On the Use of Reincorporation in Interactive Drama

Zach Tomaszewski

Information and Computer Science Department

University of Hawaii—Manoa, Honolulu, HI 96822

ztomasze@hawaii.edu

http://zach.tomaszewski.name/argax/

Abstract

Marlinspike is an interactive drama system. It produces a story by playing short pre-authored story components called scenes in response to the actions of a human player. Marlinspike selects the next scene to play so as to reincorporate—or narratively build upon—as much of the story-so-far as possible. In accordance with an Aristotelian definition of narrative unity, this reincorporation serves to make earlier events—particularly the player's actions—narratively necessary to the finished story. An evaluation with human players of Marlinspike's novel reincorporation feature produced mixed results. On the one hand, reincorporation does indeed produce internal story structures that are more unified and that include more of the players' significant actions. However, the players themselves did not report a correspondingly improved experience of either story quality or story-level agency.

Introduction

An interactive drama is a system in which a human player assumes the role of a character in an unfolding story. Through their actions within the virtual story world, the player influences the course of a story that is procedurally generated at runtime.

A number of different approaches to interactive drama already exist. Among others, these include rule-based (Crawford 2004), character-based, planning-based (Young & Riedl 2003; Pizzi, Cavazza, & Lugrin 2007), and scene-based designs. In a scene-based design, small pre-authored story segments are selected and played by a central directing agent in response to the player's actions.

One scene-based system is Grasbon and Braun's GEIST (Spierling et al 2002; Grasbon & Braun 2001). It is based partly on Vladimir Propp's work on folktale morphology. GEIST randomly selects the next scene to play from those scenes that have had their preconditions met. GEIST scene preconditions include the scene's required story context, the Propp function that the scene will fulfill within the story, and how the scene satisfies the requirements of the user model on such requirements as level of violence and excitement. Some of GEIST's scenes are polymorphic, which means the results of the scene depends on actions taken by the player during the course of the scene.

Fairclough's OPIATE system (2005) also builds stories from pre-authored scene components. Like GEIST, each of OPIATE's scenes fulfill a Propp function within the story. OPIATE uses case-based reasoning to assemble complete stories that match and extend the events of the story so far. If the player fails three times to make the choices required by the current story plan, that story is put on hold and a new story structure is generated.

Although Mateas and Stern call their story segments *beats*, they are similar to scenes. In *Façade* (Mateas 2002), beats also have preconditions that must be met before they can play. Possible beats are then selected based on the current level of story tension and the affinity the player has demonstrated for the two non-player characters (NPCs).

The Marlinspike system presented here follows in the scene-based tradition of these previous systems. Marlinspike contains a single central drama manager agent that selects the next scene. The NPCs are not autonomous but instead are controlled through the content of scenes.

Like GEIST and *Façade*, Marlinspike does not plan ahead. Instead, it simply selects the next scene from those scenes that currently have their preconditions met. When more than one scene could be selected, Marlinspike is guided by a simple Aristotelian principle: the action of a story should be both complete and unified. A story is complete if it is a single whole with a clear beginning, middle, and end. A story is unified if all of its events are connected by necessary or probable cause. That is, earlier events should logically lead to later events so that each event is necessary to the complete story. An event is necessary if it cannot be removed from the finished story without leaving the story "disjointed and disturbed" (Aristotle 1999).

In order to produce a unified story while selecting only one scene at a time, Marlinspike relies on the improvisational theater technique of reincorporation

(Johnstone 1979). To reincorporate an earlier event or story detail, an improv actor simply refers back to it or otherwise builds upon it within the current scene. This effectively makes earlier events necessary to the finished story because the later events now logically depend upon them.

For example, if a character enters a dinner party scene carrying a wrench, the wrench needs to be acknowledged in some way within the story. Otherwise, in the context of a dinner party, the wrench would be both unnecessary and distracting. The wrench could be used to establish that the character wielding it is a motorist whose car just broke down. This break-down event should then itself be reincorporated. Perhaps the motorist needs help fixing his car or his uninvited arrival offends the foppish dinner guests. So long as the motorist affects the course of the dinner party in some way, then both the entrance of the motorist and the wrench he carries become necessary to the finished story.
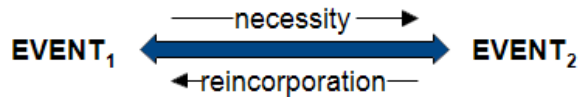

Figure 1: Necessity and reincorporation are two views of the same relationship between two events.

