Interaction, Narrative, and Drama

Creating an Adaptive Interactive Narrative using Performance Arts Theories

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Abstract

Interactive narratives have been used in a variety of applications, including video games, educational games, and training simulations. Maintaining engagement within such environments is an important problem, because it affects entertainment, motivation, and presence. Performance arts theorists have discussed and formalized many techniques that increase engagement and enhance dramatic content of art productions. While constructing a narrative manually, using these techniques, is acceptable for linear media, using this approach for interactive environments results in inflexible experiences due to the unpredictability of users' actions. Few researchers attempted to develop adaptive interactive narrative experiences. However, developing a quality interactive experience is largely an art process, and many of these adaptive techniques do not encode artistic principles. In this paper, I present a new interactive narrative architecture designed using a set of dramatic techniques that I formulated based on several years of training in film and theatre.

Keywords

Interactive Entertainment, Interactive Storytelling, Adaptive Systems, Games.

Bio:

Dr. Seif El-Nasr earned her Ph.D. degree from Northwestern University, her master's degree in Computer Science from Texas A&M University and her B. S. degree in Computer Science from the American University in Cairo. Dr. Seif El-Nasr received a CIRA Grant and several awards, including 2^{nd} best paper award at the International Conference of Virtual Storytelling, *Best Student Paper Award* at the International Conference on Autonomous Agents '99, and *Leadership Excellence Award* from Texas A&M University. She is on the editorial board of the International Journal of Intelligent Games and Simulation, and ACM Computers in Entertainment.

1 Introduction

The goal of the work presented here is to enhance the engagement and dramatic quality of an interactive narrative by employing dramatic techniques collected through years of training in areas of acting, screenwriting, and directing (Baid 1973; Boorstin 1990; Foss 1992; Kawin 1992; Bucklan 1998). Before proceeding to discuss this argument, I will define the term engagement. Several theories and definitions have been proposed. Csikszentmihalyi (1990; 2000) called the concept of engagement *flow*, which he defined as a state in which a subject becomes totally absorbed in an activity; this state is also characterized by decreased self-consciousness and time awareness. Boorstin (1990) a film theorist described the engagement that one feels when viewing a film in three perspectives. One perspective he called the *voyeuristic eye* which he described as the feeling of joy resulting from discovery and learning. Another perspective, he called the *vicarious eye*, is the feeling of empathy through an understanding of characters' emotions and choices. The last perspective he defined as the *visceral eye*, which is the feeling of enjoyment as a result of simple emotional reactions to audio-visual stimuli. Blythe et al. (2004; 2004) differentiated between fun and pleasure, defining fun as a distracting activity that leads to satisfaction, and pleasure as a deeper form of enjoyment where participants become absorbed in an activity. They described engaging activities as activities that stimulate memory, evoke anticipation, and provide opportunities for personal growth.

Several game developers (Hunicke, Blanc et al. 2004) attempted to provide a clear definition for the word engagement. Raph Koster (2004) defined *fun* as the process of learning and exploration – a view similar to Boorstin's notion of the *voyeuristic eye*. Koster explained that an experience stops being engaging when we stop learning. Hunicke et al. (2004) discussed eight categories of fun as: sensation (sensory effects used to evoke emotions), fantasy (theme of the world in which the player is immersed), narrative, challenge, fellowship (social dimension), discovery (exploration of the unknown), expression, and submission (passing time). Their work is similar to Malone's work (Malone 1984) which defined the factors affecting engagement in video games as: challenge, fantasy (metaphor of the interaction and the theme of the world), and curiosity (sensory effects that evoke response).

While there is a distinct difference in the forms of engagement described by these theories, Blythe's use of the word pleasure is closer to the form of engagement used in this paper, which is also close to Boorstin's (1990) *voyeuristic* and *vicarious eyes*. In particular, by introducing dramatic techniques I aim to explore the opportunity to stimulate self-growth, self-reflection, empathy, and anticipation within an interactive narrative experience.

Eliciting this type of engagement is important for entertainment products, such as video games, for obvious reasons. Recently researchers have been exploring different ways of evoking similar notions of engagement in training simulations (Swartout, Hill et al. 2001), educational games (Kafai 2001), and other software applications (Malone 1984; Webster 1988; Dyck, Pinelle et al. 2003), with the argument that employing engaging techniques in these applications will lead to increased productivity and learning. In this paper, I focus on addressing the question of how to increase engagement in applications that employ interactive narrative in their design, such as video games (e.g., adventure or horror games), educational games, and narrative-based training simulations, such as the *leaders project* (Hill, Gordon et al. 2004; Gordon 2005).

For several years, game developers held discussions at the Game Developers Conference, gave presentations (Kane 2003; Lazzaro 2005), and published books (Freeman 2003) on the topic of increasing engagement in games. While there are several successful game titles on the market, and while these game titles are fun to play, none of these titles reach the type of engagement described above (Blythe and Hassenzahl 2004; Blythe, Overbeeke et al. 2004). In particular, most of these titles satisfy the kind of pleasure described as the *visceral eye*, few of them satisfy the kind of pleasure described as the *voyeuristic eye*, but none of them satisfies the kind of pleasure described as the *vicarious eye*.

These types of engagement have been extensively studied in theatre, film, and the performance arts. In particular, techniques to illicit these types of engagement have been addressed in screenwriting (McKee 1997; Freeman 2003; Lucey 1996), acting (Stanislavski 1936; Stanislavski 1949; Bruder 1986; Meisner, Longwell et al. 1987; McKee 1997; Freeman 2003) and storytelling (Propp, Wagner et al. 1968; Campbell 1972) theories. However, these techniques are difficult to use successfully within interactive narratives. Currently, game developers (and other developers) script the interactive narrative by embedding the dramatic principles they were trained to use; an obvious example of such work is Freeman's discussion of embedding screenwriting techniques within game narratives (McKee 1997; Freeman 2003). While these techniques enhance the quality of the narrative, scripting them tends to restrict the narrative to a linear form, as exhibited in games such as the *Prince of Persia* series.

Several researchers have investigated the alternative of using artificial intelligence to create adaptive narrative experiences. For example, the *Oz project* developed an emergent narrative experience by adding the user in an interactive environment inhabited by believable agents (Bates 1992). Young proposed a plan-based interactive narrative architecture, where plans are revised depending on users' actions, thus enhancing the adaptability of the story and accommodating user's actions (Young 2000). Peter Weyhrauch proposed an interactive drama manager that uses game theory to select a story event given the current story state, thus sustaining dramatic progress through presenting a dramatic structure (Weyhrauch 1997). Andrew Stern and Michael Mateas developed an interactive story, called *Façade*, based on a domestic drama (Mateas and Stern 2000), where a story engine selects events to execute dynamically, at run-time, based on the user's actions, the history of events, and the author's story goals, and thus adapting the narrative to the user's interaction.

