TaRCoS: Providing a Combat Simulation Tool for Tabletop Role-Playing Games

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***Abstract*—Role-Playing Game (RPG) is a game where players pretend to be a character acting in an environment and story created by the narrator and the players. During a tabletop RPG game, there are events, usually battles, in which players waste a lot of time to get a result for the action they choose to perform. To optimize this aspect, this paper presents the Tabletop RPG Combat Simulator (TaRCoS), a software tool able to perform tabletop RPG combat and show the winner of modeled matches in a tabletop RPG system. It eliminates the expenditure of time to get a battle result, such as the excessive calculations of dice rolls, and provides data for balancing purposes of specific characters during an initial combat configuration for modeled matches. As a result, TaRCoS improves the dynamics of playing tabletop RPG games, avoiding unnecessary efforts to define battle results and allowing players and narrators to be concerned with the description of the scene, the construction of desired game elements, and the player immersion in an amazing game story.**

***Index Terms*—Role-Playing Game (RPG), tabletop RPG game, combat simulation, software tool**

I. Introduction

Among the available digital games, there is a huge variety of game genres that determine the gameplay style. Tabletop *Role-Playing Game* (RPG), for example, is a popular and collaborative RPG that is usually played by groups of 3 to 6 players and one *Narrator* (also known as *Master*) [1], [2]. Each player creates the whole concept of his character, based on predefined rules of an established tabletop RPG system, which interacts with the world and the stories created by the narrator/master. These stories always take into account how the character would act in challenges and situations that will be found.

Every tabletop RPG is based on turns and actions in which the character can be successful or not. Examples of actions are: climbing, running, attacking, defending, dodging, resisting the damage, among others. Each action has its own difficulty level imposed by the narrator/master, as well as the skill requirements on tokens to be performed [3]–[5].

To decide whether a player was successful in his actions or not, most tabletop RPG systems make use of dice rolls, thus representing an essential element of luck in any game [6], [7]. However, when this element has a long duration, a lot of time is wasted with calculations of moves that could be optimized. As a result, the gameplay becomes impaired, causing less enjoyment of the story and consequently less fun for its players. Thus, there is a fundamental element of the game (in this case luck) that directly interferes with the gameplay and fun [7], which is problematic for those who play and those who develop them.

As an attempt to improve the gameplay in tabletop RPG systems that make use of dice rolls, the ***Ta**bletop **RPG Co**mbat **S**imulator* (***TaRCoS***) was developed. It is a software tool that simulates confrontation mechanics between RPG characters, and instantly displays the results of battles between players during a tabletop RPG session. TaRCoS also provides the necessary data for balancing purposes of specific game characters, something important for the initial combat configuration of modeled matches. Finally, by the TaRCoS use, it is expected to speed up the dynamics of playing tabletop RPG games, allowing players and narrators to be concerned with the main objectives of the game instead of its execution details, which are the description of the scene, the construction of desired game elements, and the player immersion in an amazing game story.

II. Related Work

As identified researches to automate tabletop RPG games, Nova and Lopes [8] presented a set of methods used to develop the *Simulador de Combate Utilizando Regras de D&D* (*SCURDD*) — in english, *Combat Simulator Using D&D Rules* (CSUDDR). Its objective is to assist RPG masters of the D&D 3.5 system to build appropriate challenges to the context of their matches, increasing and improving both the engagement and the experience of their players. To this end, it makes use of two types of Artificial Intelligence (AI), the specialist and the adaptive, comparing their performance during the simulations.

Piana Junior [9] presented ORC, a virtual simulation environment for tabletop RPGs, whose focus was on customizing the game scenario, the element models and the characters files. ORC allows the construction and customization of characters, boards, ready-made 3D models and tokens for the desired game, together with two chats for communication during the game play, one by writing and the other by voice. Moreover, the tool also allows the elaboration of online narratives, seeking to streamline the game processes and its defined rules.