Thus, the Marlinspike interactive drama architecture uses reincorporation to produce a unified story. Using a specific game named Demeter, the effectiveness of this reincorporation technique was evaluated using human players. An overview of the Marlinspike architecture and the results of its evaluation are described below.

Marlinspike

Since the Marlinspike architecture has already been described in greater detail elsewhere (Tomaszewski 2011, Tomaszewski & Binsted 2009), the following is only a brief overview.

A Marlinspike story takes place within a virtual story world. This world is comprised of locations, props, and characters. The player directs the actions of one of these characters (PC). The other non-player characters (NPCs) are controlled through scenes, which are selected by the drama manager.

Through his character, the player can perform a number of world-level deeds. A deed is a simple physical world-level event. It is the specific application of a verb to a particular world object in a specific location. Example verbs include `Talk`, `Attack`, `Take`, `Open`, `Wait`, and `Go`. A deed affects only world-level states, such as by changing the state of a door from closed to open or by moving the PC to a new location.

Deeds are then translated into action events. An action is a story-level representation of a player's deed. This deed-to-action translation often follows simple default rules. For example, an `Open`(door) or `Take`(necklace) deed would each normally be translated as a MANIPULATE action. But the default translation into an action can also take into account the state of NPCs or other world objects. For example, `Kiss`(Alice) might become a ROMANCE(Alice) action if Alice likes the PC, but it would instead become ASSAULT(Alice) if Alice dislikes the PC.

Deed-to-action translations can also be overridden or extended by the previous story context. For example, if the PC has established a relationship with an NPC named Betty, then `Kiss`(Alice) might now also be considered a BETRAY(Betty) action. A single deed can thus be
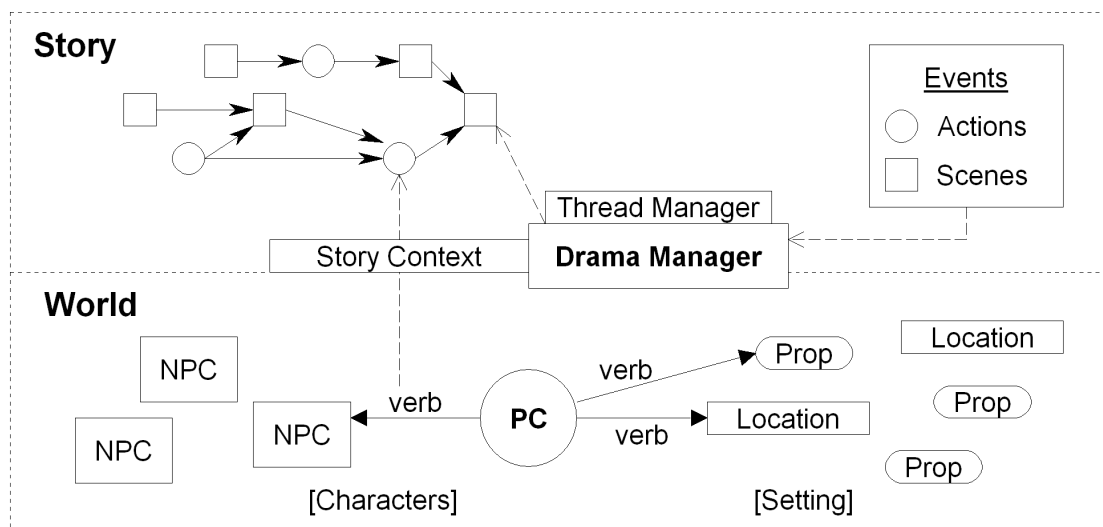

Figure 2: The Marlinspike interactive drama architecture

represented by one or more actions that indicate the story-level meaning or significance of the physical deed in the story world.

Each possible action has an author-specified import value that indicates how narratively exciting it is. For example, MANIPULATE would have a low import while ASSAULT and BETRAY would have moderate to high import values.

After each player deed, the Marlinspike drama manager has the chance to respond by selecting a scene to play. Scenes extend the story by directing NPCs to act and by affecting world objects. Scenes are usually written to be heavily customized at runtime based on the current story context. For example, scenes can usually play in many different locations. Different NPCs can be assigned to the roles required by the scene depending on the their current affinities.

