Historical Representation and Game Mechanics: A Case Study on WWII

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Figure 1: The prototype game is inspired by WWII, which determined its design and mechanics. The game's main screen (left) and its battle field screen during a campaign gameplay (right) are hereby depicted.

ABSTRACT

A myriad of works found in movies, novels, games, and other media are closely related to the history of mankind. Despite the fact that history, as we know, is subject to controversy due to the influence of human activity built upon the true, real facts, the process of designing a historical representation in this type of product is a matter of the utmost relevance to the entertainment industry. In this work, we first present a comprehensive discussion about the representation of history found in games in order to defend a playful standpoint in which the representation process must be designed to mediate how the game is used for entertainment purposes whilst it also conveys credible information about the context and events. Finally, we present the design process of an actual turn-based strategy game inspired by the World War II that considers the historical importance of machinery, notable figures, and combat strategies under the light of how game mechanics can be used to portray aspects documented from this remarkable event of human history.

Keywords: Historical representation, game mechanics, turn-based strategy games.

1 INTRODUCTION

Folklore is a fundamental trait of human culture [6] inspiring generations through centuries. A myriad of works found in movies, novels, games and other media are closely related to the history of mankind [16]. Despite the fact that history, as we know, is subject to controversy due to the influence of human activity built upon the true, real facts [8] [5], the process of designing a historical representation in this type of work is a matter of fundamental importance to the entertainment industry as business.

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Stories are also told in modern, electronic games and comprise an important element considering how developers approach game design [20]. Many remarkable titles are can be classified as an interactive narrative experience built on top of gaming software and hardware components as the supporting platform for storytelling [17].

In this work, we first present a comprehensive discussion about the representation of history found in games in order to defend a playful standpoint in which the representation process must be designed to mediate how the game is be used for entertainment purposes whilst it also conveys credible information about the context and events [10] [3]. For doing so we developed a prototype game as a study case. We present the design process of an actual turn-based strategy game inspired by the World War II (WWII) that considers the historical importance of machinery, notable figures and combat strategies under the light of how game mechanics can be used to portray aspects documented from this remarkable event of human history.

These are the main contribution of this paper:

- Discuss about history representation in media, with special attention to electronic games.
- Discuss how traits, facts, characters from history can be represented in game mechanics.
- Propose turn-based game based on WWII.
- We describe in detail how historical representation led to results of an actual game development.

The remaining of this work is organized as follows. Section 2 brings forth background definitions and studies about history representation in media works. Related work is discussed throughout Section 3. Game design choices we made for shaping a turn-based strategy game representing WWII is detailed Section 4. The game prototype is shown in Section 5 along its implementation details. Results obtained regarding the prototype are discussed in Section 6. Finally, Section 7 presents concluding remarks and future works.

2 History Representation in Media

2.1 History. Storytelling, and Adaptation

As stated by Silva Filho *et al.* [6], creating characters is a practice which origin is intimately related to various expressions of human society such as history, myths and religion, so storytelling systems usually resort to creating characters representing transcendental beings that personify ideas, thus inspiring and influencing the upcoming generations of human society. It is worthy to mention that numerous myths and religious figures were also inspired by actual historical facts and persona [24]. These authors also point out that, since elements from many cultures are now available to be known in many artistic works from different medias, creating original character design might be very difficult. Moreover, Silva Filho *et al.* also warn to the small number of academic research carried out on character design processes regarding the gaming industry Thus, there is a common sense that story-making as we know is often related to storytelling, which, in their turn, comprises narratives and representations of historical facts [10] [23].

Thomas Leitch [16] considers as natural that oneself should gravitate toward the political motives in adaptations of different kinds as the politics of history adaptation. Although this may suggest a strong criticism which in turn will be open to virtually all kinds of controversies, the author states that most scholars usually focus on placing different adaptations into historical contexts in order to unveil the underlying political motives which may be occluded behind facts as they were documented. Instead of adopting this essentially critical standpoint, Leitch proposes to discuss the status of history itself as a series of adaptations in order to establish a context that foregrounds not only the historical determination of adaptation but the adaptive nature of historiography.

The relationship between the facts used as references (i.e., the documented history) and the adaptation strongly depends on the purpose of the work: for example, a historical film can be accused of poor representation when actors' costumes or speeches do not resemble the idea that the spectators have of that epoch or occasion. [5]. Let us take the movie 300[1] directed by Zack Snyder, analyzed by Clare Foster [5], as an example. According to her report on information collected from interviews, the director claimed that the film was 90% accurate compared to the historical fact known as the Battle of Thermopylae. However, at the time the film was targeted from accusations that its depiction was disrespectful to modern Iraqis and Iranians, considering in the historical context that George W. Bush's War on Terror was at its peak. The director informs that the actual original work was the influential comic magazine 300 HC[2] by Frank Miller, which, in its turn, is an artistic adaptation of the same historical battle. Therefore, there are other elements for consideration besides fidelity to the original reference material and the purposes of the work itself.

2.2 History, Games, and Ritual

Liminality [23], in its turn, is an anthropological concept borrowed from Arnold Van Gennep, who examined rites of passage in many cultures. Turner resorted to develop his own definition of this concept in order to give more sense to ritual processes. Gennep's original definition is relatively complex and it associates liminality to a tripartite processual structure despite the possible occurrence of many clearly separate episodes. Turner's definition, in its turn, states that liminality would be the transition between two different states of existence. For example, a priest preparing for a ritual, at which time he leaves his "normal self" and then changes into the ritual priest's existence for the duration of this spiritual experience.

We argue that it is reasonable to assume that player's attitude towards playing a game fits the definition of liminality space proposed by Turner. So, modern virtual liminal spaces are autonomous realities, clearly demarcated from the social structure and can optionally be entered as reality in a game which the player submerges into for the sake of her search for entertainment [24]. The liminality of a game has as main objective the player's leisure and it does so by presenting typically reductive and surrounded worlds. The game theorized by Hong produces a sense of time-space removal which is common for the game world, while, at the same time, it can rely on a scenario of a historical representation.