While adapting the narrative to accommodate interaction is important, creating an experience that exhibits the type of engagement described above requires the representation of dramatic principles, including conflict, pacing, and temporal dramatic progression (Baid 1973; Halliwell and Aristotle 1998; Carson 2000; Freeman 2003). Few of the previous works mentioned above were constructed using dramatic theories. For example, the *Oz project* was influenced by Egri's work (Egri 1994) on dramatic techniques for character-based narratives. Mateas and Stern's work was based on Aristotelian dramatic theory (Halliwell and Aristotle 1998); specifically, they encoded the dramatic arc using a mathematical function (Mateas 2002; Mateas and Stern 2002; Mateas and Stern 2004).

In this paper, I emphasize the use of several additional dramatic techniques, including Stansloviski's and Benedett's acting theories (Benedetti 1994; Halliwell and Aristotle 1998) as well as screenwriting and directing techniques (Stanislavski 1936; Stanislavski 1949; Stanislavski 1987; Stanislavski and Hapgood 1989; Lucey 1996; McKee 1997). The dramatic techniques presented in this paper are the result of accumulated tacit knowledge on acting, directing, and screenwriting. They are not comprehensive, and are not meant to be comprehensive. The goal is to add to the current set of useful drama-based techniques that can be adapted and used within an interactive narrative.

The contribution of this paper is two-fold: (1) presenting a set of dramatic techniques that are believed to enhance interactive narratives' engagement quality (where engagement is as defined above), and (2) adapting these techniques within an interactive narrative architecture. The paper is divided into the following sections. First, I discuss previous research works that have influenced my work. Second, I outline several techniques borrowed from performance arts, discussing specific theories and their adaptation to interactive narratives. Third, I discuss a prototype interactive narrative architecture developed based on performance arts theories. In describing the architecture, I will describe the methods by which the discussed dramatic techniques are encoded. Fourth, I outline an implementation of this architecture. Last, I present some results showing the influence of the used dramatic techniques on the experience of the user.

2 Previous work

The work presented in this paper has been influenced and inspired by the *Oz project* (Bates 1992; Bates 1992; Reilly 1996; Weyhrauch 1997). The architecture described extends the *Oz project* (Bates 1992; Bates 1992; Reilly 1996; Weyhrauch 1997) as well as Mateas and Stern's work (Mateas 2002; 2002; 2004). In this section, I will outline previous work and discuss the unique contribution of the work presented in this paper.

2.1 Oz project

The *Oz project* (Bates 1992; Bates 1992; Reilly 1996; Weyhrauch 1997) is an example seminal work in the area of adaptive emergent narrative. The aim of the project was to provide users the experience of living in dramatically interesting micro-worlds that include moderately competent believable characters. Their work was greatly influenced by Egri's work on dramatic narrative (1994). Among their accomplishments is a believable agent architecture, which includes emotions, personality, and attitudes, as well as methods for expressing an agent's internal states graphically. One of the major components of the architecture is *Hap* (Loyall 1997) – a behavior language that allows designers to author character behaviors. The language was developed based on a reactive planning algorithm (Firby 1989). At run-time, characters use reactive planning to select behaviors that allow them to achieve their goals. The algorithm iteratively loops for all behaviors, choosing applicable behaviors for a given context. If the chosen behavior is not simple (i.e. contains sub goals to resolve), then the algorithm will search for behaviors that can solve these sub goals. In doing so, the algorithm builds an *And-Or tree* of behaviors as described in Forbus (1993). The system executes the actions at the leaf of the tree, and then propagates success or failure through the tree. This architecture was later extended to include an emotional model called *Em* (Reilly 1996), and a drama manager (Weyhrauch 1997).

The work I present here uses *Hap* as the base agent architecture, and further extends it to include a continuous behavior evaluation model, discussed later. In addition, I also use a user modeling technique to predict the users' character, which designers can use as a precondition to authored behaviors. Additionally, I added a story engine and a director agent to include a storytelling element for the interaction.

2.2 Façade

Mateas and Stern (Mateas 2002; 2002; 2003) built an interactive drama called *Façade*. Due to restrictions of space, it is hard to give Façade the space it deserves. Instead, I will merely summarize the major components of the architecture here. The architecture is composed of: A Behavior Language called *ABL* (Mateas and Stern 2004), a natural language understanding engine, and a beat sequencing language. The word beat here defines the smallest unit of action that has its own complete shape with a goal and an action. *ABL* (Mateas and Stern 2004) is a reactive planner system that extends *Hap* (Loyall 1997) by integrating a mechanism for handling joint behaviors between two agents. In *Façade*, the user interacts with characters (Non-Player Characters) by typing text messages. This level of interaction requires a good natural language engine to decipher user input. Hence, Mateas and Stern built a natural language understanding engine that uses forward chaining to map input text to discourse acts, which were used by other components of the architecture to select behaviors and story beats. The Beat Sequencing Language was implemented based on reactive planning, similar to *Hap*. One important unique feature of the beat sequencer is that it selects beats that fit a projected dramatic arc (based on Aristotelian dramatic arc principle, described more in detail in section 3).

The work presented here follows the same philosophy as *Façade*. The beat sequencing and behavior systems presented in this paper are very similar to the story engine and behavior system used in Façade. There are several unique features to the work presented here, however. Specifically, I introduced (a) a user model to select story beats and character behaviors (thus encoding the character arc principle from screenwriting (Lucey 1996; McKee 1997; Freeman 2003)) and (b) an improvisational approach to the agent architecture developed based on acting theories (Stanislavski 1936; Stanislavski 1949; Meisner, Longwell et al. 1987; Stanislavski 1987; Stanislavski and Hapgood 1989). In addition, I extended the beat selection criteria to include selecting beats based on the ticking clock principle from screenwriting theory (McKee 1997), discussed later.

2.3 Cavazza et al.'s Interactive Storytelling Architecture

Cavazza et al. (2002; 2003) developed an interactive storytelling system composed of a story engine that uses planning, in particular Hierarchical Task Networks (HTN), to select events that achieve story goals. Although the work presented here uses a similar planning approach, the main contribution of this paper is to encode several dramatic techniques to enhance the engagement qualities of the narrative.

2.4 Young et al.'s Interactive Storytelling Architecture

Young proposed an interactive narrative architecture that uses planning (Young 2000; Young 2001). Young's approach relies on re-planning to accommodate users' behaviors. For example, if the user attempts to shoot an important character, then the system, recognizing that the character is important, will adopt a 'gun out of bullets' routine to prevent the user from killing the important character. This technique is problematic and may lead to user frustration, because it deliberately obstructs the user from his goal in order to keep him on the story track. I see the work presented here as a contribution to Young's work by encoding artistic and dramatic techniques for adapting the narrative given users' actions.

2.5 Emergent Narrative

Another interesting approach is the work of Sobral et al. (2003) on emergent narrative, which was later extended to include emotional intelligent characters (Aylett, Louchart et al. 2005). They developed an interactive simulation to train children to cope with a bullying situation. Rather than using planning, they developed a stage manager agent that uses a sequencing algorithm based on constraint satisfaction to select story events to present. They identified several constraints categorized as pedagogical constraints (concerned with the learning objective of the simulation) and temporal constraints (e.g. an action must be taken within *n* seconds). The stage manager agent selects a story event by attempting to satisfy these constraints. The constraint satisfaction approach can be easily adapted to use the dramatic techniques presented here. Therefore, I see this paper's contribution as a step towards adding dramatic constraints that may enhance the interactive experience's engagement quality.