Marlinspike scenes have preconditions that must all be satisfied before the scene can be selected. Preconditions may include world-level details, such as the current location of certain characters or the state of particular props or NPCs. Scenes must also include at least one previous story event—either a player action or a previous scene—as a precondition. (This requirement allows for threading, as described below.)

Scenes may also include a number of hooks. A hook is an earlier event that the scene may optionally refer to if it has occurred. Unlike a precondition, a hook event is not required to have occurred for the scene to play. For example, suppose a scene has an NPC betray another character. This scene might have a precondition that the betraying NPC have a low morality or else a strong dislike for the betrayed character. However, the scene may also include as a hook any previous events in which the betrayed character previously affronted the NPC. When played, the scene would then be able to provide additional narration in which the NPC reveals that her current betrayal is (at least in part) an act of revenge for these previous affronts. Hooks are always an act of reincorporation. In this example, the NPC's betrayal makes the earlier affronts narratively necessary by presenting them as causes of the current event.

After a scene plays, it may add one or more triggers to the story context. These triggers are the means by which later deed-to-action translations can be modified or extended. For example, if a scene has an NPC named Bluebeard tell the PC not to open a certain closet, the scene would then add a trigger to translate any future

Open(closet) deed as a DEFY(Bluebeard) action.

The Marlinspike drama manager tracks the reincorporation connections between events. Two events can be connected either because:

- Event 1 served as a precondition or hook for a scene in Event 2
- Event 1 provided a story context trigger that affected the translation of a deed into an action in Event 2.

A series of such connected events is called a thread. (See Figure 3.)

Only events of significant import start a new thread. An interactive drama can include many events—such as the PC traveling from room to room, opening and closing doors, or looking at objects—that are not normally narratively exciting. For this reason, Marlinspike does not try to reincorporate every event but only those of moderate to high import.

Because one event can reincorporate multiple previous events, it is possible for an event to splice two or more existing threads into a single thread. For example, in Figure 4, $SCENE_9$ has spliced the ends of Thread 2 and Thread 3 together to form Thread 4. Thread 4 now includes all the events of the other threads except for $SCENE_6$ in Thread 1.
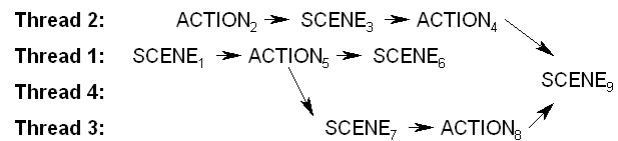

Figure 4: An example of thread structure.
The arrows show connections of narrative necessity.

Every Marlinspike scene is either a beginning, middle, or ending scene. Beginning scenes have no preconditions and are played to start a new story. In response to player deeds, the drama manager then selects a middle or ending scene that has all of its preconditions met. When more than one scene could play, the drama manager selects the scene that reincorporates the greatest number of previous events of significant import.

A story ends when the drama manager selects an ending scene. The story is complete if the beginning and ending scene are connected by at least one thread of events. This thread connecting the beginning and ending of the finished story is called the main story thread. The story is fully unified if all threads end with the ending scene. This is another way of saying that all threads have been spliced

Figure 3: A simple thread demonstrating the two kinds of reincorporation.

into the main thread. For example, if SCENE9 in Figure 4 were an ending scene, the resulting story would be unified except for SCENE6 at the end of Thread 1.

Demeter

To evaluate the Marlinspike architecture, I implemented a prototype game named *Demeter: Blood in the Sky*. This horror story is set in an alternate 1923 on a trans-Atlantic Zeppelin flight. The game begins when the passengers (including the player's character) wake on the third day of the journey to find the crew all brutally slain... and an undead creature lurking in the body of the Zeppelin above.

Demeter includes 18 locations. There are 6 passenger NPCs and 1 undead revenant NPC. The game accepts 27 possible verbs that may translate to 26 different actions. The drama manager can then respond with 26 different scenes, which includes one beginning scene and two possible ending scenes. To simplify the authoring, there are also 16 NPC reactions and scene-like components that can be used internally by scenes. For example, most Demeter scenes will start by internally playing the same NPCs_React component in order to handle any necessary NPC reactions to the most recent player action.