Hong also presents an analysis of the liminal qualities that a game that oughts to represent history must possess. First of all, the game has to be sufficiently real. The author resorts to the well-known title The Elders Scrolls V: Skyrim [3] developed by Bethesda Game Studios and published by Bethesda Softworks, which represents a changed Norse mythology for the game world o exemplify the aforementioned quality. This game's universe suffers from climate changes, displays day and night circles, and has its own lunar system. All this makes the experience of playing that title plausible enough for the player to deem it believable. Let us observe Skyrim's representation of the Norse. "Nords", as they are called in the game, have high stature, light-colored hair and eyes, wear helmets with horns and use big axes as typical weapons. This makes the player easily associate the Nords with the idea that he has of Vikings, coupled with a communication that the game design gives the player his concept and also what kind of prior knowledge the player must have to understand the game.

The second quality of Hong's liminal game is *mystical time*. The past as experienced in games is usually a representation of a context of when life and death were at stake, even though players are aware that what is presented in the game is not the actual story. The concept of mystical time and how the game uses it for liminality can become richer when used along with one of the definitions from Schut [21] on the representation of history of the games, that it is mostly (and unfortunately) masculinized due to the paternalistic traits found in most cultures. Most games that simulate history tend to involve elements related to armed conflict, politics, and economics. These aspects demonstrate the aggressiveness, commonly associated with masculinity. Mystic time also attempts to bring to the game a liminal representation of an era in which the player is in a place where his decisions can influence history, which in its turn, relates to the concept of *agency* from Storytelling. The point is that the player does not necessarily want a story representation identical to the events as found in documents and culture, but rather a scenario that she can interact with the historical space presented by the game, like a sandbox.

In this sense, Hong [10] states that the development of a game title is also becoming the creation of a world fulfilled with symbologies, rules, mechanics and art that create a coherent space or reality for manipulation by the player. Hong agrees that such a game space can be classified as a Turner liminal space, although a derivative one while we advocate that games are becoming fairly close to the definition of liminality [22]. It can be stated that such an existence experienced by players in the game's universe and in the real-world communities built around it are not a way of escape from reality, but a more interesting, positive, and rewarding existence [19] [4]. In fact, these observations would even allow us to coin the term "gaming ritual".

Following a similar but more intense line of controversy to Snyder's 300, the game *Playing History 2: Slave Trade*[4] by Serious Games Interactive meant to be an educational title about how barbarous, inhuman, and cruel were the practices involved in slave trade. Given a sensitive subject, one of its game modes entitled "Slave Tetris" is about to stack the maximum of African slaves on a slave ship using a mechanic similar to that of the iconic game Tetris

[1] https://www.warnerbros.com/300

[2] https://www.darkhorse.com/Books/48-339/300-HC

[3] The Elders Scrolls V: Skyrim

[4] https://steamcommunity.com/sharedfiles/filedetails/?id=310110691

by Alexey Pajitnov. Developers supposedly intended to show how inhuman and how crowded the slave ships were. However, when this mechanic came to the attention of the public, it was viewed with disgust. As a result, the developer had to get the game mode removed. Despite the strong controversies surrounding this case, this example shows game developers have at disposal the means to represent historical elements using mechanics and gameplay.

2.3 Preliminary Discussion

Based on the discussion presented earlier, it can be observed that a game simulating historical events usually resorts to a representation that limits itself to the space in which the history was preceded and not the events themselves. Additionally, it can be preliminarily concluded that history in digital games tends to be less about a linear narrative and more about the representation of historical places and systems, be they economic, social, technological or military.

Consequently, an assumption can be argued in that games have, or should have, a historical representation intrinsically linked to their main characteristic that separates them from other forms of entertainment: the game mechanics.

3 Related Work

Given the previous discussion about history representation in general media and also electronic games, let us now discuss what are electronic games and their game mechanics for the purposes of this investigation under the light of related works found in the literature. Aspects regarding representation of historical elements found in games will also be approached with a greater level of detail and specificity.

3.1 Electronic Games

Defining what a game may depend on the perspective or goals considered by oneself for accomplishing her game title's purposes. Schell [20], for example, defines games as a problem-solving activity which is approached with a playful attitude. It follows that, during their gameplay, players will face challenges that must be overcome by means of actions performed considering some sort of skill or even chance. Schell defines an approach for game designers, entitled *Elemental Tetrad*, he believes is useful to determine what a game is truly made of, thus dividing the game "contents" in four element types: technology, mechanics, story, and aesthetics. The author proposes that designers might consider both each of these elements separately and their balancing and coherence as a whole. It must be observed that a previous study presented by Hukicke *et al.* [12] proposed a similar analytic, formal framework for understanding and designing games, which is called MDA (Mechanics, Dynamics and Aesthetics). These authors introduced the concept of *dynamics*, which is closely related to the act of gameplay: dynamics occurs when game mechanics acts due to effective play over time.

In a recent study, Maranhão *et al.* [18] exhaustively analyzed a dozen definitions proposed by prominent scholars in the literature on what a game is. The authors mapped each of these definitions into twenty characteristics in order to obtain an objective, succinct definition of a game which may improve general understanding between designers, artists, programmers, and even players. They proposed *Rules*, *Objectives*, *Activity*, and *System* as the main characteristics useful for building an effective, embracing definition of what a game is. This definition is consistent with that adopted by Schut [21]: this author explains that since computers and games are systematized and procedural, so inescapably digital games will also be.

Roger Callois [3] states a definition of games built on top of that proposed in the seminal works by Huizinga [11]. Callois advocates that the outcomes of a game match (or play) should have uncertain ending which depends on how it was actually played. This idea is intimately related to how much replayable a game is. Such quality drives gameplay experience away from boredom, hence it is of fundamental importance in order to turn a game title into a captivating product of the entertainment industry. Moreover, designers should expect greater engagement from players who feel free to feed their curiosity by taking different approaches when the game is played again.

