Character-driven Story Generation in Interactive Storytelling

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Abstract

In this paper we describe a fully implemented prototype for interactive storytelling using the Unreal™ engine. We describe the important mechanisms involved in the variability of plot instantiations, within a scenario of sitcom genre. We also provide an evaluation of the concepts of how the dynamic interactions between agents and/or the user influence the generation of story, with first results of examples.

1. Introduction

In this paper, we present results from a first version of a fully-implemented storytelling prototype, which illustrate the generation of variants of a generic storyline. These variants result from the interaction of autonomous characters with one another, with environment resources or from user intervention.

The development of artificial actors and AI-based animation naturally leads to envision future interactive storytelling systems. A typical interactive storytelling system would be based on autonomous virtual actors that generate the plot through their real-time interaction. Besides, the user should be allowed to interfere with the ongoing action, thereby altering the plot as it unfolds.

Many interactive storytelling models have been proposed: user-centred plot resolution [1], character-based approaches [2] [3], anytime interaction [4] and the need for narrative formalisms [5]. Previous work has identified relevant dimensions and key problems for the implementation of interactive storytelling, among which: the status of the user, the level of explicit narrative representation and narrative control, the modes of user intervention, the relations between characters and plot, etc.

Some of these problems derive from the inherent tension between interaction and narrative [2] [3]. Interactive systems demand user involvement but often at the expense of a real storyline; on the other hand, a strong narrative dimension is traditionally conceived with a user as spectator rather than being actively involved. Our solution to this problem consists in limiting the user involvement in the story, though interaction should be allowed at anytime. This is achieved by driving the plot with autonomous characters' behaviours, and allowing the user to interfere with the characters' plans. The user can interact either by physical intervention on the set or by passing information to the actors (e.g., through speech input).

In the next sections, we will introduce the important concepts of character-centred storytelling as well as a brief description of our implementation. Results of variants in story generation are illustrated with different examples.

The initial storyline should actually determine not only the main character's plan, but those of other characters as well. The problem of dependencies between characters' roles has actually been described within modern narratology, though not to a formal level. Narrative

functions can be refined into bipolar relations between a couple of actors, emphasising the asymmetry in their roles [7]. We have adopted this framework to define the respective behaviours of our two leading characters. We started with the overall narrative properties imposed by the story genre (sitcoms). In terms of behaviour definition, this amounts to defining an “active” plan for the Ross character (oriented towards inviting Rachel) and a generic pattern of behaviour for Rachel (her day-to-day activities).

2.2. AI-based characters’ behaviours

Individual agent behaviours are produced by solving the set of sub-plans described in the preceding section, which are represented by Hierarchical Task Networks (HTN), such as the one of Figure 1. Using formal properties of these plans, it is possible to generate solution plans by searching directly the AND/OR graph of the HTN with an algorithm such as AO* [8] [9]. In our system, this is done with a “real-time” variant of AO*, which interleaves planning and execution and supports re-planning that is required when a character’s plan is altered through interaction with another virtual actor or the user. The terminal actions (e.g. reaching a location, using an object, interacting with other actors) forming the plan are actually played in the graphic environment through their corresponding animations. The dramatisation of these actions constitutes the story as seen by the user.

The “virtual sitcom” prototype described in this paper has been developed using the Unreal™ game engine. The Unreal™ environment provides most of the user interaction features required to support user intervention in the plot, such as navigating about and interacting with objects within the virtual set and its use has been previously reported in prototyping interactive storytelling [2]. The system has been fully implemented as a set of template C++ classes, which can be used as native functions from within UnrealScript™, Unreal™’s scripting language.

3. Variability in plot instantiation

The final application of story generation we are addressing consist in being able to alter the ending of stories that have an otherwise well-defined narrative structure. As described previously, characters’ behaviours are defined as a superset of all possible behaviours, represented as sub-goals, which correspond to various courses of actions. The story unfolds as a succession of the characters’ actions taking place within the virtual set. Important factors of variability in story generation are determined by the nature of the prototype. The different elements presented are space, time and user intervention.

