Dramatic Presence

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Abstract

Let us consider the presentation by computers of rich, highly interactive worlds, inhabited by dynamic and complex characters, and shaped by aesthetically pleasing stories. We shall call this interactive drama, and we believe that it requires strong characters, aesthetic presentation, and long term dramatic structure. This paper describes an experiment designed to understand how to create interactive drama. Three principle questions are addressed. One, how does it feel to be immersed in a dramatic virtual world, filled with characters and story? Two, what is required of the characters (actors) in such a virtual world? Three, what is required of the story and its director? We present an introduction to interactive drama, summarize the Oz system designed to create and present such experiences, and describe our experiment in detail. Finally, drawing from the experiment, we suggest several findings about interactive drama.

The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the official policies, either expressed or implied, of any other parties.

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1 Introduction

1.1 Interactive Drama

Dusk in Cairo. You are walking down a dusty street, on your way to the museum. You wish to discover the origin of a symbol found in a book belonging to your father the archeologist. Your father had told you, before he died, that this book contained his life's work. Suddenly, you hear footsteps. A man grabs the shoulder of your leather jacket. He says he is Horace, a friend of your father's, and if you come with him, he can help you. You stop in Cafe Tut – he is charming and surprisingly knowledgeable about your father. You absorb his every word, until you suddenly get an eerie feeling. Horace is asking strange questions about the book. Your father's book. You then notice a suspicious gun-like bulge in his suit jacket. You slowly get up, mentioning the restroom, and then quickly bolt out of the cafe, barely evading Horace's hands as you jump into the nearest taxi. "Quick, get me to the museum," you scream over the sound of the screeching tires. You relax as you see Horace getting smaller though the rear window of the cab. "Yes, Sir," the gold-toothed cabbie replies with a smile, heading quickly in the wrong direction.

This is a description of what a short segment of Interactive Drama should be like. You find yourself immersed in a fantasy world with exciting characters and the possibility of many adventures. Although you control your own direction by choosing each action you take, you are confident that your experience will be good, because a master interactive-storyteller subtly controls your destiny.

We shall user the phrase "interactive drama" to mean the presentation by computers of rich, highly interactive worlds, inhabited by dynamic and complex characters, and shaped by aesthetically pleasing stories. People interacting with these worlds will be called "interactors." A similar notion, which has influenced our work, has been presented by Laurel(Laurel, 1986)(Laurel, 1991).

"Highly interactive" is a very important phrase of our description. The word "interactive" distinguishes our work from conventional media, while "highly interactive" indicates the interactor is choosing what to do, say, and think at all times, in contrast to other interactive media such as hypertext, where the interactor is given only a small number of fixed choices. If our example had been a conventional story, the author alone would decide exactly what happens to our protagonist. In interactive drama, the interactor is the protagonist and determines the action.

Likewise, the term "drama" is also very important. Even though the interactor is choosing what to do, say, and think, there is a destiny, created by the author of the interactive drama. This destiny is not an exact sequence of actions and events, but is subtly shaped by the system, which embodies dramatic theory and principle, in order to create a cathartic experience.

1.2 The Oz Project

Oz is the name of a computer system we are developing that allows authors to create and present interactive dramas(Bates, 1992). Figure 1 shows the Oz system architecture.

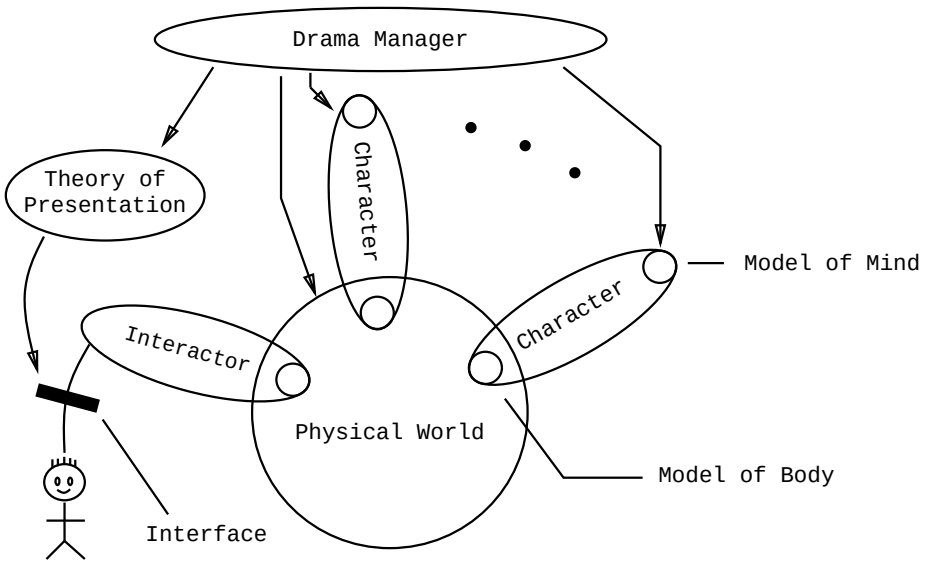

Figure 1: The Oz System Architecture

The architecture includes the simulated physical world, several characters, the interactor, a theory of presentation, and a drama manager. A model of each character's body (including the interactor's) is in the physical world. Outside this physical world, a model of mind controls each character's actions, except for the interactor's actions, which are controled by the interactor. Sensory information is passed from the physical world to the interactor through an interface controlled by a theory of presentation. As shown, the drama manager has influence over the characters' minds, the physical world, and the presentation theory.

