Emergent Narrative As A Novel Framework For Massively Collaborative Authoring

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Abstract. An emergent narrative is a narrative that is dynamically created through the interactions of autonomous intelligent virtual agents and the user. Authoring in such a system means programming characters rather than defining plot and can be a technically and conceptually challenging task. We are currently implementing a tool that helps the author in this task by training the characters through demonstration of example story lines (rehearsals), rather then explicit programming. In this paper we argue that this tool is best used by a group of authors, each providing an example story and that in order to achieve true emergence, collective authoring is required. We compare the rehearsal based authoring method of our authoring tool with other collaborative authoring efforts and underline why both the storytelling medium "emergent narrative" and our particular approach to authoring are better suited for massively collaborative authoring.

1 Introduction

An increasingly popular branch of AI research concerns itself with interactive narratives - computer based storytelling systems that dynamically respond to the audience and adapt the plot during its presentation. Unfortunately, so far no existing system has yet been able to fully realize these keen ambitions and building such a system remains an open research problem. One of the main reasons for this situation is that the creation of interactive stories poses a big challenge for an author. There is both a lack of theoretic approaches to authoring interactive stories and concrete authoring tools, which results in the interactive narrative medium being very inaccessible to authors. In previous work [1, 2] we have proposed the design of an authoring tool, which is currently being developed that might provide a solution to this problem by allowing the author to provide content in the form of linear stories and thus working within a well studied story creation framework (that of the traditional linear story). Our assumption is that with an increasing number of linear stories the authors provide, the complexity of the story world and thus the quality of an interactive story within this story world increases. In this paper we will argue in favour of a collaborative authoring approach using this tool.

2 Authoring emergent narratives

Emergent Narrative is a term that was first coined by Aylett[3] and refers to a form of interactive storytelling, where the narrative is built bottom-up from interactions of characters. Like in any other emergent system relatively simple local decisions lead to complex behaviour[4], in our example a narrative. Despite that, human authors are still needed, but their role is significantly different from authors of other forms of narrative. In an emergent narrative based system an author specifies a virtual world, characters, their goals, motivations, actions and emotions rather than defining specific plot segments. A possible visualization of an emergent narrative can be seen in Figure 1. Within this framework, characters can be implemented as autonomous intelligent virtual agents. Authoring in this kind of environment poses two challenges that are described in the following sections.

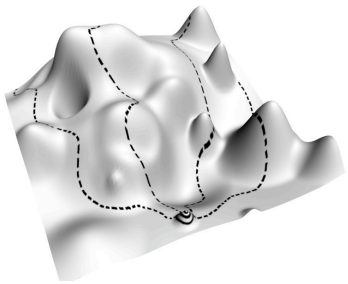

Fig. 1. A conceptual visualisation of an emergent narrative as a 3 dimensional landscape. A particular story that is experienced equals a specific path through the landscape. In this illustration several possible story paths are shown that all initially start from the same point but diverge due to decisions of the user.

2.1 Unpredictability: the conceptual authoring challenge

Not only are emergent narratives non-linear but they are also unpredictable at authoring time. The very nature of emergent narrative requires the author to "let go" of specific story lines altogether and to focus on creating the elements from which the story will emerge. The authors are not even intended to predict what stories will emerge, they are merely setting the boundaries of the story world. And yet our experience during the authoring process for the educational drama *FearNot!*[5], which was an early prototype of emergent narrative technology showed that instead of letting the story emerge naturally, authors tend to iterate between modifying story elements (character settings) and simulation, until the simulation results in the desired story lines. This approach to authoring is of course very tedious and frustrating and furthermore suppresses any emergence, as such defeating the purpose of emergent narrative.

2.2 Knowledge Representation: The technical authoring challenge

The other challenge is the form of authored content. In 1991, Eileen Cornell Way stated[6]: "There is a basic although not often articulated assumption in AI that any system which is able to behave intelligently must consist, in part, of symbolic structures that in some way *represent* the knowledge and beliefs necessary for that behaviour." This still holds true today, despite the progress that non-symbolic knowledge representation methods like neural networks have made since then. For intelligent behaviour, at a high enough level to result in something like a narrative, symbolic knowledge encoding is still absolutely vital. Existing interactive storytelling systems differ in the specifics of knowledge representation, but they all face the same problem: a symbolic description of a world is always just a model and there are many different ways to model a world. Consequently it is the author's responsibility to ensure that the model is consistent and matches the need of the application. In *FearNot!*, a system based on autonomous agents with a continuous planner, most of the authored knowledge can be found inside the action and goal descriptions of the characters planning domains. According to Simpson *et al.*, knowledge representation in AI planning, i.e. the process of representing planning domains for a particular task is "*as important a research topic as the algorithmic aspects of abstract planning engines*"[7]. In the planning context that we are concerned with, problems that the knowledge engineer/author has to face are for example finding the right level of granularity (i.e. distinguish between actions and goals) and finding the right level of abstraction/generality for describing actions and goals.