3 Performance Arts Design Theories

The premise of the work presented in this paper is to use performance arts techniques to enhance the engagement and dramatic quality of interactive narratives. In this section, I will enumerate several performance arts design techniques that are relevant and can be adapted to interactive narratives. In the next section, I will discuss an interactive narrative architecture that implements these techniques.

There are numerous published theories in the area of performance arts. These theories vary in their philosophical basis and abstraction models. Some are too abstract to adequately represent computationally. Applying techniques from performance arts to interactive narrative without adaptation is bound to disappoint due to the differences in the two media. In this section, I aim to describe tacit knowledge collected through two-to-three years of training in acting, directing, and screenwriting. Since I focused on theories that I applied and analyzed, some important theories and methods are left out, particularly, Joseph Campbell's (Campbell 1972) and Propp's (Propp, Wagner et al. 1968) work on storytelling, and Boal's work on acting theories (Boal 1979; Boal 2002).

3.1 Plot Structure and Magnitude

3.1.1 The Technique

Aristotle defined quality of plot using five basic principles: *Completeness*, *magnitude*, *unity*, *structure*, and *universality* (Halliwell and Aristotle 1998). He defined the structure of a plot as the order of events in time, where each event constitutes an important part of the plot. If removed, the plot looses its meaning. He also identified several plot components, including events leading to astonishment, recognition, reversal (twist), or suffering. In this section, I focus on plot structure and magnitude.

The order of events and their dramatic progression in time are important factors affecting plot quality (Baid 1973). Dramatic tension in a typical film or a play escalates through time until it reaches a peak (the crisis point) after which it is released. The shape of dramatic tension through time can be visualized as an arc, and thus called the *Dramatic Arc* (Styan 1960; Baid 1973). This relationship is non-monotonic, however. As Benedetti describes a play is composed of scenes and scenes are composed of beats, each has its own arc with a turning point where tension reaches its maximum point after which it is released (Benedetti 1994). Therefore, one can imagine the shape of drama as a nonlinear function with many local maxima points representing turning points in beats, but one global maximum point marking the crisis point of the performance. Choosing and ordering events to form this structure defines the plot quality.

Another factor that affects performances' engagement is the amount of time spent within each event (the pauses, etc), which Aristotle calls *Magnitude* (Halliwell and Aristotle 1998). To illustrate this concept consider a scene where a character opens a door leading into an unknown place. One way to animate this scene is to show the character opening the door and walking in. Alternatively, we can show the character as he slowly reaches for the door, and slowly opens the door, and then hesitantly walks in. Slowing the pace of the scene, as shown in the description of the second rendering, adds a different dramatic quality to the scene. Therefore, orchestrating the pacing and magnitude of each event is as important to engagement as plot structure.

3.1.2 Plot Structure and Magnitude in Interactive Narrative

In a film, the writer and director collaborate to create and manage the dramatic structure and timing to ensure a successful production. Several interactive narrative developers follow the same technique. They carefully predefine timing and ordering through scripting. While this method works for linear media, it is often criticized for being too restrictive limiting participants' choices within interactive narrative experiences. Looking for an alternative, many researchers discussed the possibility of developing interactive adaptive narrative systems. Creating such a system is difficult, because it requires the existence of a system that maintains both structure and timing. While few research projects developed systems that address plot structure (Weyhrauch 1997; Mateas and Stern 2000; Young 2000; Mateas and Stern 2001), pacing and magnitude were not addressed.

Ensuring good timing for events within an interactive narrative is a challenging problem, because almost all actions within an interactive narrative depend on the user. Unlike linear media where dramatists can anticipate an audience's mind-set, within interactive narratives users engage in several activities, including struggling with the interface, thinking of actions to do, and trying to manifest their choices through the given knobs of the interface. Therefore, controlling magnitude to ensure ‘good’ pacing and dramatic meaning is difficult due to its dependency on users’ physical and psychological state. As an illustration, consider an action scene in which the user and his partner (a non-player character) are being chased by a monster. In this dramatic moment, the player needs to communicate with his partner through a text-based interface. The game may acknowledge the technical difficulties by pausing the action until the player types his message. The length of these pauses varies depending on the user. Such variations may have a sever impact on the dramatic moment; a very long pause may destroy the dramatic moment, however, a shorter pause may not. In this paper, I address the issue of timing within an interactive narrative through the manipulation of characters’ (Non-Player Character’s) actions and story events using a user model.

3.2 The Ticking Clock

3.2.1 The Method

The concept of the ticking clock has been used as a dramatic device in many productions. Dramatists use dialogue, visual, and audio events to project possible future events. For example, in the movie *Saw* a killer traps two people in a room and gives them until 6:00pm to find an exit. The director interjected shots of the ticking clock at various points during the movie to create the anticipation of a death event. This dramatic instrument is very effective at creating anticipation, one form of pleasure as noted in Blythe and Hassenzahl (2004). Examples of this instrument can be seen in films such as *Nick of Time*, *Ninth Gate, etc*.

3.2.2 Using the Method in Interactive Narrative

One can add a trigger that executes a cut-scene projecting a future event at the right times during an interactive narrative. The main problem with this approach is in the use and meaning of the device. In a film, the director predicts the audience’s state and accordingly plants the visuals within the scenes to create anticipation. This approach works well when the dramatist can predict the current state of the audience. However, for non-linear narratives, this may not be possible. In this paper, I discuss a system that uses a user modeling algorithm to predict the user's state, and trigger events, such as the clock, in real-time, accordingly.

3.3 Character Arc

3.3.1 The Method

This principle is linked to Boorstin's *vicarious eye* (Boorstin 1990) defined earlier as a form of engagement where the audience identifies emotionally with a character and his actions. To illicit this type of engagement, Freeman defines several methods to establish character growth through time; he defines this concept as the *Character Arc* principle (Freeman 2003). An example is the birth of the hero as described by Joseph Campbell (Campbell 1999), where a character struggles and reluctantly becomes the hero in the middle or end of the story.

3.3.2 Using the Method in Interactive Narrative

While Freeman argued for the use of this technique in interactive narrative, care must be taken when adapting this technique to Non-Player Characters (NPCs). In a movie or a play, audience members identify with the main character and follow his journey through the performance. However, in an interactive narrative, where the participant takes on a role of a character, the main source of engagement is the interaction. The time the participant spends with other NPCs is, in most cases, minimal.

Instead of adapting this technique to NPCs, I argue for adapting this technique to the participant's character. (Note that in other forms of interactive narrative, e.g. the user is acting as a 'god' following characters and influencing their actions as in Cavazza et al. (2003), the Character

Arc technique can be applied to NPCs). In order to apply the Character Arc to the participant's character a new paradigm for interaction is needed. Therefore, I expanded the set of interaction models by developing an interaction model based on the *Character Arc* principle. The idea is to allow the player to develop his own character through his actions and choices within the interactive narrative, as will be discussed later.

