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Computer Support for Collaborative Dramatic Art

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There is little question that current role-playing MUD systems provide entertainment for their users. Nevertheless, experience with these systems, however entertaining, often falls short of the compelling, rich and varied experiences we associate with dramatic art. This limitation is in part due to the nature of control in MUDs. Control within a MUD is, by definition, distributed; unlike conventional dramatic media (e.g., the novel, the stage play), MUDs eliminate the boundary between artist and audience, empowering the participants with complete creative control and making them share responsibility for the creation of their own experiences.

While distributed control is a compelling strength of the MUD experience, it is also a principal limitation. In current systems, each player relies on the activities of a collection of participants to define her MUD experience. These participants are of varied skill, commitment and ability. Consequently, their contribution to the overall structure of a MUD is equally varied. In addition, MUD participants lack the global awareness of the unfolding dramatic context needed to ensure that their actions are consistent with subtle or complicated plot lines or plot lines whose current activities are distributed geographically about the MUD world. And they lack the global coordination and planning abilities required to construct aspects of dramatic structure that stretch over time (e.g., measured rise in conflict, sustained balance between antagonists,

foreshadowing). As a result, to the extent that interesting plot lines arise and are maintained, they typically require players to step beyond the bounds of their characters and spend substantial effort as administrators of the drama.

In this paper, I propose a model of the distribution of control within a MUD that supports collaboration on the production of compelling dramatic experiences. This model frees players from responsibility for aspects of the drama beyond the scope of their individual characters. I briefly describe components of a software system facilitating this division and the technical challenges facing its developers.

Future models for dramatic virtual environments (or simply DVEs) present a novel "architecture" for the production of an artistic experience. The conventional role of author is divided in this architecture into subparts and distributed between the system and the players. The audience, active agents in the drama, interact with the world *in character*, observing the action of the plot through the eyes of their characters and taking actions in the virtual world as their characters would. Unlike conventional CD-ROM-based games, the players have a relatively unrestricted range of actions to choose from at any point during the performance. Unlike live-action participatory drama such as *Tony and Tina's Wedding*, the plot line is *reactive*, changing in substantial ways in response to the actions of the players.

Of course, this freedom for the player comes at some expense, paid for with system resources. The system, controlled by one or more *system directors*, must expend a great deal of behind-the-scenes effort to manage the global aspects of the drama. Armed with a collection of dramatic themes and a computational model of the state of the virtual world, the system director must manage the coordination of activity responsible for creating and sustaining the drama's conflict and associated dramatic effects (e.g., suspense and foreshadowing). In particular, the director must establish the type of enabling coordination required for action to unfold (the coordination that puts Juliet at her window at the same moment that Romeo scales the orchard wall), leaving to individual characters the coordination that is established *within* the action of the drama (for instance, Brutus and Cassius's agreement to conspire against Caesar).

As the drama of a DVE begins, the director sets out an initial plot line and then begins to monitor the action of the virtual world. He responds to actions that diverge from this plot, dynamically reshaping the narrative in accordance with the premise of the drama. The coherence of this narrative is a result, in

part, of the goal-directed behavior of the characters in it. Managing the structure of the narrative requires that the director anticipate how players' current activities may interact with characters' future intentions as time progresses in the MUD.

There are two principle resources available to the system director for achieving and maintaining this type of global coordination. First, the director can manipulate aspects of the DVE that are external to the player. These aspects include the system characters (actors and computer agents under system control) and the MUD's setting (its objects, room descriptions, exits, etc). The director passes abstract instructions to the system characters, constraining their actions to be consistent with the current plot. He manipulates the setting to establish mood and to facilitate or inhibit player actions. Both these types of manipulations on the part of the director have analogs in more conventional stage performance, although neither is experienced in quite so interactive or dynamic a manner.

The second set of resources available to the director are more closely related to individual players than to system objects. By considering a player's activities (or potential activities) in terms of their immediate or future consequences, a system director can detect unwanted or harmful interactions between those actions and the anticipated plot line. In response to global requirements for coherence, a director can alter the choice of actions available to the player characters at any given moment. In addition, the success or failure of a player's actions is entirely within the control of the system and can be manipulated to achieve the same effect.

