Finite State Machines and Live Emergent Narrative Theatre

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Abstract

This paper presents a project currently in development that examines novel approaches to creating and presenting emergent narrative as a live performance. The proposed approach will allow a narrative to emerge from a systemic relationship between audience, finite state machine and performers. It exists at the intersection of gaming and theatre, implementing finite state machines to generate a data set for performers to utilise, and that audience members can access and modify during a live performance.

1 Introduction

Emergent narrative is a form of narrative development where there is little or no author agency. The term was first coined in 1995 by Tinsley Galyean in his doctoral thesis Narrative Guidance of Interactivity. Galyean saw emergence as a natural everyday phenomenon, stating that "We all construct narratives out of our daily activities to help us remember, understand, categorize and share experience." [Galyean, 1995]. In place of traditional authoring, stories emerge from low-level interactions between elements in a system, "Rather than seeing the hierarchy above as a top-down structure, one may view it as a bottom-up structure, in which each level is created by interaction below it." [Aylett, 1999] Having stories emerge from low-level interactions inevitably leads to problems with "narrative intelligibility" [Bruni and Baceviciute, 2013], the idea that a story must be coherent and meaningful for an audience. There are many other problems such as with "story recognition", which is a problem with a systems ability to understand and adapt to the narrative it is generating; "Systems whose narratives emerge from simulations currently have no way of discerning the very stories they support." [Ryan *et al.*, 2015].

The proposed approach creates information through low-level finite state machine interactions with a digital environment. Finite state machines utilize a finite set of states to perform tasks, it is prominent in video games as it is useful when creating non-playable characters that are both reactive to environmental conditions and player interactions. To create audience agency, the way in which the data is generated can be modified by the audience. The data is then communicated to performers for use in their live improvisational story processes. The research aims to answer the following questions: what types of data can be produced to help performers form, develop and maintain consistent emergent narratives? How will this data be communicated and used? In what way can we ensure that audience members understand the causal links between their actions and the actions of the performers?

2 Related Work

Research in this area is needed because of growing trends towards emergent narrative within the arts, video game and film sectors. In video game and film, exploration of emergent narrative has been established, through works such as Slime Rancher [Monomi-Park, 2016] and Wolves in the Walls [Fable-Studio, 2018]. These employ different rule sets to develop a narrative from interactions between users and virtual agents. *Slime Rancher*, in particular, employs finite state machine AI, in order to develop complex interconnected relationships between characters. Nick Popovich, CEO of Monomi Park explains that to create emergent storytelling, you must "cook emergent behaviours into the actors in your game, which generates emergent gameplay, which is then viewed as emergent storytelling." This is done by creating character agents with a "collision of wants and needs" [GDC, 2017]. Therefore, "An emergent approach to game design requires a globally designed game system that provides rules and boundaries for player interactions, rather than prescripted paths" [Sweetser and Wiles, 2005].

Using finite state machines for video games is a well-established practice, but within a theatrical context, the implementation is limited. *Bad News: A game of death and communication* [Ryan *et al.*, 2016] employs improvisational actors to take the role of characters in a small fictional town in America. All of the relevant information is procedurally generated and the user takes actions within this world through a text-based interface.

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There are emergent structures in Improvisational theatre, but the dynamics are more complex as it "depends on performers observing their own and other performers actions, executing some quick deliberative process, and then selecting new actions to perform." [Magerko *et al.*, 2009]. In *Bad news: A game of death and communication*, this is mitigated by the pace of interactivity and the procedurally generated contextual and character relationship information, ensuring that performers have a basis for their actions. Within contemporary performance art, works that play with the nature of audience interactions are well established and are useful when considering audience agency over a performance. Marina Abramović's performance *Lips of Thomas* [Abramovic, 1975] is an example of nuanced audience agency. In this performance Abramović' engaged in several self-abusive activities including shredding her clothes, self-flagellation and laying on a block of ice. These actions eventually prompted the audience to physically stop the performance, and so "created a situation wherein the audience was suspended between the norms and rules of art and everyday life, between aesthetic and ethical imperatives" [Fischer-Lichte, 2008].