Oz has three primary research foci: characters, presentation, and drama. As in tradition media, each of these areas is important for creating a rich dramatic experience. In our research on characters we study how to create computer controlled agents that appear reactive, goal directed, emotional, moderately intelligent, and capable of using natural language.(Bates et al., 1991)(Bates et al., 1992)(Reilly and Bates, 1992). Currently, the project has two different presentation models: textual and animated. The textual system uses text as the input and output medium. The world and characters are described through text, and the interactor's actions are entered to the computer through text. In the animated system, the world and characters are presented graphically. Humans interact with the system physically, through sonar sensors and a mouse. In the future of both systems, people may interact with the system through sounds and speech. At this point, our presentation research deals with how to generate and understand English(Kantrowitz, 1990)(Kantrowitz and Bates, 1992). We also study how the state of a story can affect the best way to describe a scene(Smith and Bates, 1989). The work on drama has to do with how we can represent and control an interactive story with the computer(Bates, 1990).

1.3 A Live Interactive Drama Experiment

In the process of designing and implementing the Oz system, we wanted to know the answers to three fundamental questions. First, how does it feel to be immersed in a dramatic virtual world, filled with characters and story? Is this different from immersion in a non-dramatic virtual world? Second, what are the requirements on the characters (actors) in this virtual world? And third, what are the requirements of the story and drama manager to make the interaction engaging?

In order to begin answering these questions, we performed a live experiment. This experiment simulated the Oz computer system in the real world: live actors instead of computer controlled characters, a live director instead of an automated drama manager, and the real world perceived directly instead of a simulated world presented by computer. By simulating Oz, we hoped to explore the concept of interactive drama and learn about its demands.

The experiment was similar to an acting improvisation, but with several important differences. First, there was a coherent (interactive) plot to follow. Second, the actors were directed occasionally as the story progressed, instead of making up or following the story themselves. Third, a interactor was on stage with the actors. And, finally, the experience was designed for the interactor. This is important. The experience was not for the director, the actors, or the people observing the experiment; it was for the interactor.

2 Purpose of the experiment

As mentioned above, the purpose of our experiment was to discover the answer to our three principle questions.

2.1 Dramatic Immersion

First, we asked how the interactor felt when immersed in a dramatic virtual world filled with character and story. In addition to the basic question, we had questions about the nature of the experience. For example, would the interactor be able to enter into a world we created, become emotionally involved, respond, then leave with a feeling of satisfaction of having experienced something of value? Would this feeling be the same for different interactors? How would the dramatic experience of the participant differ from that of an observer? Would it feel real, contrived, involving, interesting or boring? What interactions or events heightened the experience? Which ones decreased the intensity of the experience? Would the experience be different from or similar to other experiences with short stories, novels, plays, and film? Since we had so many questions, we viewed our experiment as exploratory rather than strictly scientific.

2.2 The Actors

Second, we asked how the actors performed their roles. We wished to observe the actors and their interactions with the director, in order to find out what knowledge they had that allowed them to play their roles. In addition, we wanted to understand the interface between

the actors and the director, and how the actors would respond to commands. Most likely, we would need to encode this information into our computer agents and drama manager.

2.3 The Director

Third, we asked how the director both used our story representation and also affected the experience. Because we feel they are important to interactive drama, the experiment emphasized the director and the story. In this experiment we had a human director and a simple story representation called the plot graph. We addressed three areas of concern: representation, interface, and the feel of the experience.

The first goal was to test the plot graph model. We chose the plot graph over a traditional script for two reasons. One, all dialogue was improvised. Two, since the reactions of the interactor were unknown, a tight structuring of the plot was impossible. The plot was instead designed to suggest a general flow of major events that the interactor should experience. The exact order or details of these events was intentionally absent. Later in this paper we describe the plot graph in detail.

A second goal was to understand the communication from the director to the actors. In interactive drama, the actors are independent agents, pursuing their own goals. However, to satisfy the plot the director must occasionally change the natural behavior of the characters. We wished to understand how and when the director pushed the actors in order to advance the plot. We were also interested in how the director observed the interactor.

Finally, we wanted to know if the interactor could be guided without feeling manipulated. We believe that the most satisfying experience a interactor can have relies on a delicate balance between freedom and control. At one extreme, the interactor enters a fictional world and just experiences it – the interactor meets and talks with characters, explores the physical space, examines and plays with objects, and leaves when ready. At the other extreme, the interactor is pushed through a tight story containing little leeway and few choices. We aim to find a path in the middle: allowing the interactor maximum freedom of choice and response while still presenting a shaped experience.