Of course, varying the range of choice for action that a player can successfully execute affects the style of interaction that the player experiences. CD-ROM games, for example, restrict each choice point to a small number of options; as a result, CD-ROM game players may at times feel more like they are "learning" the game than living in its world. In fact, it may be that the ability to perform unanticipated, harmful actions adds a measure of reality unique to MUDs. Unfortunately for the director, the weaker the constraint on player characters' actions, the greater the burden on the director to maintain coordination (for instance, the participants in a medieval quest-oriented DVE would be none too pleased to learn that the director had unintentionally allowed a new player to find the Holy Grail in the drama's opening moments).

Maintaining coordination in a DVE is a formidable task, even with a relatively small number of concurrent players. As DVE's grow in size, support

tools will play a key role in enabling this type of dynamic plot maintenance and coordination. Several existing technologies, developed in other contexts, provide core components that will be needed by these support tools. In particular, artificial intelligence (AI) planning systems provide the algorithms for the dynamic composition of complicated series of actions to achieve a set of goals. Despite a close correlation between this technology and the support tasks sketched above, a number of substantial technical challenges must be addressed before AI planners can be extended to meet the requirements of DVE systems.

Laying out an initial plot line is challenging even for experienced authors working in conventional, static media. In addition to making the artistic judgments that this design task requires, DVE directors need to attend to complicated temporal orderings between activities, look for unanticipated harmful interactions between components of the action, and watch for serendipitous useful interactions that can be exploited to make more interesting plot structure. The good news is that these tasks correspond closely to those tasks that research in planning algorithms has also considered central (the correspondence between AI plans and narrative has already been noted by researchers in fields ranging from cognitive and narrative psychology to artificial intelligence to interactive drama). As a result of this correspondence, planning techniques can be readily adapted to assist in these tasks.

In a perfect world, it would be possible to incorporate a formal model of dramatic structure directly into the control structures of current AI planning systems. Unfortunately, the bad news is that no computational model of dramatic structure exists. To adapt current models of plan reasoning to the requirements of a DVE, a number of extensions will be required.

First, current planning systems are designed to produce plans that will execute free of conflict. Conflict, however, is one of the essential aspects of drama and its representation and manipulation will be critical to systems that produce interesting plot lines. Another problem is the degree of autonomy over agent actions that planning systems typically assume. Plans are structured under the assumption that all agents will actually follow their direction. In *mixed-initiative* contexts like DVE's, where the initiative for action passes back and forth between multiple agents, these assumptions do not hold.

And finally, most planning systems generate plans *off-line*, passing the plans to independent execution components. Because the DVE is dynamic, the future components of a plot line can at best be considered tentative; ar-

chitectures that hand off the plans they produce and expect no feedback will be unable to respond to divergence from the plans. A DVE planner must be capable of interleaving planning with execution, altering plan structures in efficient ways in response to feedback.

Both mixed-initiative planning and reactive planning are open research questions in AI; recent work in each demonstrates encouraging results.

This discussion has focused on the tasks performed by the system director and only indirectly described those tasks performed by the players themselves. In contrast to the activities of the system's participants, the focus of the players in this model is completely local. The DVE system is designed so that each player is responsible only for the realization of her character. She accomplishes this through her dialog, her physical interaction and through the construction of a web of social relationships as the drama unfolds.

Distinguishing the roles of MUD participants is the first step in the creation of compelling experiences in dramatic virtual environments. An appropriate distribution of responsibilities allows global tasks to be dealt with by the participants who have the resources to do so and focuses the players on character-centered experiences in the DVE. By limiting the responsibilities of the player to those tasks local to her character, her experience is bounded by the virtual limits of her character's perceptions and abilities. The player is freed from the responsibility of attending to global coherence and can more readily project herself into the situation her character faces in the drama.

As this discussion indicates, this distribution of responsibility also highlights the need for functional support associated with each participant's role. A number of software tools exist with potential to support aspects of these tasks. Subsequent research will, I hope, better demonstrate their merits and result in systems that more closely resemble DVE's than today's MUDs.