Interactive theatre and dance have the potential for emergent narrative but currently employ limited emergence. The forerunners of theatrical interactivity are companies such as Punchdrunk and Blast Theory, both of which primarily use multiple-choice interactivity with a set number of pathways through a story such as *Prospero's Island* [Punch-Drunk, 2014]. Blast Theory, in particular, explores the use of technology, in their seminal work, *Desert Rain* [Blast-Theory, 1999], using mixed reality as a way to present the stories of real people during the Gulf War.

3 Research Project: Implementing an Emergent Narrative in a Theatre Setting with Live Actors.

The proposed system generates data to be used by live improvisational performers, this is achieved by using the data to control stage equipment, which creates cues for performers to interpret. The system allows the audience to modify how data is generated, rather than directly changing the data. This approach outputs data at a defined rate, that cannot be changed by the audience. This is useful for performers as the data changes gradually, making it more predictable than if the audience were to modify the data at their discretion. Each finite state machine creates an individual data set as they interact with their environment. This data consists of a positive and a negative number, and a third number which is an average between the two. These numbers are continually changing during a finite state machines life cycle. Finite state machine life cycles consist of interacting with their environment, dividing to create more finite state machines with new data, and then dying after diving twice. Once they reach this stage, they deposit their generated data for one of the onstage performers to use, then they stop all activities. The finite state machines are represented in the digital world by floating orbs that traverse the digital environment, interacting with objects and changing colour based on their data set, shown in fig 1. This allows the audience an understanding of the data that each finite state machine is holding. All interactions are shown in fig 2, they include the following: Objects of Interest, a Food Source, and Digital Representations of Performers. Objects of Interest stay in fixed locations, disappearing for a few seconds once finite state machines have interacted with them. They can be modified by audience members, allowing the audience to change their colour which changes the data generated by any finite state machines interacting with them. Red Objects of Interest will increase the negative number, and green will increase the positive number. Finite state machines will interact with the closest Object of Interest to them. Food sources are moved randomly around the environment every time finite state machines interact with them. This moves the finite state machines around the environment, stopping them from getting stuck interacting with a specific set of Objects of Interest. The audience can also interact with these Food Sources which attracts all finite state machines within five metres, giving the audience a way to control the finite state machines. Digital Representations of Performers hold individual data sets that are specific to each on-stage performer. When a finite state machine comes to the end of its life cycle, it will automatically move to the closest Digital Representation of a Performer and transfer its data. This data transfer is accumulative and so the data held by digitally represented performers are defined by the processes of the finite state machines.

The data is then communicated to the corresponding onstage performers, who use it to develop a story. Currently, as a starting point for performances, a vague context is set. We hope that in future work we will be able to work with audiences to contextualise the beginning of performances. The data produced is generic and does not intrinsically imply narrative information, so the performers need to find ways of converting it into usable information. A simple example of this might be: two performers on stage acting out a breakfast scene, the lower the value a performer receives the more argumentative they become and vice versa. It could also be used for narrative devices such as the speed of the imaginary wind. Currently, the system can use the data that is generated to modify various stage equipment such as lighting, sound, and video. These are used to create cues for performer actions. An advantage of working with performers is that there is no need for highly complex systems that attempt to act intuitively to stimuli. High-level cognitive tasks are delegated to the performers and the computationally intensive task of information generation is left to the finite state machines. By forcing the audience to work within the boundaries of the systems data generation parameters, the audience becomes immersed at the intersection of 'mechanical immersion' and 'narrative immersion' [Mason, 2013]. The audience has to engage in repetitive tasks to develop their narrative immersion. Mechanical and narrative immersion is well established in the literature and often are seen as counter to each other, "Whereas ludic immersion presupposes a physically active participant, narrative immersion is an engagement of the imagination in the construction and contemplation of a story world" [Marie-Laure Ryan, 2009], "ludic immersion" here corresponds to Mason's "mechanical immersion". We can view the immersive nature of the proposed system as cre-

ating a dual process immersion, as it is a result of both processes in sync with each other. It is important to make the distinction between manipulating data directly and manipulating the way in which it is generated. By asking an audience member to stop and make complex narrative decisions, immersion can be compromised [Louchart *et al.*, 2008].