3.2 Game Mechanics

Starting from his elemental tetrad, Schell [20] defines mechanics as "the interactions and relationships that remain when all of the aesthetics, technology, and story are stripped away". This statement provides evidence on the abstract nature of game mechanics, whether it is mathematical or procedural. Adams [1] also associates mechanics to the rules, processes, and data existing at the very heart of a game. Works found in literature even attempt to categorize game mechanics into groups and hierarchies [7] [13] [20] [17].

Maraão *et al.* [18] define game mechanics are mechanisms based on rule sets that compose the logical functioning of a game. Their perspective was considered more adequate for the purposes of this work: "mechanics become perceptible to the player when a set of rules has a unique and meaningful interaction". There is room in this definition for representing historical events, since it is grounded by how players perceive the inner workings of the game world.

3.3 Game Genres and Mechanics

Thomas H. Apperley [2] developed an examination about the notion of genre in video games. According to the author, market-based categories of game genre developed in the context of video games obscure a decisive defining feature of this medium by dividing titles into groupings broadly organized based on their level of similarity with other games defining prior forms of gameplay mediation. His argument also makes reference to the two supposedly opposite lines of thought and that define proper taxonomies for the games, narratologists, and ludologists, which adopt narrative instead of visuals, actions, and events as the main perspective for understanding electronic games, respectively. Apperley suggests that games can be better understood considering an interplay between these two game taxonomies.

However, there is a reasonable understanding that players' categorization of game genres drives away from the taxonomy proposed by narratologists, so we can assume that the elements of gameplay stand out in the eyes of the players with respect to the narrative. Therefore, decisions about the desired game genre of a title under development are a key driver for an actual project because of the forms that representations within the game may vary according to the characteristics peculiar to the chosen genre, and consequently the mechanics which are typical of that style of gameplay defined by the genre itself [20] [1].

Eva Kingsepp [15] examines the potential perception of time travel that she defines as "historical immersion" considering war-themed games such. The author adopts a semiotic perspective to accomplish an analysis over visual and auditory signs. She argues that the analyzed games contribute to collective memory but also highlights that historical facts are not considered of great importance when compared to the exciting elements of gameplay and ambiance, therefore such games change the history and narratives found in WWII to make it an stereotypical event. Such conclusion corroborates the observations on history representation made by Hong [10] and Schut [21], which are related, as we observed beforehand, to the potential game mechanics can harness for making users to interact with a plausible history and influence its possible outcomes.

Goddard and Muscat [8], in their turn, propose that research on game design should be approached by means of genres. These authors argue that genres are helpful to demarcate flexible but meaningful resemblances between titles which are worth of investigative

efforts. Goddard and Muscat claim that scholary propositions in terms of design values, structural patterns, and aesthetics provide a foundation for studies. Such a foundation is, to a certain degree, similar to how the elemental tetrad proposed by Schell [20] takes form under the light of an actual game despite the explicit reference to technology and story elements. This adds up some sense, since games falling into the same genre can vary in thematical and technological choices while they keep essentially the same overall gameplay structure.

3.4 Design and Mechanics of Turn-based Strategy Games

Schut [21] resorts to Crusader Kings II (Paradox Development Studio, 2012) as an example of mystic time. This is a strategy and historical simulation game which can be played as one of the historical characters of the medieval period at Europe, chosen from the thirteenth to the fifteenth century, therefore gameplay indicates an interpretation of the chosen character. However, the player is not obliged to reproduce the deeds of William if she wishes to play like him, and may simply give up and then conquer France or just settle for his duchy. The point is that the player does not want a story representation identical to the events, but rather a scenario that he can interact with the liminal, historical space presented by the game.

Systematization of games is also an option to represent history using mechanics. Schut [21] explains that, due to systematization, all occurrences belonging to the game's system are well-defined. This systematic apprach differs from those played by characters endowed with many duties: it can be a father, husband, dog owner, judge and an ice cream lover, occupying various types of roles at the same time. In Rome: Total War (The Creative Assembly, 2004), military units have a sole function or role, and it can vary from a unit of infantry, heavy cavalry or even general, with no transition between these roles. For example, a decorated soldier can not become general in this game. Moreover, this title lacks systematization regarding technological advances since clear and strict evolution paths must be traversed by players in order to obtain a certain unit.

Most titles avoid this by using random factors in their actors and mechanics for the sake of fleeing from predictable patterns. Chance is even more noticeable in battle simulations, which are so common in strategy games. A quick survey of military history shows that this is completely unpredictable. For example, the aforementioned Battle of Thermopylae: warriors can bravely fight lost battles and others may retreat from a certain victory because of a bad omen. Although the games attempt to model the battle as mechanics as effectively as possible, it can be recognized that battles are not a deterministic event with a system of closed and certain possibilities but a measurement of probabilities.

Finally, Schut [21] and Hong [10] agree that a game that represents the story exists so that the player can interact with it and not just watch it by endowing her with agency. Therefore, the end of the game should not be predetermined. This is precisely the essence of what Henry Jenkins [14] describes as spatial storytelling: telling the story of the world, a story in which "where it happens" is more important than "what happens". Due to the proficiency that digital games have in creating a consistent, tangible and navigable space, electronic games are well suited to spatial storytelling and its subsequent use to represent historical elements.

4 Case Study: Designing a WWII-themed Game

Given the theoretical grounding provided by means of analysis on background and related works, let us now detail the game design of our WWII-themed turn-based strategy prototype game which incorporates facts of this historical event into its mechanics.

The theme of World War II was chosen because it is relatively recent and well-documented in vast detail by many sources of information when compared for example, for example, the Ancient or Modern Age. This allows for greater fidelity in the connection between the original works and the game prototype constructed in this investigation.