3 The Story

A basic artistic problem in interactive drama is creating a structure that provides unity and cohesion and yet still permits rich interactor interaction. One characteristic of art is an overall unity which implies some set plan or structure. Indeed, the term "fiction," from the Latin *fictio*, meaning shaping, suggests planning and selection by the author. At the same time, we want a form that will allow room for the interactor's response. As mentioned above, our goal is to create interactive drama that maintains balance between interactor freedom and author control.

In our drama research we study how to represent such an interactive drama in the computer(Bates, 1990). Since the human-controlled character of an interactive drama is not under the direct control of the author, we must anticipate many possibilities. Rather than controlling specific events, we attempt to shape the overall experience that will express the themes and ideas of the author.

As an initial step toward our goal, we designed a plot graph model for interactive drama. This representation allows us to express some of the fine structure of interactive drama, yet it is easily processed by human or machine in real time. There are many problems with this representation and its processing, which we are working to remedy in on-going research. In the following sections we describe the plot graph in detail, and show its use in the experiment.

3.1 The Plot Graph

The basic idea of the plot graph is that the major scenes of the story form a partial order and are thus linked together in a directed acyclic graph (*DAG*). The nodes of the graph represent events and situations that are the major moments of the story. These are similar to the plot fragments in Lebowitz's UNIVERSE system(Lebowitz, 1985). The edges of the graph represent the "must precede" relation and are further annotated with hints or obstacles that can affect how the interactor gets from one scene to the next. The graph is used to help direct the interactor to experience the story the author has created. Figure 2 shows a simple plot graph.

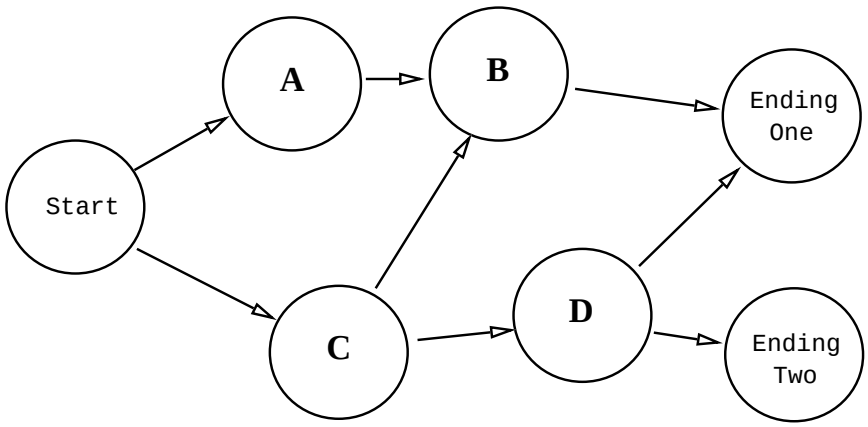

Figure 2: A simple Plot Graph

By linking the scenes in a *DAG*, the author specifies a partial order in which the scenes will take place. Only if all predecessor scenes have happened can a scene happen. In our example, scene **A** comes before **B**, and **C** before both **B** and **D**, but there is no inherent relation between scenes **A** and **D**. Thus, **B** may occur only after both **A** and **C** have occurred.[1]

As a consequence of the properties of the graph, it is traversed by moving a frontier through the graph. The frontier begins at the left edge of the graph. As each scene

[1] Other types of plot graphs easily suggest themselves. For example, a node might be allowed to happen if any predecessor (OR) happens, rather than all predecessors (AND) happening. We chose a very simple model for this experiment.

occurs, it moves behind the frontier. A scene can reach the frontier if and only if all of its predecessors are finished, i.e., behind the frontier. Theoretically, more than one scene can be on the frontier (happening) at once. The story is over when one of the scenes marked as terminal has occurred. Of course, some orders or endings will be better than others. But, the assumption with this model is that if the author has designed the plot graph carefully, any actual order that fulfills the constraints of the plot graph should be dramatic.

The links between nodes may be annotated with obstacles or hints that lead from one scene to the next. If the drama manager feels progress is too slow, it may give the interactor hints to speed her along. Likewise, if progress is too fast, the plot graph may add extra obstacles. In general, these are supposed to enhance the interactor's experience. As an example of a hint from our introductory story, if one next possible scene is *Meet your father's dire enemy, Horace*, then the link to this scene might influence Horace so that he finds you. This is a subtle way of making this scene more possible (since you don't have to seek him out or rely on chance). The drama manager would be encouraging this, presumably, since meeting Horace will help satisfy the partial order. Of course, you may go in the other direction, and other story lines would be pursued for a time.