Demeter and Marlinspike were implemented together using the Inform 6 interactive fiction (IF) system. Thus, Demeter plays much like other text-based IF games: the player reads descriptions of his surroundings and events and then enters short textual commands. Scene output can vary from one line to three screens of text.
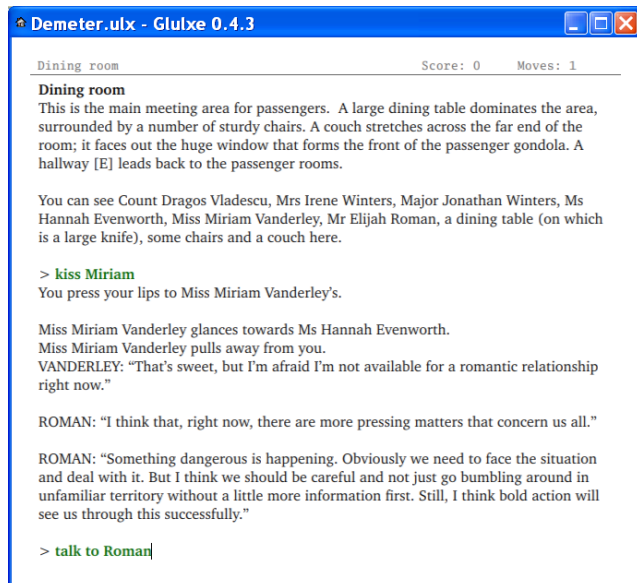

Figure 5: A screenshot of Demeter.

Demeter was designed to take 20 to 30 minutes to play. It also includes a short prologue tutorial set aboard the Zeppelin in order to familiarize new players with common commands and the IF game style in general.

The complete implementation is about 23,000 lines of Inform code. Approximately 15% of this code comprises the Marlinspike architecture; the remaining 85% is Demeter game content, including locations, props, NPCs, actions, and scenes.

Evaluation

The evaluation of Marlinspike/Demeter was announced to the University of Hawai'i community through various departmental email lists, which included both students and faculty. Interested participants clicked a link to participate online from their own computers.

Participants first completed a background questionnaire, which recorded participants' age, gender, education level, comfort and frequency of computer use, degree of digital and roleplaying game experience, and familiarity with a number of narrative and computer game genres. They were also randomly assigned to either Group 0 or Group 1.

Participants then played through the Demeter tutorial to familiarize them with the game and to help reduce any learning effects during the game itself. They then played through the Demeter game twice. Those in Group 0 first played with Marlinspike's reincorporation turned on and then with it off. Those in Group 1 first played with reincorporation off and then with it on. This use of groups provides experimental control for the order of exposure to reincorporation.

When reincorporation is turned on, Marlinspike behaves as described above. Turning reincorporation off has two effects. First of all, the next scene is simply selected randomly from those scenes that have their preconditions met. That is, the previous story material that would be reincorporated by a scene is no longer considered when selecting scenes. Selecting scenes based only on preconditions like this is similar to how the GEIST system works. The second effect is that no optional scene hooks are played. That is, even if a selected scene could make an explicit reference to an earlier event that is not one if its preconditions, it will not do so when reincorporation is off. When reincorporation is turned off, Marlinspike still tracks any threads formed by preconditions and story context triggers.

A transcript of each participant's game input was automatically recorded so that their game session could be reproduced for later analysis. After each of the two game sessions, participants completed an identical response survey regarding their perceptions of any story-like structure, their ability to make a significant impact on both the world and the unfolding story, and their general enjoyment of the game.

Results

The email announcement reached an estimated 500 list subscribers. 53 people completed the initial background survey. Of these, 29 then completed both game sessions and associated response surveys. Of these 29, two participants quit halfway through a game, one played the game twice before answering the first survey, and two were missing game transcripts due to a technical issue. Therefore, only 24 participants provided sufficiently complete data for analysis. (Due to a program bug, it was not possible to collect system-level measures for one of the two games played by 2 of these participants.)

This evaluation's sample represents the population of adults interested enough in interactive drama to volunteer 90 minutes of their time and perseverant enough to play through two complete games.

Despite the use of random assignment, the two groups exhibited some notable differences. Group 0 contained 15 participants, while Group 1 contained 9 participants. The two groups differed significantly ($p < .05$) on the mean number of previous digital games played on both a personal computer and on other digital platforms such as gaming consoles and smart phones. There was also a significant difference between mean familiarity with IF games, adventure games, and table-top roleplaying games. However, despite these specific differences in group backgrounds, no later dependent measures showed any significant difference due to group membership.

