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A Sketch-Based Tool for Authoring and Analyzing Emergent Narratives

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Abstract

We present a real-time tool for authoring and analyzing emergent narratives (EN) built using a possible worlds EN framework. The tool works by reducing the emergent narrative into a discrete tension space (TS), based on possible conflicts between characters, and actions treated as movements in the space. The shape and structure of the TS enables an analysis of higher-level narrative and character properties. Likewise, TS can be constructed through a sketch-based interface, that enables the creation of context-free emergent narrative systems.

Introduction

Authoring tools are generally considered useful to reduce the complexity of creating content for complex systems by using high-level abstractions and visualizations, as well as assisting in more pragmatic tasks such as analysis and debugging of content. Visual metaphors are often common in such systems, however such metaphors are more challenging to realize for abstract content, such as the systemic authoring required in EN systems (Kybartas, Verbrugge, and Lessard 2017). This demo presents the design and use of a visual editor created to author content for a possible-worlds EN system, by utilizing a visual representation of the potential conflict, ie. the tension, which is embedded within the authored content. This representation allows for a high-level analysis of narrative properties within the system, as well as the ability to author content by creating spaces of tension using a sketch-based interface. This is intended to also explore the application of sketch metaphors, often more common for spatial structures such as game maps (Liapis, Yannakakis, and Togelius 2013) or terrain (Smelik et al. 2011), to authoring non-visual content.

The version of tool presented here was first introduced in a prior publication (Kybartas, Verbrugge, and Lessard 2020), which included the theory and formal definition of the EN system, analysis and sketch-based authoring techniques. The concepts are presented here in brief, however the focus is specifically on the techniques and approaches to authoring content using the editor.

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Background The possible worlds (PW) EN system presented here was originally based upon Ryan's concept of the modal narrative universe (Ryan 1991). In this model, PWs are used to represent ideal versions of the actual world based upon certain *worldviews*. The narrative involves the creation and resolution of internal and interpersonal conflicts between characters as they try to shift the actual world to meet each of their different ideals. The EN system utilizes vectors to represent a set of values representing the world, with characters being represented by a set of worldview vectors representing the ideal PWs. The characters take actions, which shift the values of the actual world, to try to reduce the Manhattan distance between worldviews and actual world to be zero (ie. the worlds match). Thus, any action that shifts the distance of a worldview closer to zero is a *harmonious* action for said worldview, and any one that shifts the distance away from zero is a *conflicting* action.

The authoring tool is based upon the concept of a *tension space*, which utilizes formal models of conflict, tension and drama (Ware et al. 2014; Szilas, Estupiñán, and Richle 2018). *Tension*, is regarded as the *potential* for conflict, with actions realizing the tension into conflicts. In the EN system, the tension space is a multidimensional space, with each axis being the possible distance between the actual world and that particular worldview. At any time step, the state of the EN can be represented as a point in this space, and each action causes a movement that creates harmony or tension along each axis. By examining the properties of this space and movements within it, high-level properties of the system's and therefore the EN's behaviour can be understood (Kybartas, Verbrugge, and Lessard 2020).

Editor

The authoring tool is implemented as an editor in the popular Unity (Unity Technologies 2020) game engine. The intent was to better integrate the authoring and analysis tool as part of the development process. The editor is split into a number of windows, allowing for the authoring, analysis mentioned above, as well as error checking, playtesting and low level authoring features. The remainder of this section presents the description and use of both the analysis and sketch-based authoring windows.

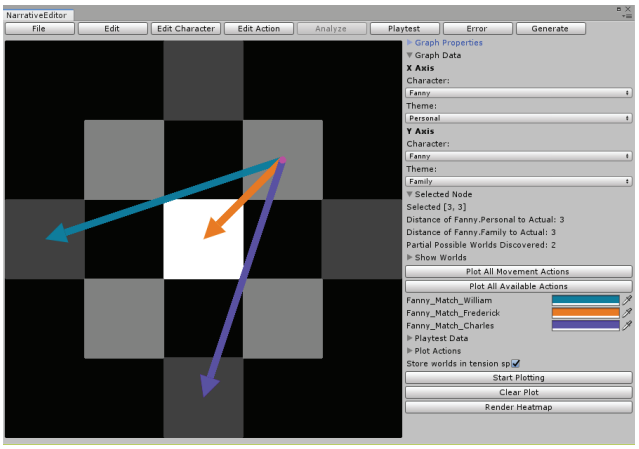

Figure 1: Screenshot of the analysis window of the editor. The tension space is shown as a grayscale heatmap with the arrows representing the possible actions at the current position of the EN.