Figure 2. Influence of spatial distribution

In our first prototype, the main role character (“Ross”) conserves the same main objective, i.e. to succeed in inviting the “Rachel” character out. Though the main goal remains unchanged, random spatial distribution of characters’ initial positions in the virtual set influences variability in the generation of each story instantiation. The virtual storytelling

environment was created using Unreal™’s editor where we added a number of pre-defined initial positions from which the system can randomly choose the virtual actors’ starting positions. Thus, every time the story is re-initialised, the virtual actors may be located at a different initial position than the previous story instantiation. As a consequence, the spatial distribution imposes a temporal constraint on the course of characters’ actions.

The outcome of characters’ goals, involving interaction with other characters or resources, can be altered as the distance from a character to an object will vary. The actions of main and second role characters will compete for resources in order to fulfil their own individual sub-plans. For instance, Ross’s sub-goal is to read Rachel’s PDA to check her availability, and Rachel’s independent sub-plan is to write down an appointment in her PDA. A spatial initial configuration may see Rachel reach the object first, making Ross’s sub-plan fail when discovering the object being already used. (see Figure 2). However, a different initial setting could give the opportunity for Ross to succeed in his goal before Rachel enters the room.

The duration of characters’ actions implies another temporal variation. Actions involving resources, like reading a magazine or writing a letter, include a “timer” definition. Certain scripted actions are associated a clock based on the internal Unreal™ clock. For instance, Rachel, wanting to read a book, will reach the object and then start using it through a durative action (see Figure 3). This situation will imply a condition on Ross’ sub-plan validity to talk to her, as Rachel may still be acting on the object.

Figure 3. Effect of actions duration

Generation of situations being closely related to the interaction between characters, we can incorporate additional variability factors in virtual storytelling by adding a random outcome of terminal actions. Situational decisions at character level will influence the unfolding of the story. For instance, when Ross talks to Phoebe enquiring about Rachel’s feelings towards him, she may decide to be cooperative, or unhelpful by not giving any information away (see Figure 4).

Figure 4. Variable outcome of actions

Interaction takes place from situational encounters of characters through the succession of actions leading the story generation. Interactions within the virtual environment can also arise from physical or linguistic user intervention [10]. Though it should not interfere all the time during the course of the story, physical interference with resources provides another means of

incorporating story variation. For instance, the user may “steal” resources that the main character requires to fulfil a sub-goal, creating need for re-planning (see Figure 5). The use of speech input also allows the user to influence the cognitive status of characters and is another way of interfering with actors’ plans.

Figure 5: Dramatisation of action failure due to user interference

The different factors of variability in story instantiation are determinants of unpredictability in the unfolding of the story. These provide essential elements for the creation of dramatic virtual storytelling environments. In the next section, we will present a complete example of plot instantiation from a simple sitcom storyline.

4. Evaluation of approach

While the conditions for character interaction lie in the on-stage spatio-temporal instantiation of the storyline, additional mechanisms are required to recognise these interactions and propagate their consequences. Figure 6 illustrates an entire story instantiation.

“In order to get the information he needs, Ross goes to read Rachel’s diary (a). When he approaches the room, he realises that Rachel is actually writing in her diary (b). Unnoticed by Rachel, he goes to meet Phoebe to ask her about Rachel (c). In the meantime, Rachel has finished writing and decides to have a chat with Phoebe. As she arrives to meet Phoebe, she sees her in a joyful conversation with Ross (d). She gets jealous and ostensibly leaves the room (e) to go out on her own (f).”

Figure 6. Sequence of actions illustrating the story instantiation

This example illustrates the interaction of the two main character's plans. These plans are designed from narrative principles. It appears that exploring actors' behaviour in storytelling is more feasible within narrative genres that display the simplest storylines, as such developing "virtual sitcoms" seems a relevant first step in the pursuit of interactive storytelling. As its own name suggests, sitcom standing for "situation comedy", a significant fraction of the story interest arises from the situations into which the actors find themselves. For instance, the fact that Rachel could misunderstand the situation where Ross was talking to Phoebe, then triggering the emotional reaction of jealousy. Her state of mind being modified (i.e., she gets upset), Rachel will then leave the room. The succession of "small" interesting situations is a mechanism for cause-and-effect relationships [6], providing the basis for dramatic story generation.