Story Structure

All stories, regardless of reincorporation condition, were complete. That is, the beginning scene was in the same main story thread as the ending scene, with one or more middle scenes in between. (This does not always happen in Demeter.)

When reincorporation was on, games were about 75% shorter ($p <= 0.05$) on story-level measures of total story length. (See Table 1.)

Measure (Mean Totals)	Reinc ON	Reinc OFF	$t(21)$	p
Events	72.6	95.8	2.39	0.03
Player deeds	52.4	69.8	2.06	0.05
Scenes	30.4	40.3	2.41	0.03

Table 1: System measures of story length.

This appears to be because fewer irrelevant scenes are selected when reincorporation is on. For example, during a discussion between the passengers about what to do, other discussion scenes would be favored when reincorporation is on because they would extend the discussion thread. When reincorporation is off, the discussion is occasionally interrupted by NPCs pursuing other behaviors. Since Demeter uses a turn-based interface, the addition of these less-relevant scenes also requires more responses from the player to continue the story, which means a corresponding increase in the number of player deeds.

Stories were also significantly more unified on all measures when reincorporation was used. For example, the average main story thread was 28.6 events long when reincorporation was used but only 13.9 events long when it was not used, $t(21) = 4.83$, $p < 0.001$. Similarly, there was an average of 5.5 extra threads at the end of games with reincorporation on, but an average of 12.3 extra threads with it off, $t(21) = 5.14$, $p < 0.001$. So, while the stories were more concise overall, reincorporation still spliced more threads and their component events into the main thread that concludes with the ending scene of the story.

Despite these noteworthy differences in Marlinspike's system-level measures of story structure, participants did not report a corresponding difference in experience. Specifically, participants were asked to indicate their agreement with the following statements using a 5-point interval Likert scale:

- The events of the game had a story-like structure.
- The game session had a clear beginning, middle, and end.
- The events of the game were logically related to each other.
- Earlier events led to later events in a coherent and understandable way.
- The other characters' actions seemed to be consistent with their apparent goals and personalities.

Participant agreement with these statements did not differ significantly when reincorporation was used compared to when it was not used.

Player Agency

World-level agency—the player's ability to successfully perform valid deeds that affect the story world—is a prerequisite for any story-level agency. System measures showed that only about 80.5% of user inputs resulted in a valid deed ($SD = 10.7$pp; max = 100%; min = 50%). This significantly improved between games (first game mean: 76.6%; second game mean: 84%; $t(21) = 3.00$, $p = .01$). This was the only play-order effect found. As expected, the use of reincorporation had no effect on world-level agency.

Responses to some survey questions correlated significantly with this "valid deeds per user inputs" system measure of world agency. These correlations included whether players knew what deeds were possible to perform within the game, $r(44) = 0.45$, $p = .002$; whether they were able to construct valid commands, $r(44) = 0.36$, $p = .01$;

and whether they were sufficiently able to direct their character's actions in the game world, $r(44) = 0.46$, $p = .001$. However, these survey results did not themselves reveal the same significant difference between the first and second game as found with the system measure.

Story-level agency is the player's ability to intentionally and significantly affect the course of the story. A system measure of this is the portion of the player's actions that become part of a thread. Of particular interest are narratively significant (high import) actions and whether they are eventually threaded into the main story thread. (See Table 2.)

Measure (Means)	Reinc ON	Reinc OFF	$t(21)$	p
% of actions in threads	59%	51%	2.05	.053
% of actions in main thread	37%	13%	7.02	< .001
% of significant actions in main thread	44%	4%	3.97	< .001

Table 2: System measures of story-level player agency.

Marlinspike's reincorporation feature only slightly improved the reincorporation of actions of any import into a thread. This improvement was of borderline significance. However, there was a very notable and significant improvement in the number of actions reincorporated into the main thread, particularly regarding actions of high import. (It is disappointing to note that, even when reincorporation was used, there were still a large portion of player actions—even significant actions—that were left unnecessary to the finished story.)

As with story structure, participants' survey responses failed to show the same significant difference between the reincorporation conditions. Specifically, participants were asked to indicate their agreement with the following statements using a 5-point Likert scale:

- My actions seemed to have a significant impact on the course of the story.
- I believe the story would have been different had I performed different actions.
- I believe the story would have been better had I performed different actions.