3.4 Defining Characters' Tactics

3.4.1 The Method

In performing a character, an actor defines his character's super objectives and tactics for the performance (Stanislavski 1936; Stanislavski 1949). By super objective, I mean the character's goals. Tactics are the set of behaviors that an actor uses to achieve his character's goals. While performing, actors typically choose a goal and a tactic. They then continuously monitor the other characters or the environment evaluating the success or failure of the chosen tactic (Benedetti 1994). If an actor senses that a tactic is failing, he adopts a different tactic.

One important lesson that I learned through acting courses is that choosing the right goals for your character is important (see section 3.5). Choosing tactics that suit your character's personality is also important. Most importantly, however, constant awareness of the success/failure of the tactics you, as an actor, are applying is of extreme importance to the character's believability. Actors normally improvise by monitoring, evaluating, and quickly reverting to a different tactic if failure is anticipated.

3.4.2 Using the Method in Interactive Narrative

In interactive experiences, there are many Non-Player Characters (NPCs). These NPCs can appear for one shot or the entire experience. Careful character design in terms of actions, animation, and dialogue is crucial to the success of the experience, as the game industry has already determined (Freeman 2003). Using an acting approach, as described above, rather than a screenwriting approach can be beneficial (Wiener 2004). While artists employ acting techniques in creating animations for the characters, the AI architecture falls short because it does not employ the improvisational abilities described above.

3.5 Defining Characters' goals

3.5.1 The Method

One important rule that is often used in actor training (Bruder 1986) is: actors should choose goals for their characters, such that the goal (a) includes other character(s) in the scene, and (b) is in conflict with the other character(s). This is essential to create and sustain conflict in the scene. I found this rule to be very effective and extremely important in acting and improvisation.

3.5.2 Using the Method in Interactive Narrative

This technique can also be used in an interactive environment by rewriting the rule to: at least one character in the scene should choose a goal that includes and is in opposition to the user. Note that I am focusing on interactive narratives where the participant is playing the role of a character. This creates conflict and sustains drama as defined in relation to the user. In order to choose character goals that oppose the user, a representation of users' intention or goals is required. In this paper, I present an approach to represent users' goals and character based on user modeling, as will be discussed later.

3.6 Emotions through action and activity

3.6.1 The Method

"An actor cannot play an emotion; an actor can only play an action; emotion must arise out of action (Bethune 2004)." One of Stansloviski's important lessons is to project emotion through action (Stanislavski 1936; Stanislavski 1949). Rather than playing an emotion, actors are advised to play the action and encode the emotion in the action through parameters, such as speed, intensity, shape, and direction.

Another important lesson that can be transferred from acting models is the use of activity for an actor. Instead of having an actor stand on the stage empty handed, it is often useful to use an activity through which the actor encodes his/her emotions and purpose. In training, this particular method came up at least once every session, where having actors empty-handed on stage led to unconvincing characters, unbelievable characters, and miss communicated intentions. It was amazing how these problems were instantly resolved by asking actors to employ an activity.

3.6.2 Using the Method in Interactive Narrative

Encoding emotions in sub-text (a term used to define projection of information and feelings through inflections, pauses, and non-verbal behaviors) presents a major technical challenge. Fully articulated characters are hard to develop, especially in real-time. Currently games use predefined animations that artists prepare or generate by motion capture equipment to portray a specific line of dialogue or action. However, this implies that the sub-text is fixed. This method is not often appropriate for adaptive narratives. The alternative is to modify in real-time the predefined animations. Even with advancements in graphics and gesture systems (Cassell 1998; Vuilleme 1999; Kopp 2001), this problem presents a major challenge.

In the architecture described here, I am not presenting a general solution to this problem. Instead, I produced several animations with different 'adverbs' attached to them for the same action. Therefore, I encoded several 'general' sub-texts within already pre-made animations. For example, the animator developed several animations for the action ‘walk’ to include adverbs as ‘slowly’, ‘cautiously’, and ‘confidently’. This is labor intensive, but produces the required artistic results.

4 Architecture

Using the principles discussed above, I developed an interactive narrative system. Note that the interactive narrative system assumes that the participant takes on the role of a character, similar to adventure games, such as *Prince of Persia*. With this assumption in mind, I present the system.

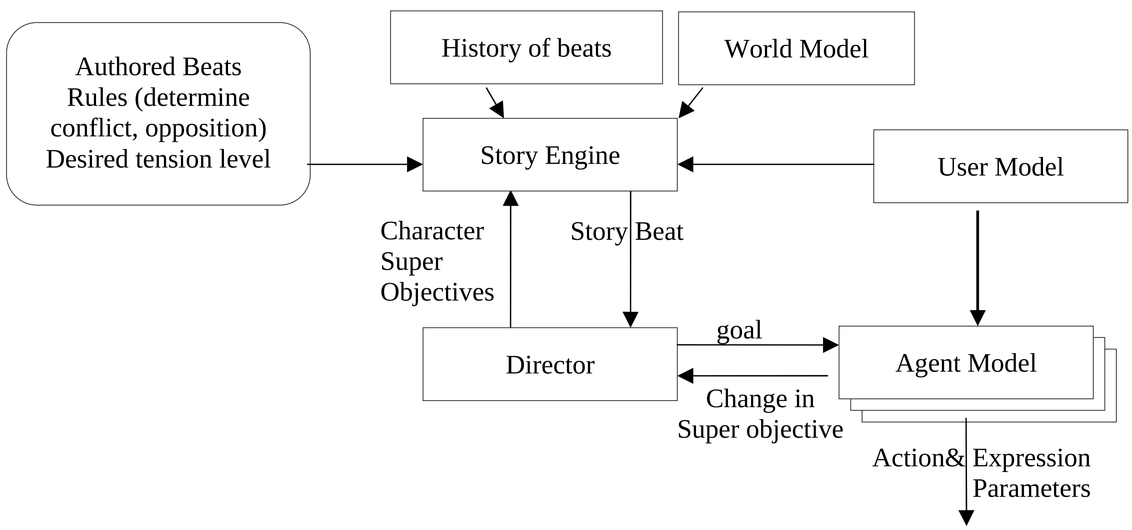

Figure 1: System Architecture

The system is composed of a story engine, several character agents, a director agent, and a user model, which is continuously refined as the interactive experience progresses. A summarized version of the system architecture is shown in figure 1. The story engine, similar to the work of Mateas and Stern (2000; 2001), selects a story event to execute based on a set of authored story actions. The story engine, unlike the work of Mateas and Stern, bases its selection on a user model (shown in the figure). Given a selected story action, the director agent allocates sub-goals to characters (agents). The agent model (shown in figure 2) consists of a behavior engine that is used to choose behaviors to achieve the agent's goal given by the director agent. The behavior engine is developed in conformance with the principles described in sections 3.4 (defining characters' tactics) and 3.6 (emotions through action). The behavior engine extends *Hap* (Loyall 1997) by including a low-level tactic monitoring technique which allows characters to anticipate tactic failure and improvise by selecting another tactic to achieve the goal.

Creating a good interactive narrative requires an artistic as well as a computational contribution. The sections below describe the architecture and the algorithms used as well as their utility in encoding the dramatic devices discussed in section 3. This is done by breaking each section into two sub-sections: the system (describing the algorithms and computational representations of the symbolic concepts) and the use of the system to encode dramatic devices (describing the artistic contribution).