D&D 5e Encounter Simulator [10] is an online tool that calculates the chances of winning a D&D encounter. It relies on a python script, which simulates an encounter 1000 times for statistical accuracy. Characters can be entered in a variety of ways, from a predefined to an incomplete list of parameters, which the code will either calculate from others or default to the value of a commoner.

CSUDDR, ORC and D&D 5e Encounter Simulator bring together the use of digital resources as a way to improve elements of a classic style of play, allowing masters and narrators to create more attractive stories for their players through graphic elements and a better confrontations balance. The proposed TaRCoS software tool, on the other hand, seeks to dynamize the gameplay in RPG sessions, by automating time-consuming during confrontation situations such as battles in different types of RPG systems.

III. Methodology

For the TaRCoS development, a study and analysis of RPG games was carried out in order to: a) define significant game elements; b) identify game complexities; and c) learn game specifications. After that, a character representation approach, together with system rules simulations and processing strategies of modeled battles, were defined.

A. RPG Sessions Analysis

Each RPG session is different from each other. Therefore, it is not possible to set guidelines that define how long it will take for each game. In this sense, the best way to obtain game parameters, in order to establish values such as the "average duration of a match" and the "time required to perform an action" after a dice roll and the result evaluation, is through direct observation of running matches.

Three groups were observed playing two different RPG systems: D&D and Storyteller. Among the participants, there were different types of players, from expert players with more than ten years playing tabletop RPGs, to novice players with only a few months of play. It is noteworthy that even expert players still need to adapt when faced with a new system, since learning the rules requires some effort, and the individual's experience with RPG is more interpretive than systematic.

Among the observed groups, it was noticed that the situations that took longer with the dice rolls were the fighting, since the other actions such as "climbing a tree", "stealing a guard", or "sneaking around" often used only a single **test**. During a combat, there were **tests** to determine whether the character was hit, whether the character dodged, how much damage he did and, in some situations, how much damage he was able to resist (the Storyteller system), consuming as a result a relevant amount of time for each game.

B. TaRCoS Prototype Development

Regarding the representation of RPG characters using the TaRCoS software tool, JSON files were used to set the RPG characteristics for distinct RPG systems, which can be modified through any text editing program (Figure 1). Thus, using a directory with the "files/characters" path, an extra folder is included for each RPG character, which contains JSON files describing each one an RPG character configuration for a distinct RPG system (Figure 2).

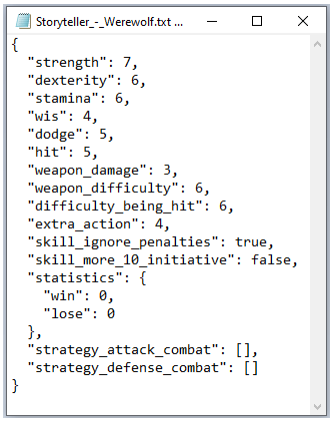

Fig. 1. Storyteller file of the Ahadi character.

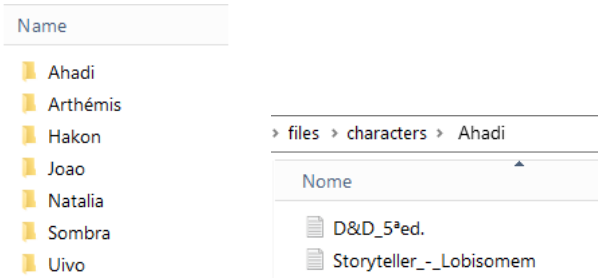

Fig. 2. Character folders and Ahadi character file list.

For each RPG system, there is a huge variety of rules, combinations of actions, effects and powers that can be performed by players. In this sense, to treat the three selected RPG systems in an equivalent way, abstractions were made in the rules where some of them needed to be disregarded or modified, such as the rules of movement and advantages. Character features and basic actions of the character, such as attacking, defending, dodging and the use of extra attacks, were also considered for combat simulations.