The hints and obstacles are written as actions that are performed as the scene reaches the frontier. In the computer model, they are simple programs attached to edges of the graph. They consist of commands that can affect the physical world, the actors in that world, and the state of presentation. Doors may become locked or unlocked, actors may arrive or become emotional, or a vital object may be described vividly. Usually, the more subtle the hint the better. For example, muddy footprints by a door are more subtle than a large yellow arrow pointing in the right direction.

Scenes, that is, nodes of the graph, also use commands. For example, as part of a scene where a grisly murdered body is found, the author might specify that all future presentation should be somber.

Although this representation of an interactive story is limited, it does provide a balance between author control and interactor freedom. The suggestion is that any successful traversal of the plot graph will be dramatic. Therefore, by monitoring the interactor's progress with the plot graph and providing hints or obstacles, the drama manager promotes a dramatic experience. Part of our experiment was to find out if this would work.

In the computer, the plot graph structure must be programmed, but for a human director, the graph can be specified in a picture. Just such a graph was created for our experiment, and given to the director. What follows is a description of our interactive story, including the plot graph.

3.2 The Bus Station Story

The experiment's world was a bus station. The characters included the Clerk, who was bored with her job and uncooperative with customers; Tom, a professional man in his thirties, temporarily blinded from recent surgery, who was going to his girlfriend's house; and Ned, a young punk who needed money. The Interactor was to play him- or herself with this one instruction: buy a bus ticket to a city to attend a relative's funeral. In fact, the

Interactor's attainment of this goal was not important to the story, but gave the Interactor a goal on which to focus. The plot graph shown below in Figure 3 outlines the story given to the director to use as a guide for the experiment. In retrospect, we noticed that a few links may have been missing from the diagram. For example, we would not want the Interactor to leave on his bus before Ned the Punk entered.

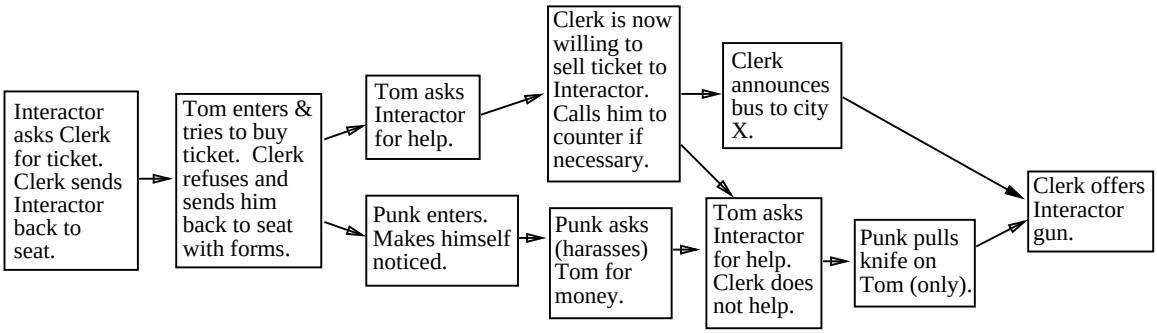

Figure 3: The Bus Station Story Plot Graph

A typical run of the interactive story might begin with the Interactor entering the bus station and asking the Clerk for a ticket. The Clerk would be directed to delay selling the ticket for some reason. Then Tom might enter and try to buy a ticket for himself, but the Clerk would ask Tom to fill out special handicap forms. Because he cannot see well, Tom might ask the Interactor for help. Around this time, the Punk could enter, agitated. The Punk might ask Tom or the Interactor for money. Eventually, the Clerk would call the Interactor to the counter and say she can now sell the ticket. In response to the Punk's increasing harassment, Tom again might ask the Interactor for help. The Clerk could then announce the arrival of the Interactor's bus at the same time that the Punk pulls a knife on Tom. The Clerk could then offer the Interactor a gun, which the Interactor may or may not use. Since the story is interactive, not every enacted story will end up this way.

4 The Experiment

4.1 The Setup of the Experiment

We selected the stage of the small Studio Theater of Carnegie Mellon's Drama Department as the location of the experiment primarily because there was seating for observers below the stage and out of sight of the participants. We did not want either the actors or the interactor to perform in front of an audience as they might in a small room with observers in plain view. Observers sat in the darkened house of the theater, and the actors were told to direct their action to the interactor, instead of toward the observers. The "bus station" was also set up to be videotaped from the observers' point of view.

We used a table, a few tall wooden boxes, and several chairs in a "V" arrangement to create the set. The experiment was run twice, the first time with the second author

as interactor, the second with a young woman as interactor. After the first run of the experiment, one of the actors rearranged the set into an "L" shape to open up the space and allow more room for the interactor and actors to interact. We used no special stage lighting – only the house lights and the work lights plus the lights in the wings of the stage. The result was a make-shift, non-realistic set that didn't look at all like a bus station.

From the wings of the theatre, the director observed the action and communicated to the actors through a transmitter connected to radio headsets. The interactor could see the headsets, but could not hear the commands. Neither the director nor actors were familiar with interactive drama, but all had extensive dramatic training and experience in improvisational work. They are professors and students at the Carnegie Mellon Drama Department.

