

Exploring approaches to open-world Interactive Storytelling

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Abstract

In this document I present some of my work in open-world Interactive Storytelling, as part of my Master’s thesis in Natural Language Processing and Computational Creativity. The main objective of my thesis is to model some of the main mechanisms that human Game Masters need to run a Role-playing game session, when they usually combine planning and improvisation to create interesting interactive worlds with engaging challenges that work as narrative hooks for the rest of the players.

Interactive Storytelling and RPGs

Back in the 1980s, the world-wide boardgaming community was caught by the popularization of Role-playing Games (RPGs), when *Dungeons and Dragons* (D&D) was born as a fork of war games (Ewalt 2013). Role-playing games are a type of interactive experience in which the players take the role of some living entities to collaboratively build a story. Among all the players in a RPG, the Game Master (Tychsen et al. 2005) stands out as the one typically in charge of orchestrating the game, creating challenges for the players and a rich world to interact with. While in classic RPGs — like D&D (Mearls, Crawford, and Perkins 2018) or Call of Cthulhu (Mason et al. 2021) — each player brings a single character to life (Hitchens and Drachen 2008) and the Game Master (GM) acts as the rest of characters, other authors have experimented with new ideas. For instance, in *Everyone is John* (Villegas and Witt 2019) every player is an independent voice inside the mind of a single man, or in *Alice is Missing* the creative responsibility is equally distributed among the players¹ (Starke 2020).

As RPGs brought innovative ideas for storytelling, the influence of RPGs in modern video games is huge (MacCallum-Stewart, Stenros, and Björk 2018). Although there are many digital RPGs, digitally modelling the dynamics of the real tabletop experience is extremely hard, as there are at least two main problems: *generating* an engaging story and fictional world for the players, and *understanding* the outcome of their actions to keep the fictional

¹The players act as friends of Alice, a missing teenager. Using phones or computers, they chat like if they are communicating in the first hours of the tragedy. The creative force is shared by all the players, hence no one is previously in charge of creating narrative hooks or pushing the story forward.

world coherent. Historically, the Interactive Storytelling (IS) field (Trichopoulos, Alexandridis, and Caridakis 2023) has tackled these two problems by designing worlds with a pre-programmed logic for all its components e.g. what is the effect of using this *lighter*, or using the *elevator*, or combining that *stick* with this *metal arrowhead*. However, if we want to reproduce the classic experience by modelling an automated Game Master — where the system is capable of improvising some aspects during gameplay² — we need to find a strategy where the preprogrammed actions do not restrict the free will of the player. As a consequence of the advent of Deep Learning methods, the Natural Language Processing (NLP) field has experienced a performance boost in many tasks, what allowed IS researchers to explore other approaches to this problem (Callison-Burch et al. 2022; Wang et al. 2023).

For my Master’s thesis I am working on modelling some of the linguistic and creative mechanisms that a GM use when running a RPG session. In the next section I will briefly describe my work, and later I will enumerate some future ideas.

Some little steps

Given the popularization of Large Language Models (LLMs, e.g. ChatGPT), the good results they show in many NLP tasks, and that the most popular RPG engine uses them as their backbone³, we tried to methodologically find a way to unveil the weaknesses of these models when acting as GMs. Thus, we first tried to find some gamemastering challenges that could be analyzed during the interaction with these dialogue systems. We proposed a strategy to evaluate gamemastering models based on three core mechanisms: calculating the outcome of a player action, coherently designing a world, and successfully tracking the items in the world. The analysis of the gamemastering challenges, the formalization of the tests, and the experimental results of the evaluation of three LLMs, were published and presented at

²As a more general problem, in 2016, Martin, Harrison, and Riedl introduced the term *Improvisational Storytelling* for Interactive Storytelling systems in which the input possibilities are limited by the imagination of the player, as happens in improvisational theater.

³AIDungeon: <https://aidungeon.io/>

the *12th International Conference of the Games and Learning Alliance (GALA 2023)* (Góngora et al. 2023). The paper also has an associated public GitHub repository⁴.

One of the main weaknesses we found is that these models struggle with keeping the generated world coherent, what is aligned with the findings reported in the survey by Wang et al. (2023). For instance, if in the fictional world there is not an apple on the table, and the player insists to take it, the LLMs tend to move the story forward to satisfy that condition. Since world coherence and suspense are main components in IS, this constitutes a great problem. Therefore, we worked on a strategy to feed the LLM with a structured representation of the world state, hence trying to control (or at least easily detect) some coherence problems. Then, we parse the output of the LLM to accordingly update the world state for the next utterance of the player. Only a playable basic open-world situation can be represented with it, but as the proposed strategy is also beneficial for the creative needs of GMs, we think it can be used as a starting point for a whole gamemastering model. The description of this method (called PAYADOR) will be presented at the *15th International Conference on Computational Creativity*, and the source code is available on GitHub⁵.

Future steps

Now that we have a minimal open-world situation to experiment with, we are looking forward to extend it to work on more complex problems where creativity delivers a higher degree of uncertainty. For example:

- **Generation of items and places.** As the player starts exploring the world, the automated GM has to create new content for the fictional world. It can be generating new reachable places, interesting items or charismatic non-playable characters (NPCs). However, this can get really complex, for example if the player wants to combine items to generate a new one e.g. attach a *hook* to a *stick* to get a *fishing pole* that is used to get another item that cannot be taken with her hands.
- **Model complex aspects of NPCs** Human Game Masters usually carefully design the personality traits of their NPCs, and their personal connections with player characters (Acharya, Mateas, and Wardrip-Fruin 2021). We would like to model these kind of details, for instance, in order to add emotions to the dialogues (Oñate, Méndez, and Gervás 2019) between the players and the NPCs.
- **Modelling scenes.** TTRPGs classically consist of the GM narrating a scene, while proposing a challenge to the players. We think it could be possible to model some basic scenes using our basic open-world environment e.g. the player is being chased by a guard.
- **Planning scenes.** Once we get to model a scene, we can start thinking of planning future scenes as feasible successors for the current scene (Martin, Harrison, and Riedl 2016) e.g. if the player is being chased by a guard, then

two possible outcomes could be (1) the guard catches the player or (2) the player manages to escape.

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⁴<https://github.com/songora27/skill-check-GM-tests>

⁵<https://github.com/pln-fing-udelar/payador>