

The Virtual Storyteller

Mariët Theune, Sander Faas, Anton Nijholt, Dirk Heylen
University of Twente
PO Box 217, 7500 AE Enschede, The Netherlands
{theune | anijholt | heylen}@cs.utwente.nl

INTRODUCTION

In this paper we present the Virtual Storyteller [7], a multi-agent framework for dynamic story creation that we developed as part of our research on virtual environments inhabited by autonomous embodied agents [10]. One 3D environment built in our research group is a replica of a local theatre: the Virtual Music Centre (VMC). Here, visitors can meet various embodied agents that provide information or entertainment. This is a natural setting for the Virtual Storyteller, which uses an embodied, speaking agent to present the generated stories using appropriate prosody and gestures. In addition to this traditional form of storytelling, extensions to virtual drama are envisaged, where embodied characters act out the story on the stage of the VMC. In the following, we give an overview of the Virtual Storyteller and point out some future work.

OVERVIEW OF THE VIRTUAL STORYTELLER

The Virtual Storyteller framework consists of several intelligent agents that are responsible for automatic story creation at three levels. The first of these levels is the *plot*: a coherent series of events that make up the story's content. The second level is the *narrative*: a description of the plot in natural language. The third level is the *presentation*: a realisation of the story through speech and gestures by an embodied agent. These levels correspond to the *fabula*, *story* and *text* from narrative theory [2].

Plots are created by the actions of one or more virtual characters (or 'actors'), guided by a virtual director. Both characters and director are implemented as intelligent agents, capable of reasoning within their own domain of knowledge. The characters can make plans to achieve their personal goals using 'story world knowledge': knowledge about their virtual environment and the actions they can take in it. The director is able to judge whether a character's intended action fits into the plot structure, using both story world knowledge and general knowledge about what makes a 'good' plot. In addition to the actors and the director, the Virtual Storyteller also has a narrator and a presentation agent, which are responsible for the narrative and the presentation levels of the story. Figure 1

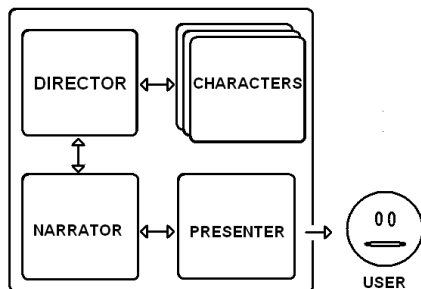


Figure 1. Architecture of the Virtual Storyteller.

shows the architecture of the Virtual Storyteller.

The agent framework for the Virtual Storyteller was built using JADE (Java Agent Development Environment [3]), and the agents' rule bases were constructed using Jess (Java Expert System Shell [9]). Below we describe the creation of each of the story levels in more detail.

Plot creation as a combined effort

In the Virtual Storyteller, the plot automatically emerges through the actions of a number of (semi-) autonomous character agents. Because the characters choose their actions on the basis of logical reasoning, given their story world knowledge and their goals, the resulting plots are *consistent*, meaning that the characters' actions are in line with their own previous actions and with the story world. An important difference with similar, 'character-based' approaches [1,13] is that in our system, there is also a director agent who ensures that the unfolding plot has a proper structure. Currently, the director's knowledge base contains a very simple plot grammar, which specifies that a story must have a beginning (where the characters and the environment are introduced), a middle part (where the main action takes place), and a happy end. Basically, this corresponds to 'Freytag's triangle' [8]. To ensure a proper plot structure, the director can use the following control methods (based on the classification in [4]):

- *Environmental*: introducing new characters and objects into the virtual environment.
- *Motivational*: giving a character a goal to pursue.
- *Proscriptive*: disallowing a character's intended action.

To get the plot going, the director first creates a setting (environmental control) and provides the characters with a goal (motivational control). Before performing any action, the characters must ask the director for permission, which is where proscriptive control comes into play. For example, the director might keep the antagonist from killing the protagonist early on during plot development, to prevent a premature ending to the story. The director might also allow the killing, but then introduce a new character to save the protagonist (e.g., using a magic potion). Note that the director does not have *proscriptive* control: he cannot force a character to perform a specific action. However, he may try to 'push' the plot in the desired direction using environmental and motivational control. Whether this is sufficient to achieve adequate plots, still remains to be seen.

Currently, the system is aimed at the generation of very simple fairy tales. Future extensions include the use of a more fine-grained plot structure, e.g., based on Propp's functions [12]. The next step is to apply the system to other domains. Our framework is well suited for this, since new (Jess) rule bases can be easily loaded into both the director and the character agents.