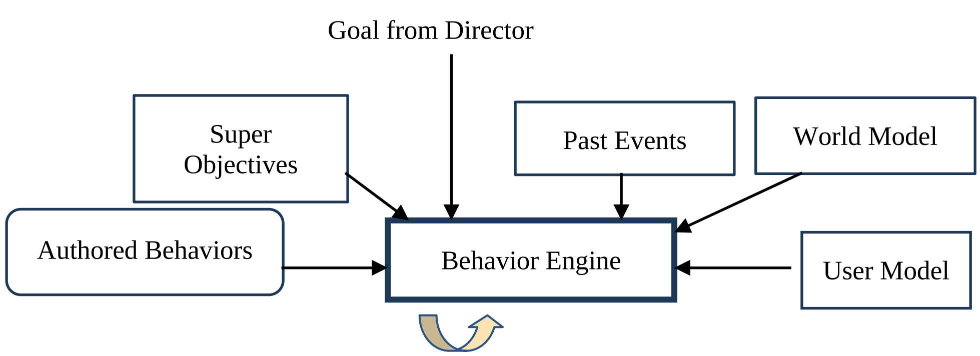

Figure 2: Agent Model

4.1 The interactivity Model and the User Model

4.1.1. User Model Representation and User Character Inference System

User modeling is an extensively explored topic within several research areas, including web-based searches, intelligent tutoring systems, and conversational agents (D. Browne 1990; Maybury and

Wahlster 1998). Many user models have been developed, including models fitting users into stereotypes (Rich 1979; Tsiriga and Virvou 2002), inferring users' knowledge (D. Browne 1990; Maybury and Wahlster 1998), inferring users' cognitive models (e.g. learning styles and personality), estimating users' goal and plans (Kautz and Allen 1986), and modeling and inferring users' mood and emotions (Picard 2003). The models used to infer these characteristics differ depending on the concepts modeled; for example, a simple questionnaire can suffice for collecting information on users' knowledge, but such techniques may not suffice for inferring users' cognitive models.

In this paper, I use a simple user model represented as a vector of personality traits, which defines a character stereotype. An example vector used in the current implementation is as follows:

<reluctant hero, violent, self-interested, coward, truth-seeker>

Given this representation, I developed a system that infers a user's character given his actions and story context. Inferring a user's intentions or goals given an action is a difficult problem although some solutions exist (Pollack 1986; Kautz 1987). For interactive narrative, the problem is simpler because the narrative provides a context that can be used to infer users' intentions. Given a user action, I use a rule-based system that calculates a new value for the vector shown above based on story context, user action, and previous vector values. The system currently uses very simple rules, such as 'if user advances to attack unarmed characters, then advance user on the violence scale.' In addition to inferring the character, the system also calculates a confidence measure of its current estimate. This measure is defined as follows:

$$f(\partial_{a_t}, M(a_{t-1}, S_{t-1}))$$

Thus, confidence is a function *f* where *a* is user action, ∂_{a_t} is time it takes user to take action *a* at time *t*, *M* is a function that estimates a character given the action *a* and story history *S* at time *t-1*.

This is based on the assumption that time indicates indecisiveness. For example, if it takes a player 10 seconds to make a violent action choice and it takes another player 50 seconds to make the same choice, then the system will interpret the first player as more violent than the second. This model is overly simplistic, but it represents an initial attempt to explore a different interaction model.

I also developed a scripting language that allows designers to define the function *M*, and thus influencing the way the system estimates a user's character given his/her action and story context. This is important because developing a general system that can infer a character given an action is difficult, but designers can often predict the mapping of specific patterns given the story context.

4.1.2. Using the User Model to Encode Dramatic Techniques

With the exception of *Façade*, none of the current interactive narratives targeted the type of engagement described by Boorstin as the *vicarious eye* (Boorstin 1990), which is typically evoked through character struggle, sympathy, and action. Alternatively, I seek to explore an interactivity method that evokes this kind of engagement. I formulated an interaction model based on the *Character Arc* principle discussed in section 3.3 (McKee 1997). The idea is to allow the player to develop his character's personality traits through his choices.

To establish this model of interaction, a computational user model as the one described in section 4.1.1 is required. The screenwriter initializes the traits forming a vector, an example is shown above. Using the language developed with the user modeling system, the screenwriter can write rules that allow the system to advance the user model based on story context. An example rule is as follows:

If user chose to kill Electra and Electra identified herself as his sister
then advance user in the violence scale

Designers can use the user's predicted character to trigger story events and character behaviors. Therefore, artistically, the story and characters' behaviors can change depending on the inferred user character, revealing a new approach for adaptive narrative.

4.2 Story Engine

Given a narrative goal, a set of authored story beats, an estimated user's character, and the story state, the story engine selects a story beat to execute.

4.2.1 Story Engine – Beat Representation

Story beats are represented as follows:

- Trigger: a goal that the beat solves
- Priority: the priority of the beat. This number changes as other rules estimate the tension value of this beat given the history of beats fired
- Preconditions: defines the context that enables this beat
- Postconditions: defines the actions or side effects of the beat
- Sub-problems: define the sub-problems that need to be solved for the beat to succeed. These sub-problems can be: (a) collection of beat-goals that need to be solved in sequence or parallel, (b) collection of direction-goals that need to be solved in sequence or parallel, or (c) a combination of both (a) and (b)

This definition is similar to *Hap*'s (Loyall 1997) behavior representation.

4.2.2 Story Engine – Beat Selection Algorithm

To select a beat to execute, the story engine uses a reactive planning algorithm (Firby 1989). The algorithm is summarized as follows:

1. make a list of goals, put story goal in the list
2. current goal = Pick a goal from the list of goals
3. for all applicable beat (given the preconditions) that can solve the current goal
    a. If beat is a simple Beat then go to step 2

b. else loop through subproblems
    i. if goal is a beat-goal, add goal to the list of goals
    ii. else add goal into direction goals to be solved, keep timing information, and variable info
    iii. go to step 2

Throughout this process timing information as well as variable associations are synchronized as described in (Firby 1989; Forbus 1993; Loyall 1997). The algorithm resolves conflicts when several beats are applicable by selecting the beat with the highest priority.

4.2.3 System for manipulating beat priority

I added a system that allows users to encode rules for manipulating beat priority. These rules are represented as follows:

Trigger: beat ?x is among candidates
and beat ?y was executed in the past
and beat ?y was executed in the past
and user character is ?f
….
Action: set priority of beat ?x to *s*

Where the question mark (?) before a letter denotes a variable. This representation then states that if (a) specific pattern of beats were executed and (b) user is of predicted character *?f*, then the action part of the rule executes (manipulating beat priority).

4.2.4 Using the Story Engine to encode dramatic Principles

As discussed in section 3.2, a clock event is a projection of an event that is likely to happen in the future. To create this type of event, designers can define clock-type beats. Clock-type beats are defined as regular beats where the direction goal is a basic visual, audio, or dialogue used to show a future event. As discussed in section 3.2 (the *Ticking Clock* technique), for a clock event to successfully create anticipation, designers need to trigger it based on context and user's state. Therefore, designers need to use player's predicted character (computed by the user modeling inference system) as preconditions to the clock-type beats.