Regarding the combat movement, it is an important action in some RPG systems (in this case D&D and GURPS), as it defines the movement of a character on a map, along with the condition of being approaching or moving away of another character. However, in Storyteller, there is no rule pertaining to this action in a combat. So, in order to simplify and standardize the simulation, it was decided that every character is in the reach of another to carry out his actions during a combat.

Since RPG is a storytelling game, characters at certain times are expected to have advantages or disadvantages. In D&D systems, for example, the term "advantage" means playing two D20 and taking the result of the highest die. Thus, to simplify and obtain the best possible result in a combat, it was established that the characters will always use their best

skills and advantages during a combat. In other words, actions in a battle are always performed with the character having the advantage status.

In Storyteller, a circumstance of privilege can be completely situational by the narrator. However, there is the specialization rule (the "10" rule), where an expert character can roll an extra die whenever he gets the value 0 (which is the maximum value in D10). This new value has no effect of the rule of "1", where a die with a face equals to 1 cancels another of greater value. So, by default, the characters will always be considered combat experts, unless, at the discretion of the simulator user, he wants to obey the official rule, determining this in the simulation settings.

Regarding the simulations of characters battles, they were implemented to take the most advantageous action (when possible) in the current situation encountered by the character in a battle. Thus, for D&D simulations, as the combat rules of this system are more complex and have many variables, the simulation was programmed only to "Attack", while the defensive action is in charge of the Armor Class (AC), where its value is equal to the difficulty to be reached.

However, in Storyteller simulations, there is a significant difference, as the combat rules try to attend to several aspects such as agility, concentration, injuries and skills. The first of these is the "Actions Division", where, before the combat even starts, the player must determine how many actions he intends to take in his turn, obeying the limit of the lowest value between his Dexterity or Reasoning. If he has no further "Actions" on the turn, he will be unable to do anything else, including defending himself from an enemy attack, until the turn ends and the process is repeated.

The simulation is also responsible for determining the target character on the turn, taking as a criteria the amount of damage suffered and the current initiative. It also divides the actions, so that the amount of used dice is greater than two in each tested action. It is a "calibration" decision, since it was observed during the session analysis that players avoid taking actions with a very low probability of success. In addition, the simulation also determines which action will be taken by the player ("Standing", "Attacking", "Defending", "Dodging"), always seeking to choose the best defensive action or being able to make a risky attack, if there is a chance to kill the enemy instead of defending yourself.

Since one action does not need to be completed for another to start, all actions are performed in parallel by multiple *threads* in each battle simulation. To this end, all character tokens serve only as a basis, with no value being changed in combat. Attributes such as: current life, available actions, amount of damage caused, among others, are represented in a controller class that copies the original characters values and processes them during the entire simulation.

IV. Results and Discussion

A. RPG Session Analysis

In three game sessions, 168 different dice rolls were collected, obtaining: the amount of dice, the average time, and the total time of the tests. It was observed that in D&D games the RPG system works very well with regard to the duration of the dice rolls, with only one or sometimes two dice being played to determine whether the character was successful or not. However, in the Storyteller system, the amounts of both dice and rolls are variant, and the way to check success or failure depends on two factors: amount of dice and level of difficulty.

Thus, from the obtained values, it is possible to observe a significant association between the amount of dice and the time, a correlation that can be translated as the more dice, the longer it will take to reach the resolution. In contrast, the greater the difficulty, the shorter the time required to obtain an answer (Figures 3 and 4).

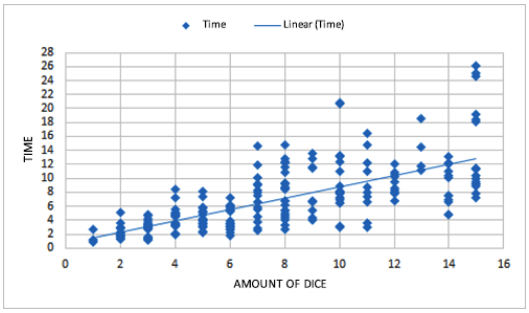

Fig. 3. Scatter plot between the amount of dice and time.