3 Rehearsal based authoring

We are currently implementing an emergent narrative authoring system based on the *FAtiMA!* agent architecture (originally developed as part of the *FearNot!* software) that will facilitate the authoring process and help authors avoiding some of the aforementioned problems. The main requirement for the software is to make authoring as accessible and user friendly as possible. We intend to achieve this goal by equipping the software with a video game like interface, so that the process of authoring becomes more user friendly and fun. The system learns new goals and action descriptions from observing example storylines(rehearsals). An author provides the system with those rehearsals by simply playing, controlling the characters, very much like a puppeteer would control puppets. This kind of indirect authoring of planning domains has been drawn from the idea of planning operator induction as described in[8]. We have chosen this approach to allow authors to continue thinking in terms of linear stories. In order for a rehearsal to be efficient it of course has to include some new events or at least a new order of events that add something to what was already covered by previous rehearsals. With the previously described features, our work shares many similarities with other research on learning by demonstration (e.g. [9, 10]). We have however added a mixed initiative planning feature that distinguishes our authoring method from most related work. Mixed initiative planning refers

to a planning software that is supervised and assisted by a human being[11]. In our case it means that the characters' or puppets' minds are activated during the authoring process. Although they are controlled by the author, they still plan their own actions. Authors can decide to let the characters perform the actions they have planned or let them perform another action they see more fitting in the situation. In those cases author and character can also engage in a dialogue, in which the author motivates the orders given to the character. The software can use this additional feedback for further refinement of the planning domain.

Adding the mixed initiative mode should provide two core benefits: First, it will provide authors with immediate feedback on a character's authored personality so far and thus make it easier for them to "debug" a character and correct parts of its personality. Second, especially after multiple rehearsals authors will be relieved from the burden of giving the characters repeated instructions. With every rehearsal a character will become more active and autonomous and authors can focus on the input of new knowledge rather then repeating knowledge the character already has. Summarising, the main benefits of our rehearsal based authoring method are a user-friendly game-like interface, the fact that it allows authors to think linearly, i.e. top-down while creating bottom-up emergence and the built-in feedback mechanism through mixed initiative planning. We will not focus further on these issues in this paper, as they are already discussed in more detail in [1] and [2].

4 Massively Collaborative Authoring

User generated content is a buzz-word of the internet industry and the motor of the Web 2.0. Online communities like *MySpace* or *Facebook*, virtual worlds like *Second Life* or the on-line encyclopaedia *Wikipedia* are all well-known examples of how to successfully leverage internet users as content providers. We envisage that a similar collective authoring process could be applied to the creation of emergent narratives. Technically, this would be possible using the rehearsal based authoring mechanism described in the previous section. Different people can provide rehearsals at different times, so every author feeds a little bit into the system.

4.1 Other collaborative authoring projects

Our work bears a certain resemblance to other collaborative authoring projects. Common-sense knowledge bases / ontologies like *Cyc*[1] or *OpenMind Common Sense*[12] are also trying to learn symbolic representations of knowledge through collaborative input of many users, however not within a storytelling context as in our work. We only need to capture the amount of common sense knowledge that is necessary for the agent to act believably in the given story context. We do not

[1] http://www.cyc.com

want to create real intelligence, the illusion of intelligence for a narrative purpose is enough. *Jabberwacky*[2] is a chat-bot that learns from millions of conversations with internet users. Every user that comes to the *Jabberwacky* website to chat is an indirect author and increases the chat-bot's repertoire of utterances. A quite similar approach can be found in *The Restaurant*[13], a research experiment in using gameplay data aquired in a multiplayer game to author the AI for a single player game. The idea of "user generated content" also slowly finds its way into the commercial video game industry. The most notable example for this is *Spore*, the new game of *Sims* creator Will Wright, which through highly procedural AI and graphics allows players to create very unique content. The game automatically streams this content to other players to populate their game world. Again, players are used as authors. Finally, it is worth mentioning *a million penguins*[3], an attempt to collaboratively create a novel on the Web through a wiki. While there is no official academic publication about the lessons learned form this experiment yet, several blog posts[4] summarize the resulting narrative as incoherent and chaotic. Most participants enjoyed the project as an interesting experiment with the conclusion that the literary form of a novel and the collaborative approach of a wiki are too different to be combined.

4.2 Advantages of Collaboration

The collaboration of many users on the web can be seen as an emergent phenomenon itself, so it shares an important feature (emergence) with emergent narratives. Mapping the emergent processes of the web onto the creation of emergent narrative systems thus seems like a sensible step. As we have pointed out, an emergent narrative resembles a whole landscape full of possible stories. In order to create that landscape, a high quantity as well as quality of input is required - an enormous task for a single individual. As the previous literature review has shown, the internet community is both capable of providing vast amounts of data (quantity) and also possesses a great collective creativity (quality) that was ultimately too much to fit in a single novel and resulted in chaos in the case of *a million penguins*. However, the medium of emergent narrative is different. While collaboration in *a million penguins* meant extending the storyline further in length[5], in an emergent narrative it means making the story world richer. Another author just adds more possibilities to what might happen when someone plays through an emergent narrative. Figure 2 illustrates this contrast.