In addition to the principle of the *ticking clock*, section 3.5 discusses the principle of *choosing characters' goals*, which dictates that when choosing a goal for a character care must be taken to choose a goal that adds conflict to the scene. This is accomplished by again using the player's predicted character (computed by the user modeling inference system). Designers can add a user's predicted character as a precondition to certain beats. For example, designers can write beats that initiate an attack on the user only when he has projected himself as a coward. The use of the user model here can ensure a certain level of conflict, and perhaps an action that nudges the player to action.

The *Dramatic Arc* is another important principle, as discussed in section 3.1. It can be established through selecting beats, that when executed, will complete the shape of the drama. The method by which the system allows such modulation of projected dramatic tension is by selecting beats that increase or decrease tension appropriately, given the dramatic progress of the narrative and the user's predicted character. As described above, the beat system selects the beat with the highest priority. Therefore, using the rule-based system described in section 4.2.3 designers can write rules that manipulate priority of beats based on dramatic progress, thus affecting the beat selection through manipulation of beat priority, e.g.:

Trigger:	beat#5 is among candidates
	<u>and</u> beat#2 is followed by beat #5
	<u>and</u> user is the violent type
Action:	increase priority of beat#5 by 10 increments

There are many limitations to this approach. First, this method does not encode magnitude, as described in section 3.1. Magnitude is partly addressed by the agent model, as will be discussed later. Second, encoding all possible transitions and their dramatic significance in terms of tension change is a very time consuming and laborious task. An alternative is to use a technique based on Propp (Propp, Wagner et al. 1968).

4.3 Agent Model

The agent model consists of a behavior system that, similar to *Hap* (Loyall 1997), which selects a behavior for the character based on the world model, the beats fired, the character's goal, and the user's predicted character.

4.3.1 Agent Model – Behavior Representation

Behaviors are represented, similar to beats, as follows:

> Trigger: a goal that triggers the character behavior
> Preconditions: defines the context that enables this behavior
> Postconditions: defines the actions or side effects of the behavior
> Sub-problems: define the sub-problems that need to be solved for the behavior to succeed. These sub-problems field can be: (a) collection of character goals that need to be solved in sequence or parallel, (b) collection of character goals that need to be solved in sequence or parallel, or (c) a combination of both (a) and (b)

Simple behaviors are behaviors in their simplest form, i.e. behaviors without sub-problems, represented as:

> Trigger: a goal that triggers the character action
> Preconditions: defines the context that enables this action
> Postconditions: defines the actions or side effects of the action
> Action: represented as Action + Adverb describes how the agent performs the action, encoding the sub-text (Freeman 2003)

4.3.2 Agent Model – Behavior System

The agent continuously chooses behaviors that achieve its goal forming a tree of behaviors where the leaves are all simple behaviors. The system then executes the actions propagating failure or success up the tree. This is very similar to *Hap* (Loyall 1997) and other reactive planning systems (Firby 1989), thus I won't go into detail describing the algorithms here. However, I will outline the major contributions and uniqueness of this particular behavior engine.

As described above, the action is defined as an animation and an adverb that describes how the action is performed. The animator defines several animations with different adverbs for each character. Based on the character and the adverb used, the animation system uses a blending algorithm to blend different animations with the correct adverb. This system can later be replaced by a system that automatically manipulates an animation to an adverb.

Another important contribution of the work presented here is in the agent's ability to adapt dynamically to the user's behaviors and character. I call this technique the *dynamic low-level tactic evaluation* technique. Agents continuously monitor mouse movements and mouse clicks for clues from which they can infer users' attention and characters. Given these inferred values, the agent will continuously adjust its success or failure rates until failure reaches a tolerance limit. Then the character will (1) declare the behavior a failure, (2) update the user model, and (3) choose behavior to solve the character-goal. The algorithm can be summarized as follows:

1. choose behavior plan given user stereotype, character goal, failed behaviors
2. for each time tick
   - 2.1. monitor user action assessing current behavior
     - 2.1.1. if failure limit reached, fail behavior and go to step 2
     - 2.1.2. Update user model

This algorithm allows the agents to improvise, a feature that increases the believability of the characters and the interactive experience.

4.3.3 Agent Model and Dramatic Principles

The agent model as described above encodes several principles by definition of the algorithms described. For example, the use the low-level tactic evaluation algorithm clearly encodes the principles discussed in 3.4 on defining characters' tactics. Using the users' predicted character as input, dramatists can define behaviors that slow down or speed up the pacing. For example, if the user is the coward type, then NPCs can push the user harder by threatening him. Therefore, designers can encode this information in the preconditions of the behaviors, and thus execute behaviors that are more appropriate to the users' predicted character.

Using the adverb plus action system is an important component of this engine. Adverbs encode the sub-text and emotions that should be projected in the action, as advocated by Stanislavski's theory (Stanislavski 1936; Stanislavski 1949) on emotions through activity described in section 3.6. For example, the adverb 'slowly' can be represented as an aspect of the action walk, establishing the manner in which the character performs the action. The action itself is animated in different manners defined by the adverb and the character. For example, 'take the sword' is an action that is defined as three animations 'take sword eagerly', 'take sword hesitantly', and 'take sword regretfully.'

5 Implementation and Results

5.1 The Story

I transformed the legend of the house of Argos (based on works of *Sophocles*) into an interactive story, called *Mirage*. The story introduces the user/participant as a new character called *Archemedis*, son of Aegisthus and Clytemnestra. He was given away to a farmer when he was a baby since the kingdom was unsafe for him. When his foster parents reveal his false identity, he starts a journey back to Argos. Since he was spirited away from the palace at an early age, he does not know much about the history of Argos. The interactive experience begins there.

The opening scene, 'going to Argos,' is visually projected to show different clues, thus allowing users to create different motivations for their own character. For example, he could be going back to Argos for power, for money, or just to find out the truth. The reason is never revealed in the experience, it is up to the user to draw his own conclusions and build his character accordingly. This is important to solidify the interaction model described in this paper.

Most dramatic narratives use a clock device, as described in section 3.2, which defines the anticipation and builds tension (McKee 97). In *Mirage*, I use the arrival of *Orestes* (*Electra*'s brother and *Archemedis*' (player's character) half brother) as the clock for this narrative. However, the interpretation of Orestes' arrival will be different depending on the participant's choices.

5.2 Scenes from *Mirage*

Below I discuss several scenes from *Mirage* showing an implementation of the architecture described in section 4. In order to show variations in the plot, I will use screenshots and dialogue. The particular scene shown here is situated in a room within a palace. As the user enters the room, he is confronted by *Electra* (NPC). The player interacts with objects by clicking on them and choosing from a pop-up menu of actions (similar to adventure or RPG games). To interact with a character, the participate clicks on it and chooses an action from the pop-up menu; actions include: slap, speak, etc. If the action speak is chosen, another pop-up menu is presented showing 3-5 word phrases describing the tactic the user can take. The phrases represent an actual tactic rather than a statement that the user can say to the character.

