Chapter 27

TOWARDS INTEGRATING PLOT AND CHARACTER FOR INTERACTIVE DRAMA

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Abstract The authors are currently engaged in a three year collaboration to build an interactive story world integrating believable agents and interactive plot. This paper provides a brief description of the project goals and design requirements, discusses the problem of autonomy in the context of story-based believable agents, and describes an architecture that uses the dramatic beat as a structural principle to integrate plot and character.

1. Introduction

Interactive drama concerns itself with building dramatically interesting virtual worlds inhabited by computer-controlled characters, within which the user (hereafter referred to as the player) experiences a story from a first person perspective [7]). Over the past decade there has been a fair amount of research into believable agents, that is, autonomous characters exhibiting rich personalities, emotions, and social interactions ([12]; [8]; [5]; [4]; [9]; [1]). There has been comparatively little work, however, exploring how the local, reactive behavior of believable agents can be integrated with the more global, deliberative nature of a story plot, so as to build interactive, dramatic worlds ([16]; [2]). The authors are currently engaged in a three year collaboration to build an interactive story world integrating believable agents and interactive plot. This paper provides a brief description of the project goals and design requirements, discusses the problem of autonomy in the context of story-based believable agents, and finally describes an architecture that uses the dramatic beat as a structural principle to integrate plot and character.

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2. Design Requirements

Artistically complete. The player should have a complete, artistically whole experience.

Animated characters. The characters will be represented as real-time animated figures that can emote, have personality and can speak.

Interface. The player will experience the world from a first-person 3D perspective. The viewpoint is controlled with the keyboard and mouse.

Dialog. Dialog will be the primary mechanism by which a player interacts with characters and influences how the story unfolds. To achieve dialog, the player types out text that is visible on screen; the computer characters' dialog is spoken speech with simultaneously displayed text. The conversation discourse is real-time; that is, if the player is typing, it is as if they are speaking those words in (pseudo) real-time. The system should be very robust when responding to inappropriate and unintelligible input.

Interactivity and plot. The player's actions should have a significant influence on what events occur in the plot, which are left out, and how the story ends. The plot should be generative enough that it supports replayability. Only after playing the experience 6 or 7 times should the player begin to feel they have "exhausted" the interactive story. In fact, full appreciation of the experience requires the story be played multiple times.

Short one-act play. We want to design an experience that provides the player with 15 minutes of emotionally intense, tightly unified, dramatic action.

Relationships. The story should be about the emotional entanglements of human relationships. Our story is a domestic drama in which the relationship of a married couple, Grace and Trip, falls apart during an innocent evening visit by the Player.

Three characters. The story should have three characters, two controlled by the computer and one controlled by the player.

The player should not be over-constrained by a role. The amount of non-interactive exposition describing the player's role should be minimal.

Distributable. The system will be implemented on a platform that is reasonably distributable, with the intention of getting the interactive experience into the hands of as many people as possible.

For more details, see [13].

3. Autonomy and Story-Based Believable Agents

Most work in believable agents has been organized around the metaphor of strong autonomy. Such an agent chooses its next action based on local perception of its environment plus internal state corresponding to the goals and possibly the emotional state of the agent. Using autonomy as a metaphor driving the design of believable agents works well for believable agent applications in

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which a single agent is facilitating a task, such as instructing a student ([9]), or giving a presentation ([6]), or in entertainment applications in which a user develops a long-term relationship with the characters by "hanging-out" with them ([1]). But for believable agents used as characters in a story world, strong autonomy becomes problematic. Knowing which action to take at any given time depends not just on the private internal state of the agent plus current world state, but also on the current story state, including the entire past history of interactions building on each other towards some end. The global nature of story state is inconsistent with the notion of an autonomous character that makes decisions based only on private goal and emotion state and local sensing of the environment.

Only a small amount of work has been done on the integration of story and character. This work has preserved the strong autonomy of the characters by architecturally dividing the responsibility for state maintenance between a drama manager, which is responsible for maintaining story state, and the believable agents, which are responsible for maintaining character state and making the moment-by-moment behavior decisions ([16]; [2]). These two components communicate via a narrow-bandwidth, one-directional interface flowing from drama manager to agent. The messages sent across this interface consist of goals that characters should assume or perhaps specific actions they should perform. The character is still responsible for most of the decision making.