The game genre was a decisive decision because the forms that a representation can take vary greatly according to the characteristics peculiar to the genre and consequently the mechanics typical of that gameplay style. We decided by the adoption of the Tactical RPG genre, a subgenre of both strategy and Role-Playing Games (RPG). Among its main characteristics, we can cite: (a) the use of a board in which the player can move his units, represented as pieces similar to Chess, into in order to attack, defend, and flee; (b) pieces have different classes and corresponding moves at their disposal; (c) the opponent also has control over a piece set; (d) usually the player who defeats all units of the opponent or performs a maneuver analogous to a checkmate is considered the winner.

According to the objectives of the present work, our design choices are taken for the sake of endowing our prototype's mechanics with two fundamental qualities: (a) these must be sufficiently credible; and (b) these should represent the history of World War II. It is important to point out that the main goal of this effort was not to create a fully thematized game about the WWII historical period, but focus on its game mechanics due to the severely reduced team of developers. So, let us now discuss aspects found in war-themed strategy games.

4.1 Reference Games

Shining Force: The Legacy of Great Intention [5] [6] published by Sega in 1992 is an iconic example of turn-based tactical role-playing game. Units can equip items before battles in which they are allowed to move, use items, perform attack, cast spells, and even search the area. Battle action order depends on agility scores for each unit. Classic RPG elements such as scenery exploration, dialogues, experience points, and leveling up are also present in this game.

Final Fantasy Tactics[7] (FFT) published by so-called Square Company in 1997 is also a strong reference for this kind of gameplay. FFT combines elements from acclaimed Final Fantasy series with an isometric tridimensional battle field, providing a gameplay similar to that found in Shining Force series, but adding random battles, a larger game world, and an adaptation of mechanics from Final Fantasy series into play.

In the real-time strategy game Hearts of Iron III[8] by Paradox Interactive, the player must control the economic, social and military aspects of a nation during the period of WWII. Historical elements have been adapted or changed to fit the game. More specifically, if the player decides to play with Germany then she will not necessarily lose the war. Something similar can be said of a non-experienced player who chooses to play with the Soviet Union: he may end up losing to the Axis. It is important to emphasize that this game tries to provide a plausible simulation considering the elements that defined the victory of the USSR. For example, most of the Soviet generals in the game have bonuses when fighting in the winter. This represents history directly in the game mechanics since the connection between the original work and the final product presents a satisfactory level of fidelity since the purpose of the game is to bring to the player the experience of commanding a nation during one of the most unstable periods of history, in which elements such as climate, strategies, and decision-making were decisive.

In Civilization V by Firaxis Games the player chooses a civilization, based on various empires, kingdoms, tribes or countries

[5] http://sega.jp/kt/apple/shiningforce/

[6] http://segaretro.org/Shining_Force

[7] http://dlgames.square-enix.com/fft/en/

[8] https://www.paradoxplaza.com/hearts-of-iron-iii/HIHI03GSK-MASTER.html

of history, and make it survive on a map that may contain between one or seven other civilizations controlled by other players or by the computer, in addition to several city-states. Each civilization possesses a military unit that corresponds to some historical element connected to that civilization: the French Empire has the Musketeers; The German Empire has the Panzer, and a unique effect connected to its history; and Portugal gains more coins in the game using its trade routes, which symbolizes the historical role of this country in the Great Navigations. These examples show how games appropriated history to design mechanics, plot lines, or audiovisual elements.

Figure 2: Kantai Collection, by Kadokawa Games (2013). Kanmusu Yuudachi, at left, is an aggressive and bold character representing an iconic destroyer of Imperial Japanese Navy at WWII.

Kantai Collection [9] by Kadokawa Gamesis a game for Web and Android (Figure 2). This title is abbreviated by Kancolle. This game resorts to the antropormization of warships of World War II as girls, ranging from children to adult women. These are called "Kanmusu" in the game plot of the game ("girl-ships" in Japanese). Although unusual, this game provides a clear example of what it is possible to achieve as a representation form less focused on reality and more focused on history.

4.2 Our Game: A World in Flames

After decisions on specific thematic and genre, in addition to presenting the main titles taken by reference, let we now focus on how the history of the World War II was adapted into the prototype game entitled *A World in Flames* (AWIF).

4.2.1 Storytelling *versus* Realism

Concerning our game, how tenuous or clear can be the line between history and myth? The representation in a game, different from what was initially expected when thinking about a project portraying historical facts and that motivated the realization of this research, has no strong obligation to strict realism unless it is a game of simulation. We found, by means of investigation and analysis of related titles, that in the game world shall be, above all, believable.

We opted to focus our development on credible game mechanics and units representing WWII. Moreover, we also believe it is worthy to use level design to favor historical representation since it provides the setup necessary to explore mechanics according to the concepts, facts, people, abilities, and strategies found in documents about WWII.

Finally, we also consider important to adopt a representational approach aimed at searching for mechanisms to mitigate and prevent possible criticism and controversy. So, we chose to introduce a fictional, terrifying, and surreal common global enemy which must be fought in cooperation with all countries.

[9] http://kancolle-a.sega.jp/

4.2.2 Background History

As stated beforehand, with this narrative emerged the need for a rival absent or preventing from criticism since the WWII still left stigmas over many countries and cultures. A plot was developed so that the enemies were no longer Polish, French or English, those that Germany faced during the war, but an unknown threat called Mistfolk. This term was coined from neologism in the English language and means "people of fog", designating beings that represent several past epochs of the history of the humanity.

The Mistfolk allowed us to include representations from the Middle Ages to the Contemporary Age but also emerges as a critical, philosophical discussion line against wars. By doing this, we mean that the enemy faced in this game actually reflects the heinous warfare culture that curses humanity from its very beginning. Therefore, the game plot suggests that these partially ethereal beings called Mistfolk are aggressive towards humans, but are able to physically influence the story in the world of AWIF. The chronology of the game world was chosen so that it allows to capture and represent details about the real facts occurred during WWII.