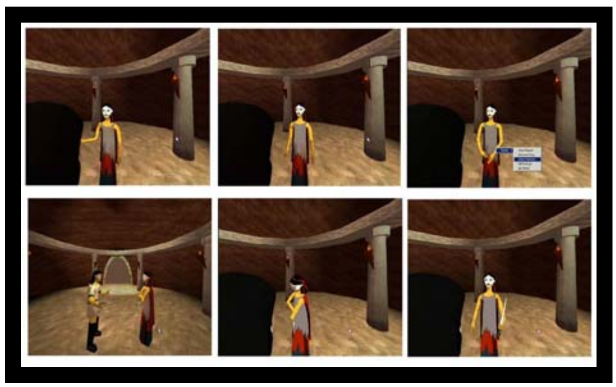

Figure 3: Showing outcome when user as truth seeker type (character choice: truth seeker)

Table 1: Dialogue for Figure 3

ELECTRA

Archemedis, listen. I know this isn't what you thought you were coming here to do. But if you *did* come to find out who you really are, maybe this is your chance. It's the sort of thing that makes heroes. Are you going to run away from this, or face it? Decide quickly, they'll be here any minute.

<user made a choice here to <u>find out the truth</u>>

ARCHEMEDIS

Listen, I don't want anything to do with any curse.

ELECTRA

But—

ARCHEMEDIS

I don't want to get the plague, I don't want to murder any royalty-- I just want to meet them. I want to find out who my real parents are. And who I am.

ELECTRA

I've already told you, she's a murdering whore and he's a tyrant with no right to the throne. As far as the real you goes—

ARCHEMEDIS

Yeah, I'd like to get a second opinion from somebody less crazy before I go on a killing spree. Besides, I'm sure if I explain the situation—

Electra pulls a SWORD.

ELECTRA

Let me explain the situation.

Figures 3 and 4 show several screenshots from *Mirage* for which dialogue scripts are transcribed in Tables 1 and 2, respectively. These scripts are voice-acted (a process by which an actor acts out the dialogue in a studio in front of a microphone; his voice is then recorded by a sound director and inserted for the characters in an animation or a video game); I transcribed the audio here to give the reader a flavor of the interaction. Readers should note that I did not transcribe the mannerisms or inflections present in the voice.

In this scene, Electra's objective is to convince the user to help her kill the king and queen. The figures 3 and 4 show two variations on the scene depending on the user's model. In figure 3 Electra, realizing that the user is the truth seeker type as inferred by the user model, reverts to violence to achieve her goal. She takes her sword out and attempts to scare the user to submit to her plan. Figure 4, on the other hand, shows an exchange where Electra realizes that the user is the coward type and is leaving. She quickly reverts to blocking his way and telling him that he may have the disease too and he needs to kill his parents to save himself, thus playing on his coward trait. These two examples show that Electra improvised and chose her behaviors based on the user model conforming to the character tactics principle (section 3.4). They also show that the goals were chosen to maximize conflict (in direct conflict with the player's intention), thus conforming to the principle discussed in section 3.5 (choosing characters' goals). Goals chosen were also consistent with the character's (*Electra*) objective.

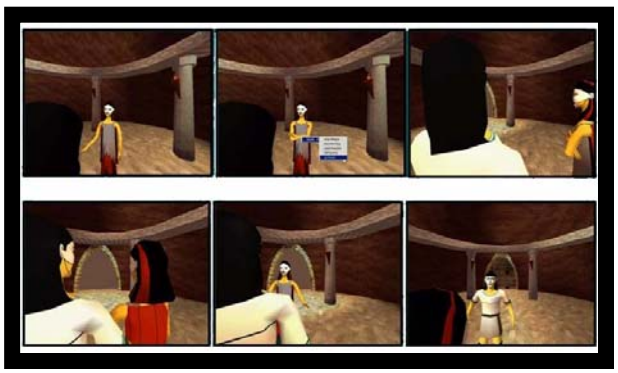

Figure 3: Showing dynamic change of tactic within the interactive story (character choice: coward)

Table 2: Dialogue for Figure 3

ELECTRA

Archemedis, listen. I know this isn't what you thought you were coming here to do. But if you *did* come to find out who you really are, maybe this is your chance. It's the sort of thing that makes hero – (interrupted)

<user made a choice to just leave>

Archemedis starts heading towards exit

<Electra fails her current behavior>

<She searches for a better argument (different behavior)>

<she replans>

<Electra's new plan includes: stop user from leaving

use 'user has the plague' argument/behavior to get him to listen>

Electra blocks user from exiting

ELECTRA

So, what, you'll just carry the plague back to them? I'm sure they'll be happy to see you.

ARCHEMEDIS

What? No! I don't have the plague!

ELECTRA

I wouldn't be so sure, Archemedis. You don't look well. Are you feeling OK?

ARCHEMEDIS

Don't kid around--

ELECTRA

I'm not kidding. You've been exposed to it. If you're going to get sick, it will be in the next few hours. There's only one way to be sure you won't get the plague. You have to end the curse.

As discussed in section 3.4, actors continuously monitor the user to identify agreement, conflict, and loss of attention or interest. Electra monitors the user in *Mirage* through mouse clicks, change in orientation, and action selection. In figure 3, she started using a behavior only to realize that the user has lost attention and is heading for the exit (shown in the third image within the figure). She anticipates tactic failure, declares it as a failure, and chooses another tactic to get to her goal, as shown in the figure. This shows character's resourcefulness and determination, which are qualities that inherently increase believability. They also help establish good timing and pacing for the action in the scene, thus addressing the magnitude issue discussed in section 3.1.

6 Evaluation

The main claim of this paper is that computationally encoded dramatic techniques (discussed in section 3) can enhance an interactive narrative experience. It is hard to provide conclusive evidence to evaluate this claim. Nielsen (Blythe, Overbeeke et al. 2004) stated that most previous work in this area use qualitative, rather subjective, methods to evaluate the final experience. These methods are often based on user surveys or observations. One problem with just evaluating the final product is that it is hard to make conclusive remarks on the actual techniques of the underlying architecture devoid of the art content, the story, etc. Instead, I used a critiquing technique applied at different stages of *Mirage*'s production.

Mirage was developed iteratively through three major prototypes, and thus evaluation was conducted at the end of each prototype. The evaluation technique used here is based on critiques supplied by film and theatre professionals. This technique is the standard practice in performance art disciplines, such as film and theatre, and therefore is more appropriate for our purposes. Since the purpose of such critiquing practice is to enhance the engagement and dramatic quality of a film or a theatre performance, I believe that these critiques can also result in an engaging and a better quality interactive narrative.

Specifically, I asked a team of five theatre and film professionals and teachers (acting teacher, 2 professional screenwriters, filmmaker, and a theatre director) to review each prototype. Theatre and film professionals and teachers understand dramatic quality and the meaning of engagement at a very deep level due to their training. In addition, due to their training, they can provide concise and clear constructive feedback, which will allow us to change the underlying architecture to enhance its quality.