Participant agreement with these statements did not differ significantly when reincorporation was used compared to when it was not used.

Enjoyment

When asked whether the game was enjoyable, participants gave a mean rating of 2.5 on a 0-to-4 scale. There was a wide distribution of responses ($SD = 1.1$), however, with

25% of participants giving the game a 4-point rating.

While there was no significant difference in enjoyment due to the use of reincorporation, it was interesting to find that the most significant correlations ($r(46) > 0.50$, $p < .001$) between satisfaction and other survey responses included:

- whether events were logically related to each other ($r = 0.53$)
- whether earlier events led to later events in a coherent and understandable way ($r = 0.65$)
- whether the NPC's actions seemed to be consistent with their apparent goals and personalities ($r = 0.68$)
- whether the player's actions had a significant impact on the course of the story ($r = 0.57$)

Although no claim of causation can be made from this, enjoyment is at least correlated with a sense of agency within a well-formed story with believable characters. Thus, it is encouraging to learn that those who enjoyed the game tended to have exactly the interactive drama experience Demeter was designed to provide.

No significant ANOVA interaction effects were found. That is, reincorporation did not have a different effect for the two groups nor was there a significant difference evident only if reincorporation was experienced on the first play session or on the second play session.

Discussion

According to Marlinspike's own measures, the use of reincorporation made a significant and noticeable difference. It both improved the unity of the modelled story structure and worked more of the players' actions into the central story. Had this study relied on simulated users, this would have been counted as a clear success. Yet actual users failed to report a similar difference in experience. There are a number of possible reasons for this discrepancy.

The first and most likely possibility is that the effects of reincorporation are simply too subtle to make a significant impact on players' experiences. First, there are a fairly small number of scenes (26) that are all written for the same story space: dealing with an undead foe aboard a Zeppelin. Furthermore, even when reincorporation is off, scenes must have their preconditions met before they can be selected. The extra selection step of considering the material that would be reincorporated by the two or three relevant scenes that could play at any given point may not make that much difference.

Secondly, disabling hooks that refer back to earlier events only changes most Demeter scenes by one or two sentences of output. Furthermore, players may already be assuming such connections between events. For example, if a party of characters goes to explore the Zeppelin for

clues to the death of the crew and returns to find the hatch to the passenger gondola locked, someone inside the gondola will need to unlock the hatch to let the party in. The exploration party can then report on what they found in the Zeppelin. Most players would perceive this as a single thread of events. However, as written now, the reporting scene extends the exploration thread and only hooks in the unlocking of the gondola hatch. (When the hook is used, the scene includes an extra line of text in which one of the returning party members thanks the opener of the hatch before beginning their report.) Thus, only when reincorporation is turned on does Marlinspike see this series of events as one thread and not two. And so turning reincorporation on can make a significant difference to the internal system model of the story while not significantly affecting players' mental models.

Regarding player agency, the relatively low level of world agency—an average of 1 in 5 commands failed to produce a valid deed—could be a barrier to players experiencing a sense of story-level agency. The open-ended survey questions offered support for this. Responses revealed that the text-based interface was the least enjoyable aspect of the game, and a handful of participants complained of not knowing what deeds were possible to perform in the game.

The open-ended survey questions also highlighted a wide range of opinion regarding agency in Demeter. 35% of the most memorable game events as reported by participants and 25% of most enjoyable aspects of the game included some sense of player agency. Yet 15% of responses regarding the least enjoyable aspect of the game stemmed from a perceived lack of agency. Also, a sense of agency requires formal constraints as well as material affordances (Tomaszewski & Binsted 2006). Yet some participants complained that the game did not provide a clear objective. That is, some participants did not know what they were "supposed" to do. While Demeter was designed to provide a story regardless of what players chose to do, this finding was a reminder that players still require a sense of intention in order to experience agency. Finally, especially since most players did not significantly interact with the NPCs, Demeter may have provided too few possible actions of high import for players to perform.

Aside from the general subtlety of the reincorporation effects and the potential barriers to player agency, it may be that the survey instrument used was simply not precise enough to detect a change in experience due to Marlinspike's reincorporation feature. While very convenient to administer, a post-game survey requires that participants accurately recall and report their experience after the fact. Measuring responses during the game—such as through in-game prompts or by having participants talk-aloud—may have been more useful, though at the risk of breaking players' immersion in the story. Also, because the

same survey was used after each game session, participants may have tended to simply provide the same responses again the second time without much reflection. Finally, a larger sample size may have helped, since the distribution of responses was quite wide.