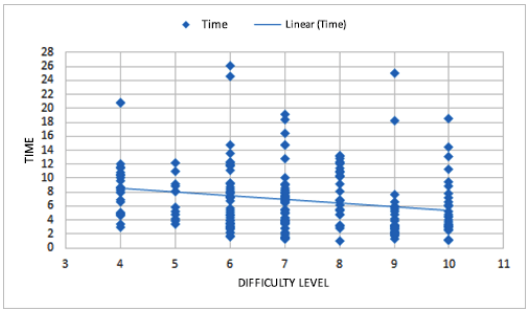

Fig. 4. Scatter plot between the level of difficulty and time.

In a comparative analysis between the experience levels of the players, it is also possible to observe a correlation with the time, because the more expertise a player has, the faster he gets the actions resolutions (Figures 5 and 6).

As a result, it is possible to observe that experienced players can play faster than inexperienced players, and is also possible to observe that the greater the difficulty of the tests, the faster the evaluation becomes. However, as the amount of dice increases the playing time, the gameplay becomes concentrated in test evaluations that are not always of great difficulty, especially in sessions with inexperienced players. In this sense, there is an evidence of the importance of producing automated solutions to evaluate the action's tests during RPG sessions, in special for the evaluated Storyteller system.

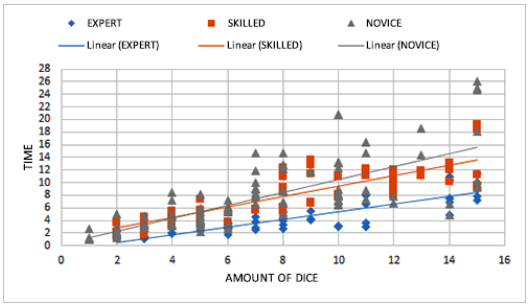

Fig. 5. Scatter plot between the amount of dice and the time according to the players experience levels.

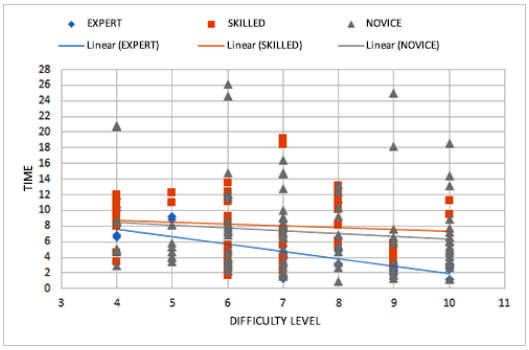

Fig. 6. Dispersion graph between the difficulty level and the time according to the players experience levels.

B. *The Combat Simulation*

To present the execution of a combat simulation between two characters, a battle was carried out between them in a total of fifty thousand and one (50001) fights. It is an amount of fights that can be processed in a satisfactory way by the simulator, generating as a result a significant number of samples to be validated. Furthermore, as the total number of simulations to be carried out is an odd number, there is a simulation that makes it difficult to draw between the characters, thus making the final result more assertive for the players.

At the end of the simulation, TaRCoS displays some important data on the screen, such as the average of the obtained values in the dice rolling and the standard deviation of the mean (Figure 7). With this information it is possible to determine if the random variable (dice) is actually behaving as one, avoiding in this sense the possibility of generating "addicted" results.

As significant information for the RPG gameplay, TaRCoS also presents the following results at the end of the simulation: the winning team; a sampling of living characters; and the character with the highest initiative value, if the character initiative was important for the simulation result (Figure 8).

For statistical purposes, an execution summary is also presented at the end of the simulation, showing: the amount of simulations performed; the importance of the initiative in combat; the winning team and its winning percentage; the

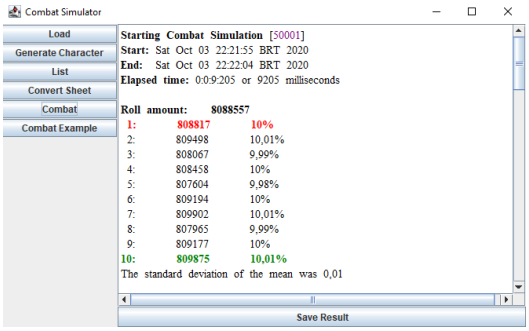

Fig. 7. Time display, obtained values from dice, averages and standard deviation from the mean after the combat simulation.