4.2 The Two Runs

The following are breakdowns of the times and major events in each run, as derived from the videotapes. These breakdowns reveal both what happened and the differences between the two runs. The italicized text describes the information flowing from director to actor over the radio headsets. As the first run began, the actors were totally unfamiliar with the plot.

First run

MIN:SEC

0:00 Interactor enters bus station. He asks when the bus for San Francisco leaves and how much it costs. Clerk answers. Interactor says he wants to buy a ticket.

0:30 *Director tells Clerk not to sell ticket.* Clerks asks to see Interactor's money. He doesn't have two hundred dollars, but offers his credit card. Clerk says credit cards are no good. Interactor shows some money and asks if it is enough.

1:10 *Director tells Clerk to send Interactor back to his seat.* Clerk says she can't sell it for that much and that he should sit down. Interactor sits down and waits.

1:30 *Director tells Clerk to call her boss about credit cards.* Clerk asks for Interactor's credit card, announcing she will call her boss to see if credit cards are acceptable.

2:00 *Director tells Clerk to stall Interactor but eventually sell ticket.* Clerk calls her boss. Interactor waits.

2:20 *Director tells Tom to enter.* Clerk is still talking. Tom enters and sits down. Interactor watches Tom enter.

2:40 *Director tells Tom to buy a ticket.* Tom gets up and walks to the desk. Clerk finishes call and tells Interactor to wait for her boss to come back. Tom tries to buy a ticket.

3:00 *Director tells Clerk to notice Tom is blind.* Interactor waits and observes conversation between Tom and Clerk. Tom has no money, and Clerk says Tom must wait for a credit card check as well.

4:00 *Director tells Clerk to have Tom fill out handicap papers.* Clerk tells Tom he must fill out special papers. Tom takes the papers and sits down. Interactor watches Tom.

4:30 *Repeated three times: Director tells Tom to get help filling out the papers – reminding him that he is nearly blind.* Tom politely asks Interactor for help. The Interactor moves to Tom's side and helps him.

5:20 *Director tells Clerk to get into her novel.* The Interactor and Tom fill out the form while the Clerk silently reads.

6:00 *Director tells Punk to enter.* Interactor and Tom continue filling out the forms.

6:15 *Director tells Punk he wants money.* The Punk enters and asks Clerk about the next bus to Chicago.

6:40 *Director tells Punk to make himself noticed.* The Punk looks around and asks Tom if he's going to Philly. Punk asks the Interactor for a dollar.

7:20 *Director tells Punk to deal with Tom, not the Interactor.* The Punk turns his attention to asking Tom for money. Meanwhile, the Interactor is filling in the sheet.

7:40 *Director tells Clerk to call Interactor to the desk to sell ticket.* Clerk answers return call from her boss. Clerk asks Interactor to come to the desk. The Interactor directs his attention to the Clerk, but occasionally watches Tom to make sure he is okay.

8:15 *Director tells Punk to "bug" Tom.* Punk continues to ask Tom for money – politely. Offers to help with the form. Tom rejects him. The Interactor buys his ticket.

8:40 *Director tells Punk to intensify his action with Tom.* Interactor returns to helping Tom fill out the form.

9:05 *Director tells Punk to get the money.* Punk starts to harass Tom.

9:30 - 11:00 *Director tells Punk to build the intensity seven times, pumping him up as the tension of the scene builds.* The Punk increasingly harasses Tom. Tom appeals to the Clerk. Punk argues with Clerk. Punk returns to harassing Tom. Interactor watches as the situation escalates around him.

11:15 *Director tells Punk to pull his knife on Tom.* Punk pulls his knife on Tom. He tells Tom it is a knife. Interactor tells Clerk to call the police. Punk violently pulls and disables telephone. Interactor jumps out of the way and sits on the other side of the station. Punk asks Tom for his wallet while Interactor watches.

11:30 *Director tells Clerk to announce the arrival of San Francisco bus (the Interactor's bus.)* Tom turns his wallet over to the Punk. Clerk announces the arrival of the San Francisco bus. Punk starts to leave.

12:20 *Director tells Punk to stay on the scene.* Interactor asks Tom if he's okay. Punk walks over to desk. Interactor starts to stand. Punk (in control) tells him to sit down. Interactor sits. At Clerk's desk, Punk starts searching through Tom's wallet.

12:40 *Director tells Clerk to get Interactor near her.* Clerk asks the Interactor to come to desk. Interactor asks permission from Punk to go to desk. The Punk denies him permission.

13:00 *Director tells Punk to allow Interactor to go to desk.* Punk tells Interactor he can go to desk. Interactor goes behind desk. Clerk gives Interactor itinerary. *Director tells Clerk to give Interactor gun.* Clerk gives Interactor gun. As Punk moves to Tom's dufflebag and searches it, Interactor returns to seat and reads itinerary, doing nothing about gun in pocket.