Three prototypes of the system were developed. The first prototype implemented a system similar to Mateas and Stern's *Façade* (2003). The prototype initially did not include a user model; the beats authored for the story engine did not include any events that are clock-type events. In addition, the character behavior system was similar to *Hap*, i.e. did not include the low-level tactic evaluation method described in 4.3. Additionally, the first prototype was implemented with a text-based interface.

For the second prototype, I integrated the 3D graphics engine and art content, including models, animations, voice acting, and sound effects. I also made several adjustments given the feedback from the first critique session. These modifications were: (1) added authored beats based on the ticking clock principle, (2) modified the behaviors authored for the characters, (3) added the user model, (4) adjusted the authored beats and character behaviors to use the user model, and (5) adjusted the story engine and character behavior system to use the user model and the ticking clock principle. For the third prototype, I adjusted the behavior system to include the low-level tactic evaluation method.

After each prototype was completed, I scheduled a one-on-one 30 minute session with each of the five theatre and film professionals/teachers. During these sessions, they were asked to play the prototype 2-3 times. They were then asked to critique it and their comments were recorded. The critiques addressed several categories, including dialogue, overall narrative, user's character, interaction model, user's motivation to continue, and character development. I gathered many comments after the first prototype. Some of the comments are paraphrased below:

I like the back story and the setup works very well. Are you familiar with the concept of the 'clock'? I think if you add that it will add to the narrative.

What do these choices mean to the character Archemedis? I don't feel their dramatic impact. May be you can look into developing Archemedis' character over time. Films are all about character development. I don't see how Archemedis develops here and how my choices influence that.

I love the story. It is not exactly a Tragedy. I think your screenwriter is adding her own twist to it, which is great.

I like Electra. I cannot see her purpose. Remember, actors define goals, tactics, and actions for themselves.

In terms of interaction, something is missing. I cannot tell you what at this point. But it feels like the user is disconnected from the character. May be a stronger back story. I don't know.

I like it. The setup, the story. But I don't see why I would want to play it. What am I achieving?

I like the story. But why did you choose a Greek Tragedy. It follows a very simple plot structure.

I think the interaction fails right when I am given a menu to choose from. It slows the pace and makes the drama feel very superficial.

I like it. I want to try all combinations to see what happens in each one of them.

Using this feedback, I discussed some of the issues raised with the screenwriter working on *Mirage*. Many of the comments were on the 'disconnect' between the interaction and the story, such as the sixth comment above. After much consideration, we decided to use an alternative approach, specifically to use the character arc principle as an interaction model by using a user model. Thus, I added the user model and adjusted the architecture and the authored rules accordingly. For these adjustments, I asked an actor from my acting class to assist me in writing rules for the characters. We also added the clock principle and adjusted the story engine as well as the authored rules. In addition, I integrated the 3D graphics engine to the system, which allowed me to show pacing and make the interaction more interesting. I then collected reviews on the second prototype. Some of the comments on the second prototype were as follows:

> *Much better. I like the character of Archemedis.*
>
> *I think it is better. The interaction is more integrated with the story. It has a more dramatic value now.*
>
> *Pacing and timing are still not right.*
>
> *Camera angles and placements are awkward. For example, the size of the character in the frame is an issue.*
>
> *I like the characters. The tactics work. But actors know when their tactics fail. In improvisation, they are very aware of their environment and the other characters around. They are always looking for clues, signs from other characters.*
>
> *I see many problems in the cinematography of the scene. The camera choices, lighting, the movement. Recording the scenes with live actors will give you a better indication of how to stage the movement.*

I added the tactic evaluation technique to the character behavior system and added an intelligent lighting system to dynamically adjust the lighting in the scene (Seif El-Nasr 2003; Seif El-Nasr and Horswill 2004; Seif El-Nasr 2005). Time constraints did not permit adjustment to the camera system. Again, I asked the reviewers to critique the final prototype. The critiques were generally very positive. There were still issues that I decided to keep for future work, such as the camera control, movement, environmental sounds, and animation.

Finally, to evaluate the dramatic quality of the system and the techniques used, I invited five other theatre and film professionals to an interaction session with *Mirage*. I did not know or work with any of these professionals. I first introduced our research group and asked them if they have played games before. Three out of the five participants have previously played video games and interactive fiction (e.g. *Zork*). I explained the aim of the critique session and stressed that we are still searching for a workable interactive drama prototype, and thus their honest feedback and comments would be greatly appreciated. They were given 10-15 minutes with *Mirage* then asked to discuss or review their experience. During the 10-15 minute interaction, I observed their interaction and noted points of confusion, or where they said 'hmmm' or 'aha'.

The critiques were very encouraging. First, several participants noticed that the characters were more responsive than in typical video games or other interactive fiction productions. They said the characters are more alive (in terms of their narrative quality, not specifically the animation) than what they would expect in a video game. One of them mentioned that the characters seem to improvise, which is a nice change. Since I did not explain the system or the models behind the characters, this result is positive.

All participants played the story more than once to look at how their choices affect the narrative and the other characters' behavior, as they later explained. Three of the participants recognized that Electra's responses change depending on the action and the level of 'aggression' of their choices. They all noted the change in the plot and the character development due to their choices. They all acknowledged that this is an interesting form of adaptation and interaction. One of them noted that this inspires her to play the interactive narrative many times, but then go back and play it as her true self and see where she ends up. At this point in time, we have only implemented what is equivalent to 15% of the story. They all complained about the briefness of the story, asking if they can see more. Unfortunately, due to time and resource limitations, we were able to produce only three scenes of a planned 19-scene story.

In addition, there were two ‘aha’ moments: the moment Electra drew the sword to threaten the user and the moment Electra fell to her knees crying. All of the participants liked the fact that Electra refined her tactics quickly drawing the sword and threatening the user, which was described as a ‘major dramatic shift’. Some also noted another dramatic shift when Electra drops her sword and starts weeping. One commented, “theatre people like that.” Many thought that that particular moment was shocking (but believable) considering her resolve and her strength in the preceding scenes.

They also gave us several suggestions. One suggested using facial expressions or changing masks to express emotions. Another suggested better choices for camera placement and movement. Two participants asked to include other characters and objects on the stage. One participant asked to use objects character activities more within the scene.

7 Conclusion

In conclusion, I have presented a new architecture encoding several dramatic techniques adapted from acting, directing, and screenwriting theories. My focus was to evaluate the potential codification of such techniques and their use to enhance engagement, dramatic content, and quality of interactive narratives. I described the system and its prototype implementation. I described the limitations of the system. I also discussed a brief summary of the critiques collected on the system. It is hard to evaluate or measure engagement in a quantitative manner. In this study, I assumed that, due to training of film and theatre professionals, tuning the interactive narrative architecture to their critiques will help enhance the dramatic and engagement quality of the interactive experience. According to the critiques and our assessment of the system, I believe that the techniques discussed in this paper can lead to a significantly better design for an interactive narrative increasing and enhancing the dramatic content of the experience. Such architecture may have an impact on training, educational, entertainment applications. However, the road to proving such a claim is still long and requires many prototypes in different systems beyond what is presented here.

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