Turning the plot into a story

Unlike many (text-based) story generation systems, which are basically plot creation systems, the Virtual Storyteller explicitly takes the narrative and presentation levels into account. The agents responsible for this are the *narrator* and the *presenter*. The narrator turns the plot into a textual narrative by translating system representations of states and events into natural language sentences. An important subtask in this process is the generation of appropriate pronouns, is one of the factors that most influence the enjoyment of a narrative [6]. The text that is produced by the narrator is sent to the presentation agent. Currently, this is an MS Agent that uses speech synthesis and text balloons to present the narrative to the user (see Figure 2). For future versions of the Virtual Storyteller we will use our own work on speech synthesis and facial animation [5], which offers more possibilities for using prosody and (facial) gestures to enhance storytelling.

Additional future work is story presentation in the form of virtual drama. This is a realistic possibility since in the Virtual Storyteller the characters already are intelligent agents, which 'only' need to be extended with a body and animation capabilities. In this scenario, the presentation agent will be no longer needed (its role will be taken over by the characters), and the function of the narrator will be changed from text generation to play writing, a task for which new, theatre-oriented knowledge will be required.

INTERACTIVITY

In the present version of the Virtual Storyteller, the user cannot influence the story creation process, but for future versions we envisage various forms of interactivity. A first step is to have the user take over some of the director's tasks, e.g., by picking the characters and their goals or by deciding which of the characters' intended actions are allowed. Since the Jade agent platform can be distributed across several machines, it would also be possible to have multiple users controlling their favourite characters from different locations, transforming the Virtual Storyteller into a kind of role playing game. It will be interesting to see how, in such a situation, the director agent can be used to steer the interaction.

In the longer run, we want to extend the system with story presentation in the form of virtual drama, with the characters acting on the stage of the VMC. This allows for new interaction forms such as having a user-controlled avatar join the actors on the stage. The user could also be seated in front of the stage as part of the audience, and influence the story by actively expressing enthusiasm or disapproval. For a detailed discussion of the possibilities for user interaction in the VMC environment, see [11].

CONCLUSIONS

In our approach to virtual storytelling, the characters are implemented as intelligent, semi-autonomous agents. A virtual director with global knowledge about plot structure guides their actions and ensures that a well-formed plot emerges. Our approach has been implemented in a general multi-agent framework called the Virtual Storyteller, which covers all story levels and allows for further development in many different directions. The knowledge

Once upon a time there lived a dwarf called Plop



Figure 2. The presentation agent.

bases currently used in the Virtual Storyteller are still quite limited. We will extend these in the near future, and further explore the creative potential of our framework.

REFERENCES

- [1] Aylett, R. (1999): Narrative in virtual environments - Towards emergent narrative. In *AAAI Fall Symposium on Narrative Intelligence*, pp. 83-86.
- [2] Bal, M. (1985): *Narratology: Introduction to the Theory of Narrative*, University of Toronto Press.
- [3] Bellifemine, F., A. Poggi, and G. Rimassa (2001): Developing multi agent systems with a FIPA-compliant agent framework. In *Software - Practice and Experience*, 31, pp. 103-128.
- [4] Blumberg, B. and T. Galyean (1997): Multi-level control for animated autonomous agents: Do the right thing...Oh, not that... In *Creating Personalities for Synthetic Actors*, eds. R. Trappl and P. Petta, Springer Lecture Notes in Computer Science vol. 1195, pp. 74-82.
- [5] Bui, T.D., D. Heylen, M. Poel, and A. Nijholt (2001): Generation of facial expressions from emotion using a fuzzy rule-based system. In *AI'01 - the 14th Australian Joint Conf. on Artificial Intelligence*.
- [6] Callaway, C. and J. Lester (2001). Evaluating the effects of natural language generation techniques on reader satisfaction. In *Cognitive Science 2001- the 23rd Annual Conference of the Cognitive Science Society*.
- [7] Faas, S. (2002): *Virtual Storyteller: An Approach to Computational Storytelling*. Masters thesis, Dept. of Computer Science, University of Twente.
- [8] Freytag, G. (1863): *The Technique of the Drama*. (Reprinted by Johnston Reprints in 1968.)
- [9] Friedman-Hill, E. (1997): *Jess, the Java Expert System Shell*. Sandia National Laboratories, Livermore, CA. (<http://herzberg.ca.sandia.gov/jess/>)
- [10] Heylen, D., A. Nijholt, and M. Poel (2001): Embodied agents in virtual environments: The Aveiro project. In *Eunite'01 - the European Symposium on Intelligent Technologies, Hybrid Systems & their implementation on Smart Adaptive Systems*, pp. 110-111.
- [11] Nijholt, A. (2000): Towards virtual communities on the Web: Actors and audience. In *ISA'2000 - International ICSC Congress on Intelligent Systems & Applications*, Vol. II, pp. 725-731.
- [12] Propp, V. (1968): *Morphology of the Folktale*, University of Texas Press.
- [13] Stern, A., A. Frank, and B. Resner (1998): Virtual Petz: A hybrid approach to creating autonomous, lifelike Dogz and Catz. In *AA'98 - the 2nd International Conference on Autonomous Agents*, pp. 334 -335.