13:30 *Confused, Director asks Clerk if Interactor has gun.* Clerk nods her head yes. Done with Tom's dufflebag, Punk goes back to desk and asks Clerk for cash in desk drawer, his back to the Interactor.

14:00 Very slowly, the Interactor stands up, points gun at Punk and tells him to sit down and drop the knife. The Punk argues with the Interactor, not believing he will shoot. Finally, Punk turns his back, and then tells Interactor to go ahead and shoot.

14:30 Interactor points gun up in the air and fires it. Punk dramatically falls to the ground.

End of first run.

Second run

MIN:SEC

0:00 Interactor enters Bus station. Asks for ticket to Philadelphia. Clerk tells her the computer is down. Interactor asks how she can get a ticket. Clerk tells her not to worry, that the bus won't be arriving for 20 minutes yet, and to take a seat. The Interactor sits.

0:40 *Director tells Tom to enter.* Tom enters. Asks for ticket to Philadelphia. Clerk tells him that the computer is down, notices that Tom is blind, and therefore tells him he must fill out handicap form. He takes the form and sits.

1:50 Tom begins to fill out form, then angrily asks Interactor for help. She agrees to help. He tells her to sit next to him, which she does. She begins to ask him the many questions and write down his answers on the form. When she asks his name, Tom pulls out the bio sheet from his pants pocket to discover it. The observers laugh at

this. Interactor and Tom go back and forth with questions and answers. Tom is angry and asks the Interactor if all these questions are necessary.

3:35 *Director tells Punk to enter.* Interactor is still helping Tom fill out the form. The Punk enters the scene very noisily, banging furniture and whistling.

4:25 Tom asks Punk to be quiet. Punk apologizes and sits down. Clerk announces that the computer is up. Tom continues to give information to Interactor. Punk starts walking around. Clerk sarcastically mentions that people were interested in getting tickets earlier. Tom sarcastically answers that some people have to fill out a form.

4:55 The Punk offers to help Tom fill out the form. Tom says no. Punk asks Tom for money. Tom refuses. Tom and Interactor stand up. Everybody crowds around the desk. Conversation begins to overlap now: The Punk continues to ask for money with Tom refusing. Clerk complains to Tom that all the questions on the form have not been filled out. Tom and Interactor try to explain that many of the unfilled out questions don't apply to him. Punk becomes more belligerent to Tom. Everybody is talking at once.

6:25 *Director tells Clerk to take control of situation, to get people in their seats. Director repeats these instructions.* The Punk quietly pulls out a knife, puts it to Tom's back, leads Tom to the seats, where they sit, and demands money from Tom. The Clerk tells everybody to sit down and be quiet. The Clerk asks the Interactor about buying her ticket. The Interactor notices the knife, and writes a note to the Clerk, telling her to call the police.

7:20 *Director tells Punk to make sure that Interactor can see what is happening with the knife and robbery.* The Punk reaches past the Interactor and cuts the telephone line. The Interactor is frozen. Clerk then asks Interactor if she can sell her the ticket. Clerk repeats the question. Interactor says yes.

8:00 *Director tells Clerk to announce the arrival of the Philadelphia bus.* The Clerk announces the bus to Philadelphia. The Punk asks Interactor if she is going to Philadelphia. She says yes. He tells her to go. Clerk sells Interactor ticket and shows her a form with the gun underneath, offering it to the Interactor.

8:30 Punk yells at Clerk to hurry up and fill out the form and let Interactor go to Philadelphia. Tom asks Interactor to please go. Clerks calmly replies that she is giving Interactor the ticket and filling out the necessary form. The Clerk is still offering the Interactor the gun, but she won't take it.

9:00 Tom tells the Punk he has his money and asks what else he wants. Punk checks through Tom's bags in response. Clerk asks Interactor if she has her ticket, and if there is anything else she needs, meaning the gun. Interactor starts to leave in one direction. *Director tells Clerk to find way to give Interactor the gun. Make sure she*

has the gun. Director asks Clerk if she has given Interactor the gun. Clerk answers no. Clerk points Interactor in the opposite direction. Interactor warily edges past the Punk, then quickly runs off the stage.

END OF SECOND RUN.

Although each run satisfied the plot graph for the story, they were different. One important difference was the interactor. In the first run, the interactor was a male graduate student in computer science; in the second, the interactor was a female theater development assistant. Of course, the endings were very different, and the duration also differed. Another source of variance was the creative input of the actors. Since the actors are free to interpret their characters and situation, different choices can be made. For example, in the first experiment, the Clerk refused to sell a ticket till she checked with her boss. In the second, the computer became the obstacle.

Perhaps the most significant difference is that the actors knew their characters and the plot for the second run. This meant that they could be much more free to use their acting skills. It also meant that the director could concentrate on the smooth unfolding of the plot, as opposed to constantly regulating each character's actions. In the first run, the actors seemed uncertain and unrehearsed, like real people. In the second, the actor's choices became faster, more like characters, and they played off each other more. We saw no evidence whether either of these situations is preferred by the interactor.