4.2.3 Game Design

The game A World in Flames was designed to focus on narrative elements through its various menus. This means that players will also gather historical information about the status of countries, cultures, and technology at the time period of WWII. Moreover, the ambiance of battles are also depicted by texts found throughout game menus.

First, the player must choose a Campaign to play, which is based on real facts from WWII. Considering actual gameplay, we adopt a classical approach for units and battlefields as found in the reference titles. Two historical facts of the Second World War were selected to be represented in the mechanics of the game: Blitzkrieg and military units.

Starting from the relationship between turn-based strategy games and the actual events of the WWII, we can observe the outstanding military performance of Germany over Europe as victorious for a period longer than two years by resorting to a new military tactic called "Blitzkrieg" (lightning war). Blitzkrieg was successful against many countries for at least three years. Given the historical importance of the Blitzkrieg, it was designed a game mode baptized according to this tactic of war, seeking to represent it through level design.

Military units are groups of people who fought during the war. Examples of units include a platoon, usually formed by eight soldiers, to an entire division of up to 10,000 soldiers. Units similar to these will be participating in the battles depicted in the game. The purpose of the units is to try to recreate the way in which certain divisions were formed during the war and to symbolize their strength, whether in numbers, firepower, or speed. For example, according to historical references, the German motorized divisions would be faster than the divisions of Polish cavalry.

As the game design developed for our AWIF prototype, the choice made as a turn-based strategy game was proven to be appropriate for historical adaptation. We found that these two core historical facts chosen as the focus could fit comfortably into the aforementioned mechanics: the units would be the player's pieces while the Blitzkrieg would be the very form that the board is created.

We also developed auxiliary mechanics as a detailed representation of fundamental aspects of what a war actually is from operational, economic, and logistic standpoints: Arsenal, Barracks, Production, and Modernization (Technological Development). These game mechanics are detailed later.

4.2.4 Blitzkrieg

Blitzkrieg was a war doctrine used mainly by Germany that consisted of mobility and surprise in order to penetrate through the enemy lines with as little resistance as possible. The corresponding game mode is represented in the game's battle prioritizing for Blitzkrieg's main points, which are mobility and surprise, built on top of the game mechanics.

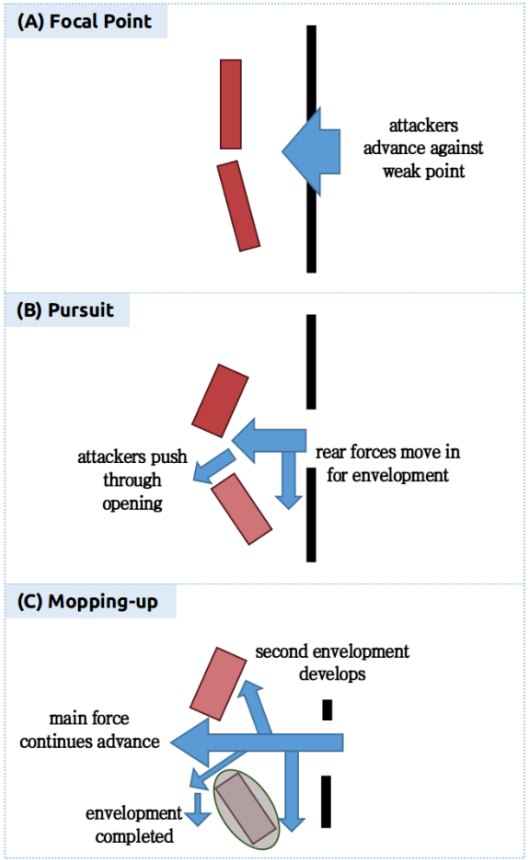

Figure 3: Blitzkrieg is designed to disorganize among enemy forces by fast-paced operation. There are three steps involved: (A) Focal Point, (B) Pursuit, and (C) Mopping-up.

So, we tried to represent all of the operation methods related to Blitzkrieg as theorized by by Heinz Guderian at 1937 [9]. There are three main operation methods, as depicted in Figure 3:

- Schwerpunkt (Focal Point), as seen in Figure 3-**A**. This is the decisive operation method and a point of main effort crucial to the achievement of the overall result. Hemce, concentrated forces are used for breaking through enemy lines and gain advantages by fighting in the enemy's rear.

- Pursuit, depicted in Figure 3-**B**, a fast-paced operation in which attackers push through opening in enemy forces while rear attacking forces move to envelope, i.e., encircle enemies in order to apply pressure by forming pockets and even making the enemy surrender. Amphetamines were given to the troops, especially drivers, to keep them awake during this operation.

- Finally, during Mopping-up (Figure 3-**C**), envelopment was complete, so other pockets can be formed as the main force continues its advance. Most losses upon the enemy are inflicted by a concentric attack leading to either victory in combat, or a mass capture of prisoners and weapons.

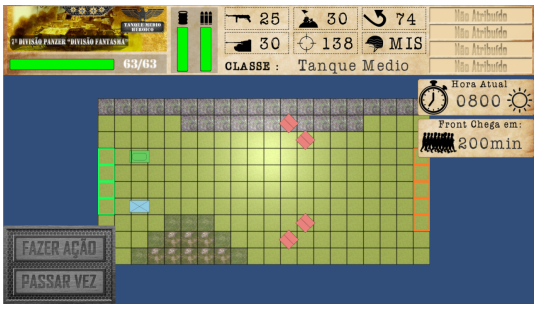

Figure 4: Battle field setup depicting Focal Point operation. The main goal is to advance into enemy lines and reach the weak spot hereby depicted by tiles highlighted in orange at right.

4.2.5 Battle Field

Battles in the Tactical RPG genre occur primarily on a board in which allied and enemy units move while attempting to complete a goal or simply eliminate all opposition. Final Fantasy Tactics (Squaresoft, 1997) and the Shining Force series (Climax Entertainment, 1993) are good examples of this genre.