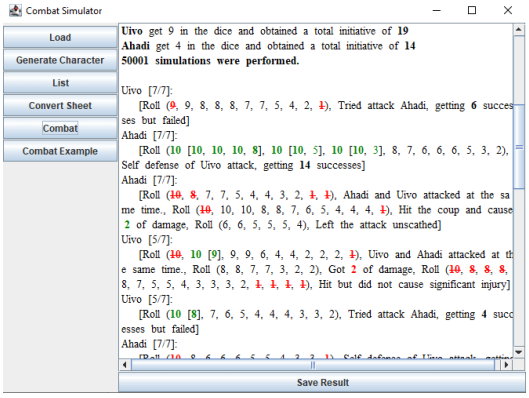

Fig. 8. Winning team, living characters and the character with the highest initiative value after the combat simulation.

defeated team and its winning percentage; the characters who finished the fight standing up; and the characters who were "killed".

C. *Verification & Validation*

Several simulations were performed for each RPG system, always with the amount of 50001. The objective was to obtain the necessary parameters that made it possible to assume that TaRCoS was operating as expected.

In this sense, a verification was made to determine if TaRCoS was showing related values to what would happen in an RPG session. Therefore, a physical simulation was performed, without using the computer, and one in the simulator for comparison at the end of the experiment. Two generic character files were built, one with about 70% victory in the matches (Figure 9) and the other with only 30% victory.

During the experimentation, it was not feasible to execute thousands of tests manually due to the delay in performing these tests. Thus, only 5 combat repetitions were performed with the aforementioned files. Even though it is a small value for comparisons, it is already possible to see that the file built to obtain 70% of the victories meets its objective.

Moreover, during the physical tests, it was noticed that the D&D system was executed in a fast and fluid way, with an average of 6 minutes to complete. Meanwhile, the Storyteller

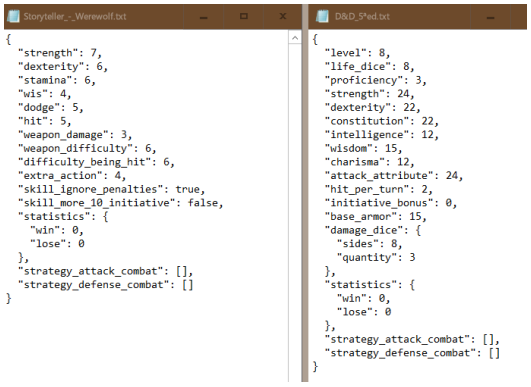

Fig. 9. Generic Storyteller and D&D files to get 70% wins.

took a lot of time, taking an average of 14 minutes to execute a fight between 2 characters. This time was longer when the action division rule was used, which allows the character to perform more than one action on the turn.

It is important to realize that, as the amount of simulations was small, it was already expected that the percentage would not reach the value of 70%, since in 5 matches the closest value would be 60% or 80%. Thus, as the final result was 80% for the victorious character, a confirmation data of the expected character victory for the proposed verification was obtained.

For the TaRCoS perspective, due to the ability to run thousands of simulations, the files came very close to the expected result, as described in Figure 10, where the file that was created to obtain 70% of the victories reached the value of 69.83%. In this sense, by the physical RPG experimentation and the simulation performed at TaRCoS, as similar values for the game champion were obtained, it is possible to affirm, for the configured case study, that the simulator was able to replicate obtained results from combats in real RPG sessions.