4.3 Discussions after the Experiment

After both runs were over, the interactors, observers, actors, director and experimenters discussed what each of them had experienced. Here we summarize the discussions.

Mostly, the interactors discussed realism. Because both interactors found the experience realistic, each made moral choices as they would make them in real life. The first interactor could not shoot the Punk, since he thought it was wrong, and the second was unwilling to take the gun or attack the Punk. Although the interactors experienced a sense of realism, they also enjoyed the safety of a controlled situation. The first interactor said in real life he would probably have run off earlier, as soon as the Punk pulled a knife. Similarly, the second interactor said she would have been much more frozen in real life. In fact, both interactors suggested that the story could have been more dangerous[2].

During the experience, the interactors were caught up in the story, didn't notice many inconsistencies in either the characters or story, and liked the surprises. In contrast, the observers did not find the characters believable and often lost interest when action seemed to lag. It is important to recall that the observers are not an "audience." An interactive drama is created for the experience of the interactor only.

The interactors also had a few general comments. They experienced some confusion between reality and story. For example, the first interactor did not know whether or not to use his own money for the bus ticket. Both said it was good to have real tasks, such

[2]However, the reactions of the interactors, especially the second, suggest that perhaps the experiences were intense enough

as filling out the blind man's form, since that gave them something specific to do. Lastly, the interactors concluded neither wanted to return to this particular story and relive it, but both wanted to enter another story.

The director, actors, and observers had other comments. Several thought a good application for such a system would be a learning tool to work out "what if's" of a particular problem. For example, this could be used for management or relationship training. Observers commented that the interactor's experience was qualitatively more interactive than pushing buttons to affect the ending of a play or movie.

One actor discussed the fact that the second run seemed predisposed to conflict since the actors were pushing it that way. In the first run, the actors seemed more like real people and less like characters. The director also pointed out that the attitudes of the actors may have affected the choices of the interactor. In the first run Tom acted pathetic, and the Punk tried to keep the interactor around; the first interactor stayed the whole time. In the second run, Tom was surly, and the Punk tried to get rid of the interactor; the second interactor left. An audience member pointed out that if the actions of the characters could strongly dictate the outcome, then perhaps the characters would have to be fine-tuned over repeated playings.

One observer commented that having all aspects of presentation be consistent is important. One interactor agreed, saying that when he was paying with his own money it seemed incongruous to the artificial set. Someone suggested that perhaps it would be best to give the interactor a uniform but small amount of detail and let him or her fill in the rest. Another suggested that the piece felt powerful because it involved real people as characters.

The actors and computer scientists agreed the role of the director was important to keep the scene flowing, since neither actors nor today's computer agents are capable of keeping track of the overall flow of the experience. The director explained that she introduced the next element, such as having the bus leave or having the Punk enter, whenever she felt the previous scene had run its course.

5 Results

The most important conclusions we make pertain to what it is like to be immersed in a dramatic interactive world. Although we gained much information about how actors, directors, and headsets can be used in a live experiment, we could not draw any definite scientific conclusions. Some principles of drama did seem to carry over to interactive drama, while others didn't. What follows is a discussion of those conclusions we feel we can make.

5.1 Dramatic Presence is Engrossing and Powerful

Most importantly, we discovered that a person will become emotionally engaged when confronted with an imaginary world containing interesting characters, when that world is under the direction of an interactive plot. We found that the interactor, like a viewer of a play, a film, or television, is willing to suspend his or her disbelief and participate in the story. However, when comparing traditional and interactive media, interactors found

interactive drama more powerful, easily causing immediate, personal emotions, not the traditional vicarious empathy for other characters.

For example, the first interactor could not shoot the thief. While he has no problem watching film violence, interactive drama shifts the issue to a personal choice. For him, it became a moral question of whether it was right to shoot another human being. The interactive experience forced him to confront the question. This effect of personal choice is powerful. However, one must be sure to recognize the placement of this choice in the plot. The interactor felt that only by setting up this decision as the culmination of a sequence was it so powerful. If the interactor were not sufficiently prepared, the moment may not have been taken seriously. This is the power of *dramatic* presence.[3]

5.2 Inconsistency in Characters is Tolerated

Contrary to our initial guesses, we found that inconsistency in the behavior of characters did not necessarily interfere with the interactor's suspension of disbelief. Seemingly, this would contradict one of Aristotle's dramatic principles: a good play will have a unified whole and be consistent. But, since interactive drama is less like scripted drama and more like real life, we do not conclude that Aristotle's principles are contradicted.

Consider, for example, this scene where one of the actors inconsistently changes his behavior in response to commands from the director.

(Interactor stands.)

Punk: No, no. Sit down. I said, sit down.

Director: (over earphones to Clerk) *Get the Interactor near you so you can give him the gun.*

Clerk: (to Interactor) Passenger to San Francisco, could I give you some information back here please?

