A multi-planar approach to encoding story worlds for dynamic narrative generation.

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1 Extended Abstract

Tabletop Role-Playing Games transport the player to a fantastical fictional world. This world is inhabited by characters, players and objects. Prior to the commencement of play, the Dungeon Master prepares not only the rules of the world but an account of historical events and the current world state. While the rules provide the player with boundaries of play, the character sheets store the current player state, and the back story provides context for the happenings during the game session.

Consider how often a story is told where, “In a land far away lived…”. Rarely does a story rely on a universe where all existents are spontaneously spawned into being. Instead, vast historical worlds with cultures, histories and languages are created. This context provides the reader/viewer/player with an understanding of the world in which they find themselves. Players learn of warring factions, key artefacts, and are introduced to key drivers of the worlds drama. When Non-Playing Characters(NPC) are introduced into the game, the dungeon master draws on this history to form quests and to feed the players a view of this world.

These behavioural systems, however, react to a player’s moves with little consideration for the world context. This lack of context leads to the trope of the robotic NPC with little awareness of the world. How do we ingrain this knowledge of a contextual world? And even more critically at this seminal stage.

How can game developers build, store and control dynamic story worlds?

This question forms a component of the more significant question of how human authors can work alongside Artificially Intelligent systems to tell stories in games that adapt based on player action. Fundamental to this challenge is a unified model of story worlds that is comprehensible to human and machine alike. The necessity to model whole worlds is a challenge that has previously been undertaken in the field of crowd simulation, where we draw our inspiration.

1.1 Background

Early approaches to populating game worlds approximated agent behaviour through the simulation of individual behavioural agents [1]. Individual agent simulation does produce high fidelity approximations, however at a high computational cost. This high computational cost limited the utilisation of individual agent simulation within video games. Instead of computing crowds as a collection of individual agents, Flow fields presented tread crowds as a fluid which is later sampled to produce character direction and speed. Flow fields indeed presented a significant step-change in the size of crowds and saw wide adoption within commercial videogames [2].

Voxel-based approaches furthered the success of flow-field, addressing the limitation of handling overlapping environments. McCarthy [3] outlines the design of a voxel-based crowd simulation engine developed for Planet Coaster [4]. The goal of the engine was to enable the population of 10,000 NPCs within the theme park simulation game Planet Coaster. This highlights that traditional approaches to crowd simulation would not enable the crowd's density to be generated due to the complex interactions and number of agents involved. The approach used combines voxel representations of the game world with flow / potential fields to simulated crowds as a singular entity. The paper also briefly outlines some of the considerations for audio and animation that were taken into account during the system's design. It is clear from the paper that balancing system resources and performance were key to achieving the real-time objective. The author highlights that an advantage of the flow system used was that the calculations could be performed asynchronously to the game thread.

While crowd simulation focuses on the movement of characters through game worlds, Vonnegut was interested in how characters traverse complex emotional curves. When examining fairy stories, Vonnegut [5] posited that the emotional curves of the majority of stories conformed to six archetypes. These archetypes were defined by plotting emotional highs and lows against time. Unlike Freytag's triangle [6], which describes the rise and fall of action within drama, Vonnegut's hypothesis instead focused on what he describes as high and low emotional states. The concept of story shapes was later ratified by applying big data analytics and sentiment analysis to Project Gutenberg's library. [7]

The ludo-narrative debate is longstanding within the field of videogames critical studies[8-11]. A central factor to this debate was the role of narratives within games. While early contemplation on this field was divisive, as the discussion has matured, the investigation into the concept of ludo-narrative resonance is currently underway. Ludo-narrative resonance seeks to combine game mechanics with narrative elements to enhance the overall ability of the game to tell a story [12]. Open world games encourage the exploration of a game world in an unrestricted fashion. This freedom leads to a fundamental challenge to the telling of stories. In which order will the player encounter the story events?

1.2 Model

Returning to our original question of "How can game developers build, store and control dynamic story worlds?". Existing approaches to world generation for games either lean towards Procedurally Generated worlds or Computational Narratives. Our model bridges these domains by providing a single unified contextual model through multiple voxel layers. These layers include terrain, masking layers and more central to this paper, drama driver layers [Fig.1]. Drama driver layers store values for the world's current emotional state, with each one storing a single feeling and its counterparts such as happiness, sadness, peril, or safety. These layers are then stacked and combined to generate a drama state for the respective location in the game world.

The stacked nature of these drivers allows the author to add the complexity required for a specific project. Additional local grids can be dynamically created during game-play by the system and human authors in response to an event, providing players with a greater sense of consequence within the world.

