Authoring Tools should be Mixed-initiative Systems

Ingibergur Sindri Stefnisson and David Thue

School of Computer Science, Reykjavik University
Menntavegur 1, Reykjavik, 101, Iceland
`{ingibergur13,davidthue}@ru.is`

Abstract. Authoring in the context of Interactive Storytelling (IS) is inherently difficult, and there is a need for authoring tools that both enable and assist authors in the creation of new content. In this position paper, we argue that mixed-initiative systems are a useful model for assisted IS authoring and we introduce two qualities that such systems should have to improve the authoring process. We consider related work with respect to these qualities and then outline our path forward.

1 Introduction

Authoring for Interactive Storytelling (IS) can be a long and arduous process. For players to have interesting choices and a reliable sense of agency, a large amount of content needs to be produced, some of which might never even be seen by most of the users of the resulting interactive story. For example, during the creation of Façade [1], multiple person-years of authoring were needed to produce roughly 20 minutes of content that can be replayed with novelty only six or seven times. Despite extensive work in the context of authoring for IS [2–4] easing the authorial burden remains a challenging task.

Medler and Magerko [5] gave requirements that a good authoring tool needs to have; they included generality, debugging capabilities, usability, environment representation, and the ability to specify pacing, timing, and scope. While meeting these requirements seem likely to make it *possible* to author using a given tool, the challenge of creating a large amount of content would still remain. The creation of content itself is one of the most challenging parts of authoring and is an issue that needs to be addressed. In this position paper, we propose that this challenge can be usefully tackled using Artificial Intelligence (AI), via the concept of mixed-initiative systems.

1.1 Terminology

We say that a system is *mixed-initiative* when one or more agents work together iteratively (i.e., taking turns) to perform a task in the context of that system; any agent can take the initiative to decide what should be done next. A mixed-initiative system is a useful way to model the process of multi-agent authoring,

since iterative refinement is a common part of many authoring strategies. One powerful example of a mixed-initiative system is Google search, in which the human agent can start typing in the search box and the system starts filling in possibilities for what the human wants to search for.

We define the *tightness* of a mixed-initiative system as the frequency with which new opportunities to take the initiative arise; highly frequent opportunities characterize a "tightly-mixed" system, while infrequent opportunities characterize a "loosely-mixed" system. For example, Google search is a tightly-mixed system because the turns alternate between the user and the suggestion agent with every keystroke that the user makes. A loosely-mixed variant of Google search might only allow suggestions to appear after the user had stopped typing their entire query. Tightness is valuable in mixed-initiative systems where the agents' actions are highly co-dependent, since it reduces the need for any single agent to act unilaterally for an extended time. Since authoring is typically a dynamic, creative process, we contend that any mixed-initiative system for authoring should be mixed tightly, rather than loosely.

Finally, we define the *balance* of a mixed-initiative system in terms of how much or little the spaces in which the agents act are the same as one another; systems where all agents act in the same space are "balanced" (e.g., two painters working on a single canvas), while systems where some or all agents act in different spaces are "unbalanced" to some degree (e.g., two cartoonists working on separate panels of a cartoon). Similarly to our notion of tightness, having a mixed-initiative system be balanced is useful when agents' actions are highly co-dependent, as it ensures that the result of every agent's action can be perceived and considered by the next agent who has a turn. For example, Google search is a balanced system because both the user and the suggestion agent operate in the same space (an area within and near the search field), and this offers both agents the benefit of refining their actions based on the results of the other agent's actions. Even so, Google search *used* to be unbalanced; previously, the suggestion agent's actions only appeared on a separate screen, after the user's query had been submitted (e.g., "Did you mean __ ?"). We contend that mixed-initiative authoring systems should be balanced.

2   Related Work

The challenge of creating content has often been approached using the techniques of Procedural Content Generation (PCG) [6–8], where content is generated or recombined from a base set of elements. While most uses of PCG can be thought of as being mixed-initiative (between the generator and the author of the generator's inputs), most of them lack the property of being balanced. The result is that any outputs of the generator that are undesirable are simply discarded, leaving the author to guess at which new inputs might yield a better output. One exception that we have found is Sentient Sketchbook [9] which is a map editor in which the system gives map suggestions in real time based on genetic algorithms that maximize given fitness parameters or the diversity of the suggestions.

Another way that generative systems have been used to ease the authoring burden is by directly assisting in the authoring process itself. Examples of AI-assisted writing such as Say Anything [10, 11] and Creative Help [12] used an AI agent to pick responses to authored text from a corpus of natural language text. While these systems are both balanced and relatively tightly-mixed, the artifacts they produce are non-interactive as soon as the authoring stops. PERSONAGE [13] uses an AI agent to assist with styling authored dialogue according to learned character models and author-selected parameters. This work lacks both tightness and balance, since each agent (author and stylist) takes only one turn and they act in different spaces. Li and Riedl [14] defined a method for adapting the plot of a computer role-playing game based on a player's preference, allowing the player to take a partial role in the authoring process. This player-controlled authoring also lacks both tightness and balance in the same way as the authoring process for PERSONAGE.

