Guest Editorial: Computational Narrative and Games

I. Introduction

Narrative is central to our culture, to the ways we communicate, and, many have argued, to our cognition itself. AI research has engaged with narrative deeply, for instance, in the work of Schank *et al.* on story understanding [1] and generation [2], in the narrative intelligence movement of the 1990s [3], and, more recently, with the communities surrounding the workshops on Computational Models of Narrative [4] and Intelligent Narrative Technologies [5].

Video and computer games, although not required to be narrative by their nature, have also connected to narrative concepts in important ways. Most computer games make at least some pretense of having a story, even if only as backstory barely suggested in gameplay. The seminal *Donkey Kong* [6], for example, could easily have been presented as a purely abstract formal puzzle, similar to *Tetris* [7]. But instead, it is framed as the quest of a hero ("Jumpman," who developed into the famous Mario) attempting to rescue a damsel in distress from the game's titular villain. One of the earliest computer games, *Adventure* (also known as *Colossal Cave* [8]), had exploration and actions in its original version, but achieved its full success when Don Woods made a stronger connection to familiar stories by importing the tropes of Tolkeinesque fantasy into the game. That game spawned entire genres, including interactive text adventures such as the Infocom games and their graphical children, and point-and-click adventure games such as *Myst* [9]. It was influential in the development of the entire field of electronic literature.

Narrative is also an increasing focus of contemporary AAA games, so much so that the Game Developers Conference now has a dedicated (and quite popular) "narrative summit" to focus on storytelling practice within video games. This expanded interest is driven both by the game industry seeking to expand its market from core gamers to nontraditional audiences, and by players who increasingly judge games in terms of their narrative qualities. Games such as *Heavy Rain* [10] and *The Walking Dead* [11] have demonstrated that there are considerable audiences for big-budget games that can provide an interactive experience of cinematic storytelling. Individually produced indie games (such as *Gone Home* [12], *Dear Esther* [13], and *Storyteller* [14]) have also shown how aspects of narrative can inform game design in radical and powerful ways.

This special issue presents diverse problems, approaches, and viewpoints in the area of AI for computational narrative for games. While this Transactions' focus is specifically on games, the problems and promises of computational narrative are not limited to gaming. Video games provide a compelling domain with clear cultural relevance and a variety of interesting challenges, but they are only one domain for computational narrative. Others include story generation, story understanding, literary and dramatic art, and interactive documentary. Techniques developed in any of these domains may, of course, prove relevant for another.

II. Computational Modeling of Narrative

Most of the work presented here involves problems of narrative generation, broadly construed. This might involve the *ab initio* creation of narratives, the dynamic instantiation of human-authored nonlinear narratives, or the interactive selection of narrative elements. Narrative generation techniques vary in the ways they deal with the tensions between the goals of narrative coherence (and story quality more broadly), the ability for human designers to exercise authorial control over the stories that are produced, and the problems of adapting an unfolding narrative to unexpected player actions.

Planning-based methods are popular for narrative generation because they allow explicit modeling of the goals and causal structure of the story itself, but also of the goals of the author and the reasoning of the reader/player; modeling these elements may prove critical to the generation of very high-quality stories. However, interactivity introduces challenges to the online application of planning-based methods within games. When players are given the freedom to take a range of actions within a game environment, it is a challenge for a system to commit to a storyline in advance; unanticipated player actions may break plan-based structures that underlie a generated storyline. Simulationist approaches (also known as emergent narrative) seek to address this by modeling the story world explicitly as a distributed simulation in which characters pursue their goals independently of any central controller. These approaches allow maximum freedom to the player at the cost of reduced authorial control and narrative coherence.