This architecture makes several assumptions regarding the nature of interactive drama and believable agents: drama manager decisions are infrequent, the internal structure of the believable agents can be reasonably decoupled from their interaction with the drama manager, and multiple-character coordination is handled within the agents. Let's explore each of these assumptions.

Infrequent guidance of strongly autonomous believable agents means that most of the time, behavior selection for the believable agents will occur locally, without reference to any (global) story state. The drama manager will intervene to move the story forward at specific points; the rest of the time the story will be "drifting," that is, action will be occurring without explicit attention to story movement. Weyhrauch ([16]) does state that his drama manager was designed for managing the sequencing of plot points, that is, for guiding characters so as to initiate the appropriate next scene necessary to make the next plot point happen (whatever plot point has been decided by the drama manager). Within a scene, some other architectural component, a "scene manager," would be necessary to manage the playing out of the individual scene. And this is where the assumption of infrequent, low-bandwidth guidance becomes violated. As is described in the next section, the smallest unit of story structure within a scene is the beat, a single action/reaction pair. The scene-level drama manager will thus need to continuously guide the autonomous decision making of the

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agent. This frequent guidance from the drama manager will be complicated by the fact that low-bandwidth guidance (such as giving a believable agent a new goal) will interact strongly with the moment-by-moment internal state of the agent, such as the set of currently active goals and behaviors, leading to surprising, and usually unwanted, behavior. In order to reliably guide an agent, the scene-level drama manager will have to engage in higher-bandwidth guidance involving the active manipulation of internal agent state (e.g. editing the currently active goal tree). Authoring strongly autonomous characters for story-worlds is not only extra, unneeded work (given that scene-level guidance will need to intervene frequently), but actively makes guidance more difficult, in that the drama manager will have to compensate for the internal decision-making processes (and associated state) of the agent.

As the drama manager provides guidance, it will often be the case that the manager will need to carefully coordinate multiple characters so as to make the next story event happen. For example, it may be important for two characters to argue in such a way as to conspire towards the revelation of specific information at a certain moment in the story. To achieve this with autonomous agents, one could try to back away from the stance of strong autonomy and provide special goals and behaviors within the individual agents that the drama manager can activate to create coordinated behavior. But even if the character author provides these special coordination hooks, coordination is still being handled at the individual goal and behavior level, in an ad-hoc way. What one really wants is a way to directly express coordinated character action at a level above the individual characters.

At this point the assumptions made by an interactive drama architecture consisting of a drama manager guiding strongly autonomous agents have been found problematic. The next section presents a sketch of a plot and character architecture that addresses these problems.

4. Integrating Plot and Character with the Dramatic Beat

In dramatic writing, stories are thought of as consisting of events that turn (change) values ([14]). A value is a property of an individual or relationship, such as trust, love, hope (or hopelessness), etc. A story event is precisely any activity that turns a value. If there is activity – characters running around, lots of witty dialog, buildings and bridges exploding, and so on – but this activity is not turning a value, then there is no story event, no dramatic action. Thus one of the primary goals of an interactive drama system should be to make sure that all activity turns values. Of course these values should be changed in such a way as to make some plot arc happen that enacts the story premise, such as in our case, "To be happy you must be true to yourself".

Major value changes occur in each scene. Each scene is a large-scale story event, such as "Grace confesses her fears to the player". Scenes are composed of beats, the smallest unit of value change. Roughly, a beat consists of one or more action/reaction pairs between characters. Generally speaking, in the interest of maintaining economy and intensity, a beat should not last longer than a few actions or lines of dialog.

4.1 Scenes and Beats as Architectural Entities

Given that the drama manager's primary goal is to make sure that activity in the story world is dramatic action, and thus turns values, it makes sense to have the drama manager use scenes and beats as architectural entities.