Tactical RPG games revolve mainly around their battle mechanics, where two opposing forces compete on a board. This requires a lot of strategy and tactical thinking to effectively defeat your opponents. The battle field is divided into square cells, i.e., tiles, for simplicity.

In the initial design, the board would be divided into two sections, the allied section and the enemy section (Figure). The units would not move between tiles, which is a square of the board. Both sections would be divided into two trays of dimensions 9x9, chosen empirically by considering real values for units' movement speed.

A more sophisticated but still simplistic battle field level, designed to represent how Schwerpunkt operates is depicted by Figure 4.

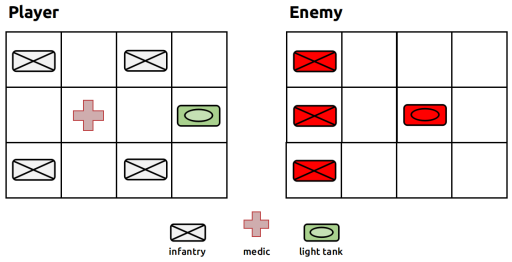

Figure 5: Preliminary design draft of the Battle Field and typical units represented by symbols and colors, referring to their class and the army they belong to, respectively.

4.2.6 Units and Battle Design

In the most seminal design, each unit in the board would have three attributes: range, measured in tiles; hit points, indicating whether it is still alive; and damage inflicted by its attacks. Given that movement was not allowed, unit positioning before battles was crucial. This battle system was discarded due to its simplicity, bad level progression and lack of forms for representation: units and battles are meant to be more powerful and crowded, respectively, as the game evolves. Moreover, a battle doctrine focused on mobility would not

be simulated in a game using immobile units. Each cell of the battle field is assigned to a terrain type, which in its turn, represents the difficulty that certain units has to navigate through a given environment. For example, motorized units would navigate much more easily on a road than in a forest or a mountain.

Concerning Blitzkrieg, representing Schwerpunkt requires a definition of the player's more agile troops forming the spearhead which would try to pass through the enemy lines and reach the other side of the map, defeating or not enemies in its route. A timeout mechanic was added to reinforce speed involved in this operation, so the success of the attack requires the spearhead to complete the Schwerpunkt before the Front and Support forces reach the battle. This is depicted by Figure 4

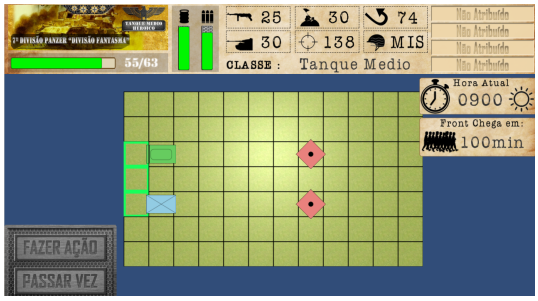

Figure 6: Pursuit stage has the smallest board size.

The Pursuit phase is simulated on a small board. This is illustrated in Figure 6, where the spearhead encounters the enemy carrier. The support group on both sides consists primarily of artillery units and noncombatants, such as doctors and engineers who either focus on (a) getting behind the front to deal devastating long-range damage, or (b) assisting the recovery of allied units.

Finally, during the Mopping-up phase, spearhead units now come back to help the Front and Support in the final stage of battle. This is depicted by Figure 1. It is worthy to observe that, when an actual Mopping-up operation is performed, the enemy is already under pressure at large disadvantage. However, this goes against the progression in difficulty a player expects from a usually challenging final battle. Hence, in order to provide a liminal balance necessary for endowing players with agency, Mopping-up is set up to represent a successful Pursuit also allows development of players' personal approach based on their findings.

4.2.7 Target Types

The units in AWIF, in addition to being divided into classes, are also divided into target types. This attribute indicates what kind of attack on this unit is more or less effective. The types of targets used in the game are: hard, soft and heroic.

This division aims to represent the effectiveness of certain weapons and ammunition. Artillery units of WWII usually had two types of ammunition, the explosive and the piercing. Explosive ammunition was intended to destroy at first contact and spread shrapnel as far as possible, while the piercing ammunition intended to penetrate through the first contact and explode on a smaller scale. However, drilling ammunition is more potent: after the first contact with unprotected targets such as infantry, it could then hit protected secondary targets, such as tanks.

It would sound strange for an infantry unit to be equipped with rifles to inflict enough damage to destroy tank-based units. So, units were divided into the aforementioned categories as these were separated mainly by their classes. Infantry in general would be soft targets, while tanks and mechanized hard target units.

Finally, the Heroic target type is a special case: such a unit belongs to one of the unit classes but does not share its class' corresponding target type. The Heroic target is a more fantasy-oriented representation than a depiction close to reality, thus representing heroic or impressive acts that a certain unit realized during the period of warfare.

4.2.8 Unit Classes

With regard to unit classes, they would be influenced of what kind of purpose the corresponding unit performed during WWII, its type of equipment, technological level during its existence and the missions that it would participate in.

The following classes were defined in the design: Light Tank; Medium Tank; Heavy Tank; UIltra Heavy Tank; Infantry; Naval Infantry; Alpine Infantry; Cavalry; Motorized Infantry; Mechanized Infantry; Engineer; Artillery; Antitank; Rocket Artillery; Self-propelled Artillery; Tanks Destroyer; and Self-propelled Rocket Artillery. We also planned to add aeronautical units to the game, dividing them into classes: Fighter Aircraft; Bomber; and Dive Bomber. However, such additional complexity could not be applied to the prototype at the time this work is written.

As classes, in addition to affecting the target type of units, also indicate what type of terrain a unit can cross. Heavy Tanks classes can not cross tiles assigned to terrain swamp, as they would be run ashore and lost.