Instead of creating a story from whole cloth, one might attempt to guide the player through a prespecified space of possible stories toward the best possible story, given the choices made by the player. This technique is often referred to as drama management. In drama management (an approach relevant to games, but not restricted to them), the space of possible stories is often represented as a set of plot points or beats, together with constraints on their application or an explicit directed graph of allowable transitions between them. The drama manager uses its knowledge of the structure of the space of possible stories to choose events within the story world that will lead to better stories, given the choices made by the player. The metrics used to evaluate the relative merits of potential storylines may be based on authorial goals, a model of the player's preferences, or some general theory of story quality.

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III. Research and Trends in This Issue

The papers presented here explore a range of approaches to computational narrative. They extend and combine the techniques above, as well as others. Some describe systems that generate or manage a story within a running game, while others look at problems of offline generation or of user experience issues during the interaction. Looking across the papers, a number of important topics and contrasts emerge.

Social interaction, and the computational modeling of social interaction in interactive drama in particular, has been a topic of increasing interest in recent years. Two papers presented here explore social simulation as both a game mechanic and a driver of narrative.

Both papers seek to develop reusable social simulations that can be used in multiple games/stories while providing the opportunities for authors to guide the simulations in desired directions.

In "Social story worlds with Comme il Faut," McCoy *et al.* discuss the issues of making CiF a general, reusable "social physics engine," as well as its use in the social puzzle game *Prom Week* [15]. Another system, Versu [16], was the basis for several interactive fiction games, particularly comedies of manners. It is the topic of "Versu—A simulationist storytelling system" by Evans and Short. Starting from the work of Jane Austen, Evans and Short's focus is on the explicit modeling of social practices and norms. In their approach, these norms are used by characters not only to select actions, but also to evaluate and model one another and respond accordingly. The social situations modeled by both systems (whether in high school or at a Regency tea party) are familiar but also heightened; they are contexts in which the social dimensions of the situation are clearly important ones. Both systems define high-level social practices or norms that can differ as the situation varies and that characters can approach differently depending upon their traits.

The work presented in this issue includes some papers focused on the story or content level of narrative (the level of "what happens?") and some papers focused on the level of discourse ("how it is told?"). Research on the underlying story world is represented by "A computational model of narrative generation for surprise arousal" by Bae and Young. They operationalize narratological models of surprise by embodying them in a planning-based story generation algorithm that explicitly models narrative based on causal centrality in a story's structure and validate their computational model with user studies. At the level of discourse, however, one must decide how to narrate the events of the story once they have been selected. This is the problem examined in "Automated story selection for color commentary in sports" by Lee *et al.* While the events that happen during a sports event are determined by the ongoing play, commentators have some freedom to narrate. Lee *et al.*'s system learns a mapping from the internal state of a baseball video game to a catalog of stories and uses this mapping to dynamically suggest stories for inclusion in the running commentary of the game.

"Skald: Minstrel reconstructed" by Tearse *et al.* reports on reconstructing an influential 1993 system (Scott Turner's *Minstrel* [17]) to be able to better understand it and to allow further experimentation with the system. The reconstruction engages with the history of the field, issues of preservation, and questions of how results can be duplicated; it also significantly revises our view of *Minstrel*. Another focused investigation, this one looking specifically at dialog, interface, and its influence on user engagement and enjoyment, is offered in "Designing user-character dialog in interactive narratives: An exploratory experiment" by Endrass *et al.* Varying the way that players interact using speech and text, the authors found a preference toward more continuous interaction (along the lines of *Façade* [18]) over explicit pauses for input, as in classical text adventure games.

As we described above, approaches that employ drama management guide a player through an established space of possible stories rather than creating stories on the fly. In "Personalized interactive narratives via sequential recommendation of plot points," Yu and Riedl present an algorithm that provides advice to a player or a reader about how to proceed through a branching narrative. Their user studies indicate that the advice produced by their approach leads to improved and more personalized player experiences. In "Lessons on using computationally generated influence for shaping narrative experiences," Roberts and Isbell, Jr., describe a drama manager that uses techniques taken from influence theory in social psychology to guide players through an experience; their experiments found that players did not sense a loss of control when this system was operating, while the resulting story experiences were more aligned with the author's goals. In "A supervised learning framework for modeling director agent strategies in educational interactive narrative," Lee *et al.* discuss a drama manager that adapts stories to players in an educational gaming context. Their system uses machine-learning techniques to select actions for an in-world agent who serves to direct the player. The results were positive, not only for players' narrative experiences but also for their learning outcomes.