In computational terms, a scene consists of preconditions, a description of the value(s) intended to be changed by the scene (e.g. love between Grace and the player moves from low to high), a (potentially large) collection of beats with which to construct the scene, and a description of the arc that the value(s) changed by the scene should follow within the scene. To decide which scene to attempt to make happen next, the drama manager examines the list of unused scenes and chooses the one that has a satisfied precondition and whose value change best matches the shape of the global plot arc.

Once a scene has been selected, the drama manager tries to make the scene play out by selecting beats that change values appropriately. A beat consists of preconditions, a description of the values changed by the beat, success and failure conditions, and a joint plan to coordinate the characters in order to carry out the specific beat.

4.2 The Function of Beats

Beats serve several functions within the architecture. First, beats are the smallest unit of dramatic value change. They are the fundamental building blocks of the interactive story. Second, beats are the fundamental unit of character guidance. The beat defines the granularity of plot/character interaction. Finally, the beat is the fundamental unit of player interaction. The beat is the smallest granularity at which the player can engage in meaningful (having meaning for the story) interaction.

4.3 Polymorphic Beats

The player's activity within a beat will often determine exactly which values are changed by a beat and by how much. For example, imagine that Trip becomes uncomfortable with the current conversation - perhaps at this moment in the story Grace is beginning to reveal problems in their relationship – and he tries to change the topic, perhaps by offering to get the player another drink. The combination of Grace's line of dialog (revealing a problem in their relationship),

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Trip's line of dialog (attempting to change the topic), and the player's response is a beat. Now if the player responds by accepting Trip's offer for a drink, the attempt to change the topic was successful, Trip may now feel a closer bond to the player, Grace may feel frustrated and angry with both Trip and the player, and the degree to which relationship problems have been revealed does not increase. On the other hand, if the player directly responds to Grace's line, either ignoring Trip, or perhaps chastising Trip for trivializing what Grace said, then the attempt to change the topic was unsuccessful, Trip's affiliation with the player may decrease and Grace's increase, and the degree to which relationship problems have been revealed increases. Before the player reacts to Grace and Trip, the drama manager does not know which beat will actually occur. While this polymorphic beat is executing, it is labelled "open." Once the player "closes" the beat by responding, the drama manager can now update the story history (a specific beat has now occurred) and the rest of the story state (dramatic values, etc.).

4.4 Joint Plans

Associated with each beat is a joint plan that guides the character behavior during that beat. Instead of directly initiating an existing goal or behavior within the character, the drama manager hands the characters new plans (behaviors) to be carried out during this beat. These joint plans describe the coordinated activity required of all the characters in order to carry out the beat. Multi-agent coordination frameworks such as joint intentions theory ([15]) or shared plans ([3] provide a systematic analysis of all the synchronization issues that arise when agents jointly carry out plans. Tambe ([17]) has built an agent architecture providing direct support for joint plans. His architecture uses the more formal analyses of joint intentions and shared plans theory to provide the communication requirements for maintaining coordination. We propose modifying the reactive planning language Hap ([11]; [10]), a language specifically designed for the authoring of believable agents, to include this coordination framework.

Beats will hand the characters joint plans to carry out which have been designed to accomplish the beat. This means that most (perhaps all) of the high level goals and plans that drive a character will no longer be located within the character at all, but rather will be parcelled out among the beats. Given that the purpose of character activity within a story world is to create dramatic action, this is an appropriate way of distributing the characters' behavior. The character behavior is now organized around the dramatic functions that the behavior serves, rather than organized around a conception of the character as independent of the dramatic action. Since the joint plans associated with beats are still reactive plans, there is no loss of character reactivity to a rapidly changing environment. Low-level goals and behaviors (e.g. locomotion, ways

to express emotion, personality moves, etc.) will still be contained within individual characters, providing a library of character- specific actions available to the higher-level behaviors handed down by the beats.

5. Conclusion

In this paper we described the project goals of a new interactive drama project being undertaken by the authors. A major goal of this project is to integrate character and story into a complete dramatic world. We then explored the assumptions underlying architectures which propose that story worlds should consist of strongly autonomous believable agents guided by a drama manager, and found those assumptions problematic. Finally, we gave a brief sketch of our interactive drama architecture, which operationalizes structures found in the theory of dramatic writing, particularly the notion of organizing dramatic value change around the scene and the beat.

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