Analysis The actual tension space of an emergent narrative is a large multidimensional space that in and of itself would be impossible to process on its own. Instead of attempting to render the full space, the analysis creates "snapshots" of the larger space, looking along only two axes (worldviews) at a time. The result then, is a 2D heatmap, in which the ideal for each worldview is that the distance between it and the actual world is 0, ie. point (0,0) is the ideal for both worldviews. Assuming characters act greedily towards their ideals, the resulting narrative would be a set of actions which moves the point representing the EN state from its starting position to the origin.

As previously discussed, the tension space itself possess a number of properties that can be discovered by looking at features of the space, such as shape, orientation, size, etc. This is since the tension space is technically a representation of all possible states the EN can reach, with point (0,0) being the goal, meaning that the tension space restricts the possible movements available to the character and their ability to reach their goals. For example a tension space that mainly only allows one worldview to reach its ideal at the cost of conflicting the other worldview, will be a thin shape with a diagonal orientation, since a move towards zero on one axis is a move away from zero on the other. This means, two worldviews that are high tension can be recognized by observing if this diagonal shape exists in a particular 2D tension space. Figure 1 shows an example of this form of analysis, with the tension space being represented as a heatmap. A particular state of the EN is represented as a small dot, and each arrow represents a movement possible in that state.

The system calculates the tension space by examining all possible world states, and finding the distance between that and the two worldviews, which gives a point indicating that there is a least one EN state that lies at said point. By keeping track of the number of states at any point, the result may be represented as a heatmap, further showing interesting properties such as concentrations of particular EN states. There are several optimizations used to run this analysis much more quickly than "brute-forcing" each possible world state, but this lies outside the scope of this paper.

Authoring Using the knowledge regarding how properties of the space correspond to certain narrative properties allows authoring to occur by creating the tension spaces between a number of world views, that are then fit to a possible EN template. This authoring approach is done using a sketch-based interface, which works in two stages. In the first, the author sketches a number of tension spaces, looking at all the different combinations of worldviews. Here, having knowledge of the high-level properties of the tension space is useful, by creating conflicting, harmonious, or more distributed tension spaces, the author can define the different ways characters will relate to each other, both internally and interpersonally. In the second stage, actions are sketched within the previously drawn tension spaces, in which the author may draw arrows between points or paths between multiple points that represent a specific movement or path the author wishes to be possible within the tension space. Since the movements represent rising and falling conflict, this is essentially akin to sketching simple narrative arcs that should be possible within the system. After the sketches are completed, they are *fit* to specific content. In the first phase, this results in worldview vectors, and in the second, the actions. The result of this is a template for an EN, which defines the overall behaviour without any of the underlying narrative needing to be defined. This is a very different process than typical authorship, in that no information about characters, actions or worlds need be known or defined until after the system behaviour is defined. Nonetheless, given the complexity and systemic nature of emergent narratives, this form of authorship has the advantage of focusing on understanding what the system is going to do, rather than authoring a number of actions or worldviews and "hoping" certain patterns of behaviour will occur.

Conclusion

Authoring and analysis tools can assist in simplifying and giving a high level perspective on the process of authoring. This paper presents an approach to EN representation that creates a visual, spatial metaphor for representing tension and conflicts in narrative. Embedding this representation in an authoring tool, enables a novel form of authoring and analysis which is focused on system behaviour as the core of the EN experience. Further investigation of this alternative authoring approach may yield both novel forms of authorship and analysis, as well as creating a deeper understanding of how narrative properties are embedded within the structure and content of EN systems.[1]

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[1]Demo available at https://youtu.be/fz2XkbQdfaE

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