Story generation is not limited to traditional techniques such as planning and simulation, however, and many novel techniques have been explored. One such technique is analogy. In "Shall I compare thee to another story?—An empirical study of analogy-based story generation," Zhu and Ontañón present a study of the Riu system. Riu uses a computational model of human analogical reasoning not only as a technique for generating stories, but also as a sophisticated storytelling device within a given story. Structuralist techniques such as story grammars are another important class of narrative generation techniques. In "Analysis of ReGEN as a graph-rewriting system for quest generation," Kybartas and Verbrugge use context-sensitive graph-rewriting rules to automate the generation of sidequests for large-scale games such as *Skyrim* [19]. Sidequests are an interesting case of narrative generation for games in that, while they have a narrative structure, they can be generated noninteractively since the enactment of the plot points of the quest is the explicit responsibility of the player. One particularly inter-

esting aspect of this work is the attempt to measure the quality of the stories generated by the system through the use of metrics such as the number of distinct paths through the quest or the uniqueness of actions with a given quest.

Looking across these papers, a number of trends can be seen. One is the attempt to find principled methods for evaluating story generators. Human subject studies based on questionnaire data are common, but the story metrics of *ReGEN*, and the "rational reconstruction" method of Skald, which provides an analog of the practice found in the sciences of independent reproduction of results by other labs, are interesting approaches. Another is the importation and operationalization of theories of human performance, Bae and Young's work on Prevoyant, or Zhu and Ontañón's use of structure mapping theory and force dynamics.

IV. Conclusion

Considerable progress has been made in AI for computational narrative. The deployment of sophisticated AI techniques in indie games such as *Storyteller* [14] and *Prom Week* [15], and mainstream commercial game platforms like Versu [16], mark an important step for the field. But considerable work remains to be done.

A significant amount of current work in AI and narrative seeks to provide authoring tools and assistance to writers and game designers. In some cases, the research is meant to replace rather than supplement human narrative production. Such work is often undertaken, however, with no or minimal consultation of the experts who are meant to be assisted or emulated by the systems being developed. While interesting developments can result, there is the risk that work will proceed along lines that relate to AI techniques but are aesthetically unproductive. There is also the possibility that the tools that are produced are difficult to deploy beyond the AI community or even the original project team. If improving authorship tools is a serious goal, or if the goal is providing narratives that are similar to human-produced ones, researchers would do well to involve human domain experts. "Automated story selection for color commentary in sports" provides one example in which this was done effectively in the evaluation stage.

Current evaluation practices have been imported from human–computer interaction (HCI), psychology, and software engineering. These work very well in cases where they are applicable, but when the research deals with large-scale aesthetic works with entertainment and artistic goals, it is far from clear that social science and engineering evaluation methodologies will suffice. It would be useful in many cases to use evaluation tools used in the arts, including reviews, critiques, case studies, and postmortems. These two approaches are not mutually exclusive, of course, and cannot be expected to provide the same sorts of insights. But, as researchers, we should seek ways of learning as much as possible about systems and about the potential of narrative.

Finally, it is worth noting that AI researchers involved with economics, linguistics, and other areas are not only producing compelling new systems, but are also making contributions in the related disciplines in which they are working. Although gaming and narrative are exciting fields of academic study and, of course, involve rich areas of practice, the contributions of AI researchers to game studies and narrative theory have been far fewer. Researchers should develop the implications of their work for gaming and narrative generally, and should share their results and insights with the relevant research communities and major conferences. By doing so, they will also give themselves the opportunity to engage with the latest research in gaming and narrative, improving their theoretical perspectives so as to better develop new computational approaches.

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