Start: Sun Mar 08 18:09:18 BRT 2020
End: Sun Mar 08 18:09:20 BRT 2020
Time elapsed: 0:0:2:207 or 2207 milliseconds
50001 simulations were performed.
Simulation result:
The initiative was decisive **64.04%** of the time
The winning team with 69.83% of victory, leaving 1 alive out of 1 and being composed of:
70porcent
The team defeated with 30.17% of victory, with 1 members and being composed by:
30porcent
Who remained standing until the end:
70porcent
Killed in combat:
30porcent

Fig. 10. Result of a combat with 70% and 30% of victory.

V. Conclusions and Future Work

This work presented TaRCoS, a tabletop RPG combat simulator that allows the players to elaborate, plan and execute different circumstances of battles among RPG characters according to described RPG systems, without the need to waste a significant amount of time during RPG game sessions.

Through TaRCoS, developers can study the impact of a certain feature on proposed confrontation systems, allowing players and narrators to be concerned only with the description of the scene and the construction of game elements, such as characters, scenario, setting and history. Moreover, TaRCoS eliminates the expenditure of time with calculations, a common problem with tabletop RPG sessions in situations with excessive data rolls, blocking as a result the narrative and the immersion that the RPG itself proposes to the players.

Despite the early stages of production, TaRCoS is already capable of reproducing combats between groups, creating and editing records, as well as converting them from one system to another. However, it is not yet presumed that it will be able to deal with all the probable situations of each system, such as the use of a greater variety of strokes, spells and effects. It is also not allowed to preconfigure a combat strategy to see if it is effective or not during a match. Moreover, only the simulations for the D&D and Storyteller systems have been completed, being necessary to finish yet the simulation for the combat system proposed in GURPS.

Although the obtained results are satisfactory, it is worth mentioning that the impact of simplifying the rules applied to TaRCoS limits the characters in the use of movement or more elaborate actions than “attacking” and “defending”. As a result, actions that heal an ally or damage an enemy can not yet be represented by TaRCoS, since only basic RPG character combats can be simulated in it.

Among the future improvements for TaRCoS, the main ones are: use through mobile devices, such as smartphones and tablets; more action options for characters in battles, such as spells and maneuvers; and the possibility of setting up a specific attack and defense strategy for each character. There are also plans to configure the entire confrontation rule in order to meet social situations, not just combative ones, such as a performance dispute between two bards, for example.

References

[1] M. Sales, “Rpg (role-playing game),” 2013, acesso em 03 de setembro de 2019. [Online]. Available: http://brasilescola.uol.com.br/curiosidades/rpg.htm

[2] A. A. W. Saldanha and J. R. M. Batista, “A concepção do role-playing game (rpg) em jogadores sistemáticos,” *Psicologia: ciência e profissão*, vol. 29, no. 4, pp. 700–717, 2009.

[3] M. Mearls, J. Crawford *et al.*, “D&d basic rules,” *nd): n. pag. Wizards of the Coast LLC*, vol. 12, 2014.

[4] M. Rein-Hagen, *Vampire: the masquerade: a storytelling game of personal horror*. White Wolf Games Studio, 1992.

[5] M. Rein-Hagen, R. Hatch, B. Bridges, and T. DiTerlizzi, *Werewolf: The Apocalypse*. White Wolf Pub, 1994.

[6] J. Huizinga, *Homo ludens: o jogo como elemento da cultura*. Editora da Universidade de S. Paulo, Editora Perspectiva, 1971, vol. 4.

[7] K. Salen, K. S. Tekinbaş, and E. Zimmerman, *Rules of play: Game design fundamentals*. MIT press, 2004.

[8] J. G. Nova and R. V. Lopes, “Scurdd: Uma ferramenta de auxílio à mestres de d&d,” *Anais do Seminário de Jogos Eletrônicos, Educação e Comunicação*, vol. 3, no. 1, 2019.

[9] D. P. Junior, “Orc–online rpg creator: Um protótipo para auxílio na criação de narrativas de jogos de interpretação rpg online,” *Centro de Ciências Exatas e Naturais da Universidade Regional de Blumenau*, 2008.

[10] M. Ferla, “D&d 5e encounter simulator,” http://dnd.matteoferla.com/, 2015.