4.2.9 Heroic Units

As we can see later, heroism is a concept that makes sense for representing nonordinary elements involved in warfare by means of units. A heroic unit is much more powerful than others of the same class, being also unusual in the game. An example would be a Simo Häyhä unit representing the Finnish elite sniper who fought during the Winter War in 1939. He is considered, to this day, the most remarkable sniper in history with the largest number of confirmed deaths as his enemies even gave him the nickname "white death". This heroic unit is of Infantry class with its damage is superior to the other units of the class. Moreover, its target type is heroic.

4.2.10 Battle System

The battle process consumes both ammunition and fuel, but for the purposes of this work let us focus on how combat works. Target types act mainly on the damage calculation over units. This happens when one unit attacks another so that specific attributes shall be considered before and during the calculation of the resulting damage, if any. Before we delve into how the damage is calculated, let us name all of the attributes assigned to a unit: HP (hit points); Recognition; Speed; Reach; Soft, Hard and Heroic Attacks; Accuracy; Evasion; Stiffness; Drill; and Experience Level. Several of these attributes can be found in RPG systems.

As stated before, **HP** represents the number of soldiers or health of a given unit, so when its value comes to zero, the unit is permanently lost. **Recognition** represents the ability a unit has to recognize threats and collect intelligence info. **Speed** represents the movement points that a unit has. Classes representing vehicles have a speed value much greater than those that move mainly on foot. The movement points are used during the action on the battle and for pathfinding purposes. **Reach** represents how far the unit's attack can inflict damage. Unlike the movement points, the range is not influenced by the terrain type. Hence, a unit with range equals to five is always able to attack enemies up to five tiles away. **Soft, Hard and Heroic Attacks** represent the potential damage that could be inflicted to the corresponding target types.

Accuracy is also used for damage calculation as it represents how accurate the unit and its equipment are. So, even with a devastating potential for damage, the unit can miss all of its attacks when its accuracy value is negligible. **Evasion** would be the opposite of accuracy and indicates how skillful a unit is in avoiding damage. Attackers can be frustrated when facing units with high

evasion, due to attacks constantly missing despite attackers' good accuracy. Given that Evasion focuses on avoiding being hit, **Stiffness** focuses on dispelling the damage by simulating how effective the unit's armor is, and it is expressed in percent. This adds depth to battle since units with high Stiffness virtually do not need to rely on evasion: even if the unit is hit, the damage would be irrelevant to combat. **Drill** represents how much the equipment manages to perforate the enemy unit's armor and inflict damage directly to the unit. Attackers with high Drill can help when enemies with high Stiffness arise in battle.

Finally, **Experience Level** indicates unit evolution by accumulating a given amount of experience points, as in RPGs. The unit becomes stronger or more efficient as it progresses to the next level due to an upgrade in its attributes. For simplicity in prototyping, we chose to increment attributes by 1 point per level. A level 50 unit with Soft Attack of 100 will effectively have a Soft Attack of 150, for example.

4.2.11 Computing Damage

During the attack, an integer random number $r \in [0, Accuracy_{attacker} + Evasion_{target}]$ is generated, so no damage is computed when $r \geq Accuracy_{attacker}$. Then the attack value corresponding to the victim's target type is added to 25% of the other two attack values, resulting in a value d. This favors strategies considering how units match and also allows to attack targets of other types (by outnumbering, for example). The damage absorbed by armor is then computed as $d(Stiffness_{target})$, and $d(Stiffness_{target} Drill_{attack})$ is added to the damage due to the attacker's drill. Finally, an effective damage also considers a random factor $c \in [0.5, 1.5]$ allowing for both attack errors and critical hits, resulting in $fd(1 - Stiffness_{target}(1 - Drill_{attack}))$.

4.2.12 Equipment

Equipment represents apparatus, hardware, gear, vehicles, and artillery pieces used in WWII. It varies among the various unit classes. In addition, certain unit classes can only use some types of equipment to influence the value of attributes for the equipped unit. In general terms, the more mechanized a unit, the more limited it is. An infantry unit can use up to four rigs to represent the malleability that an infantry unit actually had. Medium tank unit, in turn, can only use three equipment, because its purpose is more focused, so this unit is less malleable.

4.2.13 Headquarters: Satellite Mechanics

The Headquarters is where the player can perform management actions such as: organize their units; create new units; create new equipment; reload fuel and ammunition from their units; and produce resources, among others. The *Arsenal* allows to navigate between units distributed in three combat groups: spearhead, front and support. In addition, there are reserve units for equipping them. Equipped gear can also be removed.

Barracks allows players to assign reserve units to a battle group and vice-versa. Two important attributes for battles are reintroduced in the barracks: the fuel and ammunition, which are spent in battle and movement. Units with no fuel move ony 1 tile per time and have their Evasion reduced by 50%. Conversely, units out of ammunition have their Range reduced to just one tile, and their Damage and Accuracy also drop by a half.

The *Production* allows players to manufacture resources such as fuel, ammunition, etc. Finally, *Modernization* (Figure 8) provided support for management of technological developments designed under the light of documented history. The underlying production lines are an important mechanic in the game: they represent of the industrial power that the player has to arm and expand his troops. There are several production options that help players to improve both their resources numbers and quality of their troops.

4.2.14 Campaigns

A campaign is a mission for the player must complete to proceed in the game. Each mission contains a brief description of the plot that led to the measure and how goal constraints (Figure 7). Campaign Constraints were designed in AWIF to represent the physical and technological limitations that existed in a certain context of an in-game campaign. Moreover, these constraints also help to adjust the minimum difficulty of the game.

The campaign itself is divided into nodes, which are important regions or cities that must be occupied by the player's army. Berlin Schutz, defense of Berlin in German, depicted by Figure Figure 7, is a campaign with three nodes: Leipizig, Magdeburg and Berlin. This campaign ends when the player manages to complete taking his army to Berlin, which causes the release of the next campaign.