Interactor: (to Punk) Is that OK?

Clerk: (to Punk) Can he come back here so I can tell him about San Francisco?

Punk: (to Interactor) No, that's not OK. Sit there.

Director: (over earphones to Punk) *Yes it's OK.*

Punk: Ok, go ahead. Move.

(Interactor moves to desk where Clerk gives him the gun.)

[3]The evidence is more amazing when one considers the conditions: an unrealistic theatrical set, a fake gun, actors wearing headphones, a giant microphone in the middle of the "bus station," and much confusion between the actors and the director.

In a film or book, this scene would be labeled unrealistic. The observers certainly found it so. In the discussion after the experiment, however, the interactor reported finding this exchange completely plausible, and no cause for breaking the suspension of disbelief. This means that radical changes in character's behavior caused by a drama manager may be accepted by interactors.

It should be noted that not all inconsistent behavior is tolerated. For example, early in the first run the Punk asked the interactor for money and then refused to take any from him. The interactor reported in the discussion that he felt manipulated, since there was no reason for the Punk not to take the money. He felt the difference to be the existence of an explanation for the Punk's action. In the first case, the interactor could explain (to himself) the Punk's behavior. In the second he couldn't.

5.3 Time Perception Varies

Comparing the reactions of the observers and the interactors to the same events suggests the interactor's experience is very different. While the observers often became bored and lost track of what was going on, the interactors were continuously engaged. A part of that disparity comes from the sense of time compression that the interactors experienced. The first interactor said that the action "escalate[d] from normal, to annoying, to out of control in a matter of seconds." Meanwhile, the observers experienced large blocks of time where absolutely nothing seemed to happen. While the interactor was interpreting events, thinking over possibilities, and contemplating actions in his mind, the actors just "looped," taking no actions. This suggests that looping may be a requirement of computer controlled actors. The important result is that the movement of the story may not be actions in the physical world, but actions in the interactor's mind.

6 Subsequent Results

The next two conclusions are not deduced solely from this experiment. After the Bus Station story, we ran another experiment, Tea for Two, making different presentation choices. During the second experiment we noticed that some of these choices didn't work well.

6.1 Do not Push the Interactor

Tea for Two, where the interactor became a police detective who solves a murder, was larger and longer than the Bus Station story. We had scheduled about an hour and a half for each run, but each seemed better suited for two hours. As a consequence, toward the end of run the director had to make a choice: have the story continue at its natural pace, but stop prematurely because of time, or complete the story and risk disturbing the experience. He chose the latter, and the story suffered.

The interactors were unsatisfied by a forced ending. Instead of the interactors figuring out the mystery in their own way, they felt manipulated. Because solutions came with no real understanding, the building tension of the story and the interactor's satisfaction

of problem solving was lost. Instead of pushing the story forward, interactors felt pushed around by the story.

From this, we realized that aggressively pushing the interactor to a specific goal breaks the interactor's suspension of disbelief. The interactor feels manipulated and unsatisfied. This suggests that a murder mystery with one fixed acceptable ending is less suitable for the interactive medium than a more open story, such as the Bus Station story.

6.2 Characters are the Best Agents of the Drama Manager

Tea for Two was set in a rich physical world, which would have been difficult to model with real scenery and stage. Thus, in contrast to the Bus Station story, the Tea For Two experiment had an explicit narrator character, limited physical enactment, and no physical space. The narrator described both the world and events as they happened, and defined properties of the world. In this role, whatever the narrator said was believed.

As mentioned previously, one way that we try to make the traversal of the plot graph successful is to provide hints to the interactor, if necessary. Since Tea For Two was a mystery, hints were often needed. The problem was that we gave the hints through the narrator. Since it seemed as if the narrator were just telling the interactors what to do, the hints were not subtle. We were giving the interactor the answers instead of helping the interactor figure out the answers on their own.

On the other hand, when we provided hints through the other characters, the interactor found them more subtle and satisfying. Through the characters we could indirectly push the story forward. As an example, the drama manager could get the interactor to talk to a character by having the interactor go to a specific room for another task and meet the character there accidentally. This apparent power of characters to give hints seems related to the earlier conclusion that inconsistent behavior in characters is tolerated. The drama manager ought to be able to do much indirect, subtle manipulation through the characters.

7 Conclusion

This first live interactive improvisation to discover information about our model of interactive drama was a trial and error event. From this experiment, we learned that this type of experience could be interesting and meaningful, that a story could be directed around the interactor without the interactor feeling too manipulated, and that dramatic presence is engrossing and powerful. We learned that inconsistent behavior in characters does not necessarily break the interactor's suspension of disbelief, and that the perception of time differs between interactors and outside observers. We found the plot graph somewhat useful for defining interactive stories. Finally, using this experiment and another for comparison, we deduced that characters are the best agents of the drama manager, and that producing a feeling of manipulation in the interactor destroys the vital suspension of disbelief.

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