While the collaboration in an emergent narrative results in a reshaping and refinement of the story landscape, in a linear narrative the only way forward is to

[2] http://www.jabberwacky.com

[3] http://www.amillionpenguins.com

[4] e.g. http://www.futureofthebook.org/blog/archives/2007/02/a_million_penguins_a_wikinovel.html

[5] ...or creating branches in a linear medium, where they are not desired. In *a million penguins* quite a few side novels split of the main plot line when authors did not agree with the development of the storyline.

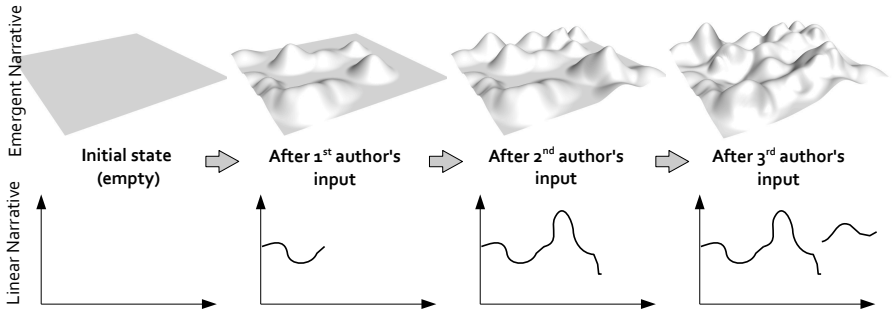

Fig. 2. Conceptual diagram comparing collaborative authoring of an emergent and a linear narrative.

add to the already existing storyline. Doing that can result in undesired jumps in the story's coherence (as seen in the Figure after the 3rd author's input) and thus a disconnected narrative.

4.3 Avoiding Incoherence

One could argue that the same incoherence can also occur in an emergent narrative (e.g. characters acting inconsistently). How can we make sure that several authors do not contradict each other or in other words, how do we keep the story landscape smooth? The potential answer lies within the previously described rehearsal based authoring and its mixed initiative feature. Since the characters are "alive" during the authoring process and give constant feedback on their so far authored personality, a second author cannot easily create a personality for a character that completely contradicts the one given to it by previous authors. Doing that will require the author to justify their decisions to the character and will as a result override the personality that was given to the character by previous authors. This might partly invalidate the previous authors' work but at least it will ensure a smooth story landscape. However, the mixed initiative feature will hopefully help authors to fit in their rehearsal plots nicely with previous rehearsals, i.e. the author will let himself be guided by the characters and vice versa.

4.4 Ignorance is useful

There is another advantage of collaboration. Everything authors have done before will inevitably influence their continuing authoring. They cannot just simply forget what they have rehearsed before and will base their future rehearsal plots on that (consciously or subconsciously). If there is only one single author that provides all the rehearsals this might thus decrease the resulting emergence. If the rehearsals are however distributed to many different authors, none of them

will know the exact rehearsal story-lines that their predecessors have rehearsed. The only connection between their work that they are aware of comes through the mixed initiative feature, i.e. the character's feedback during authoring, but this feedback is limited to only the current plot situation. In a collaborative authoring situation every single author is to a certain extent unaware of the work of the other authors and that unawareness provides a very useful prerequisite for creativity. This is in fact a general truth for all emergent systems, as Steven Johnson states in his book *Emergence*[4], when talking about the requirements of emergent behaviour (using the example of an ant colony):

> "**Ignorance is useful:** ... Having individual agents capable of directly assessing the overall state of the system can be a real liability in swarm logic, for the same reason that you don't want one of the neurons in your brain to suddenly become sentient."

Exactly the same applies to emergent narratives (a character-centric system, with individual agents limited to their own world view) and as explained above to the emergent collaborative authoring process. It is hard for a single brain to design all the elements of an emergent system, as that brain will always try to predict what emerges from the system and thus suppress true emergence. Only multiple brains can achieve that task.

5 Conclusion

In this paper we have described a rehearsal based approach to emergent narrative authoring and argued for a collaborative authoring process using this method. Emergent narrative seems to be a narrative medium that is well suited for collaboration and the rehearsal based approach that lets each author perform a number of rehearsal scales up much better than the more obvious solution of assigning one author to each character. Until a truly emergent narrative (that includes unpredictable things happening) has been built, it will remain unclear, whether this is a desirable and enjoyable experience, but in order to build one, collaboration seems inevitable.

5.1 Future work

In the last months we have started the implementation of the rehearsal based authoring tool described in this paper. After finishing the software development, we plan to perform a small-scale user study to verify the claims that have been made in this paper. For this experiment, we will provide authors with a small set of characters and a limited story domain and then investigate the effects of collaboration. Provided this yields a satisfying result, a long term goal would be a large scale study. To prepare that however, practicalities such as motivating a large number of authors to participate, preventing spamming and vandalism and the question of whether human editors should be involved need to be addressed.

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