The authoring tool ENIGMA [15–17] has a mixed-initiative component in which AI characters can give suggestions for the next event and then the author can either accept that event or deny it and force another event to occur. This system is both tightly mixed and balanced, but its goal is different from ours; they aimed to simplify the authoring of autonomous character behaviours, while we aim to simplify the authoring of plot.

Another example includes Bowman [18, 19], which uses mixed-initiative planning in a plot-based system. The author gives a domain and describes goals for the story, and an AI planner produces possible stories. The author can then refine the domain and goals to try to get different stories from the planner. This process is similar to our description of common PCG systems, in which different results can only be obtained by acting in a space (e.g., possible domains) that is distinct from the generator's space (e.g., possible stories). Assuming that the planner can produce plans quickly (e.g., on the order of seconds), we would consider Bowman's authoring process to be tightly mixed.

To the best of our knowledge, tightly-mixed and balanced tools that assist in the creation of plot have not yet been explored.

3   Conclusion

In this paper, we have argued that the challenge of building authoring tools for interactive storytelling goes beyond merely enabling authors to create digital content themselves – they must be assisted in the process of creation itself. To this end, we proposed that authoring for interactive stories can be well thought of as a mixed-initiative system, and that successful examples of such systems should exhibit both frequent opportunities for taking turns (*tightness*) and unity with regard to the space of agents' actions (*balance*). We intend to design, implement, and study such a system in our forthcoming work, and we welcome both discussions and collaborations that relate to our endeavour.

References

1. Mateas, M., Stern, A.: Façade: An experiment in building a fully-realized interactive drama. Game Developers Conference, Game Design track (2003)
2. Koenitz, H.: Extensible tools for practical experiments in idn: The advanced stories authoring and presentation system. Interactive Storytelling pp. 79–84 (2011)
3. Louchart, S., Swartjes, I., Kriegel, M., Aylett, R.: Purposeful authoring for emergent narrative. Interactive Storytelling pp. 273–284 (2008)
4. Spierling, U., Szilas, N.: Authoring issues beyond tools. In: Joint International Conference on Interactive Digital Storytelling. pp. 50–61. Springer (2009)
5. Medler, B., Magerko, B.: Scribe: A tool for authoring event driven interactive drama. Technologies for Interactive Digital Storytelling and Entertainment pp. 139–150 (2006)
6. Hendrikx, M., Meijer, S., Van Der Velden, J., Iosup, A.: Procedural content generation for games: A survey. ACM Transactions on Multimedia Computing, Communications, and Applications (TOMM) 9(1), 1 (2013)
7. Yannakakis, G.N., Togelius, J.: Experience-driven procedural content generation. IEEE Transactions on Affective Computing 2(3), 147–161 (2011)
8. Togelius, J., Yannakakis, G.N., Stanley, K.O., Browne, C.: Search-based procedural content generation: A taxonomy and survey. IEEE Transactions on Computational Intelligence and AI in Games 3(3), 172–186 (2011)
9. Liapis, A., Yannakakis, G.N., Togelius, J.: Sentient sketchbook: Computer-aided game level authoring. In: Proceedings of Foundations of Digital Games. pp. 213–220 (2013)
10. Swanson, R., Gordon, A.: Say anything: A massively collaborative open domain story writing companion. Interactive Storytelling pp. 32–40 (2008)
11. Swanson, R., Gordon, A.S.: Say anything: Using textual case-based reasoning to enable open-domain interactive storytelling. ACM Transactions on Interactive Intelligent Systems (TiiS) 2(3), 16 (2012)
12. Roemmele, M., Gordon, A.S.: Creative help: A story writing assistant. In: ICIDS. pp. 81–92 (2015)
13. Walker, M., Grant, R., Sawyer, J., Lin, G., Wardrip-Fruin, N., Buell, M.: Perceived or not perceived: Film character models for expressive nlg. Interactive Storytelling pp. 109–121 (2011)
14. Li, B., Riedl, M.O.: An offline planning approach to game plotline adaptation. In: AIIDE (2010)
15. Kriegel, M., Aylett, R., Dias, J., Paiva, A.: An authoring tool for an emergent narrative storytelling system. In: AAAI Fall, Symposium on Intelligent Narrative Technologies (2007)
16. Aylett, R., Vala, M., Sequeira, P., Paiva, A.: Fearnot!–an emergent narrative approach to virtual dramas for anti-bullying education. In: International Conference on Virtual Storytelling. pp. 202–205. Springer (2007)
17. Kriegel, M., Aylett, R.: Crowd-sourced ai authoring with enigma. Interactive Storytelling pp. 275–278 (2010)
18. Thomas, J.M., Young, R.M.: Author in the loop: Using mixed-initiative planning to improve interactive narrative. ICAPS 2006 p. 21 (2006)
19. Thomas, J.M.: Collaborative authoring of plan-based interactive narrative. ICAPS 2006 p. 127 (2006)