Though plans are designed from global narrative principles, considering the current story genre, they are run independently. The bipolarity between the characters' plans was defined to emphasise the asymmetry in their roles [7]. The overall narrative properties imposed by the story genre defined interaction between the main character's ("Ross") and its supporting role's ("Rachel") behaviours. The generic pattern of Rachel's day-to-day activities may interfere with Ross' "active" plan, as illustrated when Ross want to read Rachel's diary while she is already using it. This interactivity between characters' behaviours must be emphasised visually when it demonstrates narrative relevance.

As part of the story believability, mechanisms in action recognition will help to make the characters' emotional status visible to the user, so he can understand their interactions. The variations in characters' emotions and moods must emerge from situations relevant to the story genre without changing their overall personality profile. For instance, Rachel's mood towards other characters can vary according to the meaning of their actions for Rachel (e.g., jealousy). The next generation of real-time animation engine (i.e., Unreal2™) will help representing facial expressions, or detailed non-verbal behaviour (e.g., body postures) to improve the dramatisation of events through physical characterisation.

Above the planning and interleaving of actions, explicit situated mechanisms for reactive behaviours [11] are needed in order to deal with specific situations (e.g., Ross suddenly meets Rachel on his way). This implies high-level action recognition of interactions between characters' behaviours. If a narratively meaningful (considering the story genre) situation arises, the mechanism would act on the character's current plan by ordering a re-planning of its action.

5. Conclusion

We have shown that, although actor's behaviours are deterministic, the interaction between actors could considerably contribute towards story variability. This degree of unpredictability conditions the generation of dramatic situations. The character-centred approach has the advantage of being modular and extendable to many actors.

Further work is to be dedicated to developing more complex storylines within differing genres, scaling up using multiple plans for each actor to increase characters' interactions and narrative function recognition.

References

- [1] N.M. Sgouros, G. Papakonstantinou and P. Tsanakas, "A Framework for Plot Control in Interactive Story Systems", Proceedings AAAI'96, AAAI Press, Portland, 1996.
- [2] R.M. Young, "Creating Interactive Narrative Structures: The Potential for AI Approaches", AAAI Spring Symposium in Artificial Intelligence and Interactive Entertainment, AAAI Press, 2000.
- [3] M. Mateas, "A Neo-Aristotelian Theory of Interactive Drama", AAAI Spring Symposium in Artificial Intelligence and Interactive Entertainment, AAAI Press, 2000.
- [4] R. Nakatsu and N. Tosa, "Interactive Movies", In: B. Furht (Ed), Handbook of Internet and Multimedia – Systems and applications, CRC Press and IEEE Press, 1999.
- [5] N. Szilas, "Interactive Drama on Computer: Beyond Linear Narrative", AAAI Fall Symposium on Narrative Intelligence, Technical Report FS-99-01, AAAI Press, 1999.
- [6] R. Raskin, "Five Parameters for Story Design in the Short Fiction Film", P.O.V., n. 5, 1998.
- [7] R. Barthes, "Introduction à l'Analyse Structurale des Récits" (in French), Communications, 8, 1966, pp. 1-27.
- [8] R. Tsuneto, D. Nau and J. Hendler, "Plan-Refinement Strategies and Search-Space Size", Proceedings of the European Conference on Planning, 1997, pp. 414-426.
- [9] M. Cavazza, F. Charles, S.J. Mead, and A. Strachan, "Virtual Actors' Behaviour for 3D Interactive Storytelling", Eurographics 2001 (short paper), 2001, to appear.
- [10] F. Charles, S.J. Mead and M. Cavazza, "User Intervention in Virtual Interactive Storytelling", Proceedings of VRIC 2001, Laval, France, 2001.
- [11] C. Geib, "The Intentional Planning System: ItPlans", Proceedings of the 2nd Artificial Intelligence Planning Conference, AIPS-94, 1994, pp. 55-64.