The interface between audience and performers will allow audience members to influence the data, without disrupting the performance. It will also create a situation whereby audience members might work with or against each other to realise group or individual goals. Understanding audience agency in this context is a key part of the research. Murray defines agency as being "the satisfying power to take meaningful action and see the results of our decisions and choices." [Murray, 1997] Although, the phrase 'meaningful' is problematic, as it can be interpreted subjectively. "Diegetic" and "extra-diegetic" agency can help to clarify the types of agency an audience member could have. "Diegetic" being "those choices that a player makes as a character or presence within a story world that affect story" and "extra Diegetic" being "choices that a player makes as an external observer that affect the discourse" [Mason, 2013]. It is important to understand that with all narrative media "we will always have to exercise conscious work in order to find meaning" [Fencott, 2001]. Another potential difficulty may lie with "author-audience distance (AAD)," which is the "notion of message transmission between sender and receiver." [Bruni and Baceviciute, 2013]. With the proposed system, we consider the amalgamation of performers, audience and procedural data as redefining the traditional author, and so audience agency is wrapped up in their ability to interpret causal links between their actions and the actions of the performers. An advantage in using finite state machines to generate data is it allows for automation. This allows the audience freedom to stop or start engaging with the system at will, without disturbing the narrative. Thus, maintaining audience immersion and allowing the system to adapt to the type of audience members engaging with it, "critical readers" and "naive readers" [Young and Cardona-Rivera, 2011].

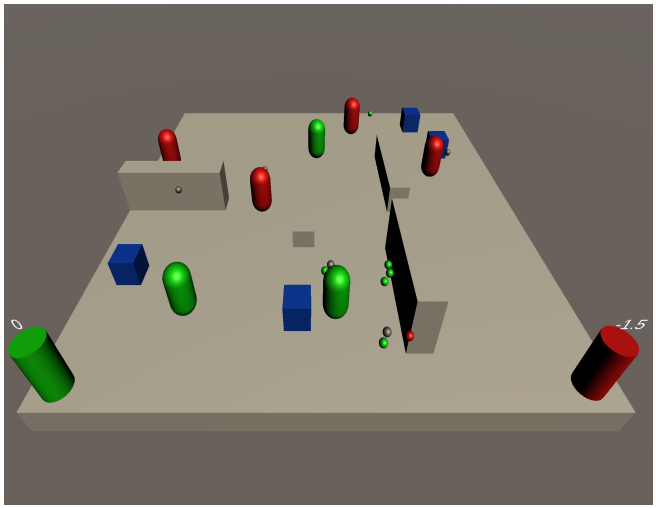

Figure 1: Image of digital environment, taken from a phone.

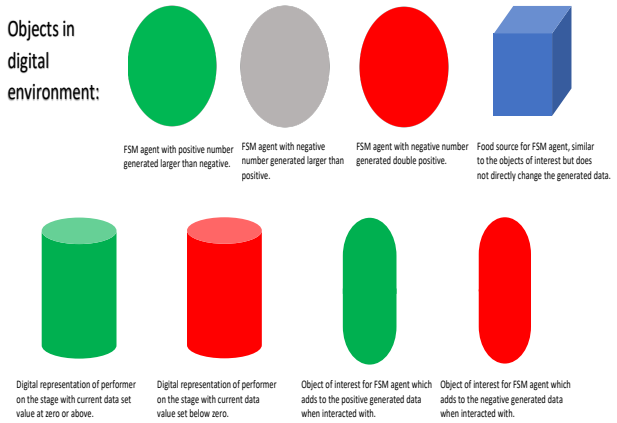

Figure 2: Legend of Fig. 1

4 Future Work

This work is the basis for implementing finite state machines within a theatrical context that creates an audience-performer relationship conducive to the development of an emergent narrative. The research primarily focuses on data creation and communication. Further work in this area could extend to developing narrative frameworks which systematise performer output, which is essential for creating explicit links between performer output and audience input. Exploring the possibilities of remote online audiences could also be productive, possibly leading to greater accessibility and large amounts of active participants which would dramatically change the dynamic between the performer and audience.

5 Conclusion

The proposed research will be a step towards a hybrid system requiring interdisciplinary collaboration and the merging of traditions and technologies. It is a novel approach to creating an emergent narrative for live performance, utilising immersive technologies, where authorial control is combinatory, a synchronized effort between the audience, the performers and the procedural data generation process. The system creates a dynamic and robust bridge between audience and performers that holds many possibilities for extending its usability. By working directly with performers, it will be possible to explore how this could extend, by understanding how generic data can be transformed into useful narrative data for improvisation.

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