigation showed us how and where this "clay" is being placed in an existing MMORPG game.
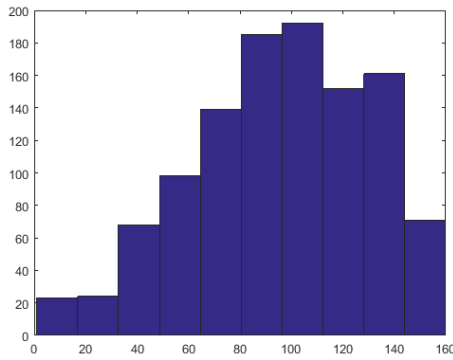
Figure 11: Level histogram for aggressive monsters after renewal. No significant change was detected.
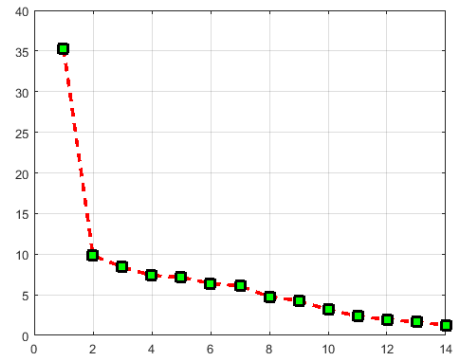

Figure 13: Explained variance for each PCA component after "renewal".
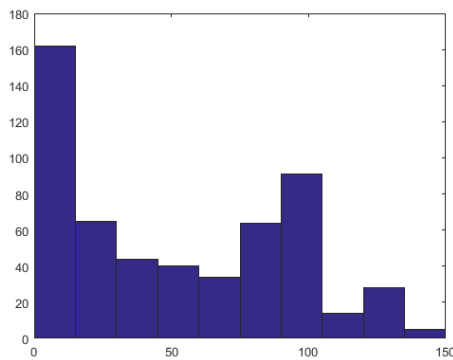

Figure 12: Level histogram for "pacifist" monsters after "renewal" displays a significant change. Certain monster classes were endowed with spell-casting skills which, in turn, made them harder to fight against.
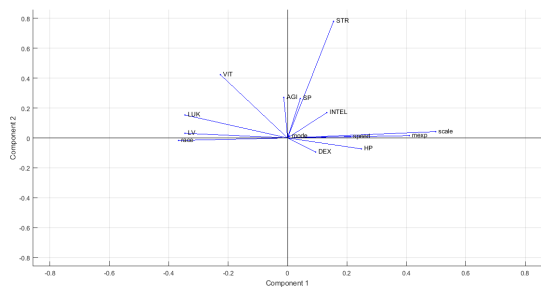

Figure 14: Loads for each PCA component after "renewal".

We have observed that the game can be shaped in two directions corresponding to the horizontal and vertical we hereby introduced, being these two closely related to the mechanics found in the game. Each implementation of updates in the analyzed game the universe can be redirected to a growth that points to one of these sides. There are also some moments it remains static, even if there is some increment on mechanics. Understanding how this growth occurs helps us understand what kind of players we considered as the target audience behind the design decisions taken at updates.

We must also observe that Ragnarök underwent a refactoring in both game design and aesthetics when most MMORPGs experienced a decline. Our approach allowed to identify clear efforts towards enhancing the experience of players who like difficulty, to not stay in their comfort zone during the gameplay. We can also detect if the game was modeling its universe in order to captivate players who prefer to be surprised throughout history, knowing new places, but keeping the difficulty of the game constant or if we are welcoming these both player profiles.

Based on the understanding of how new contents affects a successful game, oneself can take such knowledge as inspiration for ideas on developing and modeling a new title. Designers and supporting developers can then avoid making game clones as quoted by Bartle [4]. We saw that in the case of Ragnarök, its design was more focused on exploring new content, thus bringing an experience of universe knowledge to players by letting them experience new story

plots, cities, landscapes, among other forms of exploration. Additionally, such exploratory focus was carried out while the level of difficulty of the game being changed drastically over time.

It is also important to observe that other mechanics involving jobs, items, pets, etc, were added for each expansion in order to allow for players to build an identity as inhabitants of the game world.

There are numerous research opportunities starting from this investigation. We hereby enumerate some lines worth future research effort: expanding and adapting our methodology to support analysis of other game genres; performing a comparative analysis considering other knowledge databases describing how other MMORPG titles developed over time; carry out cross-examination of our analysis with insights extracted from information on player engagement; and tools providing support-time recommendation as useful inputs for procedural content generation techniques.

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