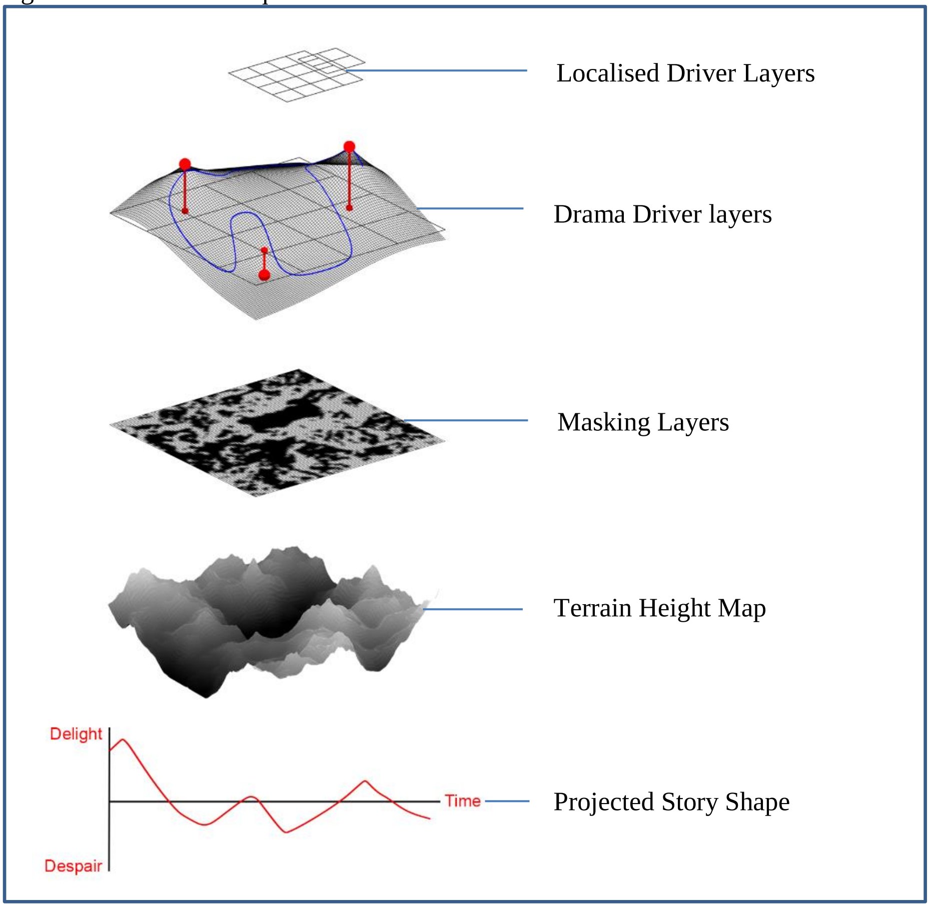

Fig. 1. Multi-planar representation of game world with projected story shape.

Author interaction with the layer is through the placement of attractors and repulsors, which are then manipulated in real-time. Synchronously the layers are computed, player trajectories are projected, and their story shapes estimated. This eventual visualisation allows the author to adjust the dramatic drivers to produce the intended story shape.

1.3 Future Work

This poster presented some of the early design considerations for the development of the Open world Dynamic Interactive Narrative framework (O.D.I.N). Future work includes the construction of a working prototype to validate the hypothesis that computational storytelling can be better with a final goal of democratising the creation of Dynamic Interactive narratives to enable expert authors and amateurs alike to tell their story in this form.

References

1. Champandard, A.J.: AI Game Development: Synthetic Creatures with Learning and Reactive Behaviors. New Riders (2003).Banerjee, B. et al.: Advancing the Layered Approach to Agent-Based Crowd Simulation. In: 2008 22nd Workshop on Principles of Advanced and Distributed Simulation. pp. 185–192 (2008). https://doi.org/10.1109/PADS.2008.13.
2. McCarthy, O.: Game Design Deep Dive: Creating believable crowds in Planet Coaster, https://www.gamasutra.com/view/news/288020/Game_Design_Deep_Dive_Creating_believable_crowds_in_Planet_Coaster.php, last accessed 2021/04/06.
3. Fletcher, A.: Planet Coaster. Frontier Developments (2016).
4. Vonnegut, K.: Shape of Stories, https://www.youtube.com/watch?v=GOGru_4z1Vc.
5. Freytag, G.: Freytag's Technique of the drama : an exposition of dramatic composition and art. An authorised translation from the 6th German ed. by Elias J. MacEwan. Chicago : Scott, Foresman (1900).
6. Reagan, A.J. et al.: The emotional arcs of stories are dominated by six basic shapes. EPJ Data Science. 5, 1, (2016). https://doi.org/10.1140/epjds/s13688-016-0093-1.
7. Aarseth, E.: Genre Trouble: Narrativism and the Art of Simulation. First Person New Media as Story Performance and Game. 45–55 (2004).
8. Murray, J.H.: The Last Word on Ludology v Narratology in Game Studies. In: '05–Proceedings of the 2005 DiGRA international conference: , Vancouver, Canada (2005).
9. Juul, J.: The definitive history of games and stories, ludology and narratology – The Ludologist, https://www.jesperjuul.net/ludologist/2004/02/22/the-definitive-history-of-games-and-stories-ludology-and-narratology/, last accessed 2020/12/17.
10. Frasca, G.: Simulation versus Narrative: Introduction to Ludology. In: The Video Game Theory Reader. Routledge (2003).
11. Brice, M.: Ludonarrative Resonance, http://www.mattiebrice.com/ludonarrative-resonance/, last accessed 2021/04/16.