Nodes, in turn, are classified into two types: hostile and occupied. When entering a hostile node the player will enter a battle against the enemy units in that node. Occupied nodes (Figure 9) allow the player to rest its units, and also lets to recharge ammo, fuel and HP to prepare for the battle on the next node.

5 Game Prototype: A World in Flames

Development of AWIF occurred in parallel with its game design. Let us introduce the practical details about the project and the main design adjustments done during the process.

5.1 Implementation Aspects

AWIF was coded using C# by a sole programmer on top of Unity 5.3.5f. It is important to observe that this game genre is not directly supported by the game engine, so it was necessary to implement an engine for the title itself.

In particular, much of the effort was employed in the implementation of Artificial Intelligence techniques, since the game was initially designed for single-player. Unit navigation uses a depth-first traversal algorithm for pathfinding. Enemy behaviour was modelled by means of a combination between traditional Finite State Machine and heuristics.

The prototype was programmed and tested using Windows 7 running on a Intel Dual Core 2.4 GHz processor with 4 GB RAM and equipped with an onboard video card. Image and audio were adapted from internet sources under the terms of Creative Commons 4 license [10]. Audio adjustments and editions were performed using Audacity[11]. The user graphics interface, as seen in Figures 7, 8, and 9, was developed from scratch using GNU Image Manipulation Program 2.8 (GIMP[12]).

Most content development focused into making Campaigns available to the user. In fact, visual models and animations representing units was kept as simple as possible since these require a lot of concept art effort in order to produce an acceptable result. Quality assurance on implementation and gameplay testing was carried out by means of play sessions observed by developers.

5.2 Game Design Adjustments

The initial conception of predefined dimensions corresponding to a limited 9x9 grid for battle fields was discarded. This allows for developers and level designers to express their creativity by means of richer map setups. Units' movement points needed a deep.

Fuel and ammunition were reworked during the implementation stage, by considering a drop of 30% on the attributes affected by fuel or ammunition when a unit reach less than 50% of the corresponding value. Menus were considered a important source of information and needed to be revisited by adding finer historical details by narrative. Each battle was preceded by Intelligence info,

[10] https://creativecommons.org/licenses/by/4.0/

[11] http://www.audacityteam.org/

[12] https://www.gimp.org/

Figure 7: Campaign screen. The player chooses one from the menu on right. Gray buttons at top-right are placeholders used for prototyping.

Figure 8: Modernization screen. The current unit is depicted on the left, and the modernized resulting unit is on the right.

which is displayed beforehand in order to let the player adapt her troops for engaging combat.

Time skipping mechanic added important credible realism about how Blitzkrieg was actually performed, as reported by users. Following that line, simulation and their related secondary mechanics pivoting around operational aspects for supplies, occupation, and other practical warfare details also contributed for a deep experience.

6 Remarks on the Study Case

From the practical standpoint, developing a turn-based strategy game is a challenging task even when historical representation does not take place. For example, the development of a prototype title proved to require lots of testing and reworking.

Representing the history in a game requires much more detail than we expected initially. Representations must create a world

Figure 9: Screen and menus when entering an occupied node. These strategic, pacified points allow the player to replenish their units.

that is at least credible for the player, which highlights the need to research the subject of WWII in depth. However, games as a media is intrinsically different from a movie or TV series: titles must keep the player's focus on his activity, avoiding Immersion and presenting fluid mechanics and an unpredictable finish.

Gameplay activities themselves are not necessarily used as a means of representing history, but an interactive representation of the universe of the game that has its own laws, myths and characters. So, the universe of the game may contain a historical representation grounded on its mechanics.

The chosen theme, which focuses on the military conflicts that occurred in the early twentieth century, is a broad and diverse subject with various theories and modes of operations. The use of the Blitzkrieg mechanics shown in the developed prototype could not apply, for example, to the human wave tactic that the Soviet Union adopted to defeat Germany in the war, although these existed at the Same time.

The game design demanded various tweaks in order to adopt the chosen genre for the desired context. Simulation of other factors such as logistics, operating methods and resource management have been incorporated into various elements of strategy games. As a result, there is a game with mechanics that deviate from the standard for the specified genr e and require an evaluation from the broad audience.

There are various ethnic, religious and social conflicts occurring at the time of writing this work. That said, it is hoped that a game about World War II whose plot focuses more on the union between different nations against a greater evil than on the faithful representation of the bloodiest conflicts in humanity does not suffer from social critics.

7 Conclusions

The report provided by this investigation shows how vast and complex the term historical representation can be in the context of digital games. Considering the creative freedoms of an electronic game, although the representation shows history in a completely different or even fanciful fashion, anthropomorphizing armaments into human units, this does not prevent certain elements of their world from referring to our history and being accepted by players.

The design effort undertaken in the construction of a WWII-based game prototype have proven to fit in the context of the selected historical facts. In effect, the studies we carried out over similar game titles and information found in documents regarding the warfare gave, at the right time, a clear direction on choices for mechanics and the battle system. Despite the game prototype's complex inner workings, the mechanics built on top of historical facts could be perceived by players, thus transmitting a liminal, interactive feel of what actually was WWII.

Moreover, we found that level design is of fundamental importance: game mechanics might not manifest their potential when the actual playable content lacks the right setup for an adequate gameplay experience. A strategy game becomes fairly complex as the project undergoes development cycles. As a product, the resulting prototype displays simplistic graphics but also contains mechanics that deviate from the standard found in similar products of the same genre. Therefore, it is worthy an extensive evaluation from the broad audience since computer games should be, above all, fun.

The following further investigations are considered as future works:

- Carrying out experimentation on which balancing adjustments are needed by means of computationally intensive simulation.
- Add support to naval and air units as finer details into the battle system.

- Explore the coexistence of different boards as the the initial design was supposed to.
- Adaptation of other themes or events into our framework, such as the European colonization of the Americas, which may give rise to singular game mechanics.

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