Authorial Lessons

The process of implementing Marlinspike/Demeter also offered some significant lessons regarding the utility of reincorporation-based drama management.

The first lesson is that, while reincorporation may be important for providing narrative unity, more needs to be considered when selecting scenes. An example from Demeter development illustrates this well. At one point, a player led an exploration party into a new room that contained a partly-dismembered corpse clutching a hammer. At this point, three scenes are possible: an NPC could exclaim at seeing the grisly corpse, an NPC that wished to be armed could pick up the hammer, or an NPC could lead the party from the room. As an author, I feel this should be the preferred order of selection for these scenes. However, Marlinspike chose to immediately lead the party from the room, since this "leaving" scene extended the "exploring the Zeppelin" thread while the other two scenes did not reincorporate more material. This example is a reminder that it is also necessary to advance the story by adding new material rather than only referring back to previous material.

Also, reincorporation must sometimes be done immediately. For example, if a number of characters are having a conversation and the PC suddenly slaps one of the NPCs, there needs to be some sort of immediate response from the NPCs regarding the slap. If considering reincorporation requirements only, it would be possible to finish the conversation first and then reincorporate the slap, but this is not a believable response from the NPCs. Also, it would limit the player's sense of agency if such a notable action produced no immediate response. For these reasons, any immediate NPC reactions were always handled within scenes in Demeter and so were not affected by whether reincorporation was used or not.

Sadly, reincorporation does not significantly reduce the authorial burden. First of all, an author must provide sufficient scenes to respond to (or at least hook in) all possible actions of high import. Secondly, reincorporation through hooks can only serve only to pull actions into the story. While this means the player is still affecting the flavor of the story, it is not the same thing as producing a significant branch in the path of the story. That is, as with any other scene-based approach, the full range of possible story paths is determined by the number and range of the scenes. Reincorporation through hooks only serves to make

the player's actions relevant to the current story path.

Finally, although the focus of the Demeter prototype was only on story structure, all other aspects of narrative had to be implemented effectively to produce a complete interactive drama. The open-ended survey questions showed that all these other aspects—characters, setting, narration style, mood, output medium, and input controls—made just as significant an impression (if not more of an impression) on players than the events of the story did. This is simply another reminder that an interactive drama author must always pay careful attention to *all* aspects of narrative, not just to story events or to characters.

Conclusion

The Marlinspike architecture provides a number of innovations. The interpretation from world-level deed to story-level action allows the same physical event to have very different interpretations depending on the specific story context. These detailed player actions are represented explicitly in the drama manager's model of the story. This treats player actions as story atoms that are implicitly equivalent in importance to any author-provided scene. This is in contrast to most other scene-based approaches in which player actions are generally subservient or confined to those scenes in which they occur.

Yet the key feature of Marlinspike is its reincorporating behavior when selecting and playing scenes. This is intended to dynamically work diverse player actions into a central story. The threads of narrative necessity thus formed between events produce a detailed and explicit model of the story. This model offers a wealth of information that can then be used by the system itself, such as by having NPCs report on previous story events or accurately infer causality between events.

The evaluation of the Demeter game—which uses the Marlinspike architecture—showed that reincorporation does indeed make for a significantly more unified internal story model that includes more of the player's actions in the story. However, human players did not report a corresponding difference in their experiences of story coherence or story-level agency. While a number of possible reasons were given for this, further research is needed to provide a more definitive answer.

Given the complexity of narrative—including such diverse elements as story, characters, setting, discourse, and medium—the implementation and evaluation of Marlinspike/Demeter has shown that reincorporation alone is not a "silver bullet" solution to the production of a fulfilling interactive drama. However, it does appear to be a valuable tool for the management of scene-based story events. Due to the strengths of Marlinspike's various contributions as an interactive drama architecture,

additional development is planned.

References.

Aristotle. 1999. *Poetics*. Trans. S. H. Butcher. Ed. Francis Fergusson. New York: Hill and Wang.

Crawford, Chris. 2004. *Chris Crawford on Interactive Storytelling*. Berkeley, CA: New Riders.

Fairclough, Chris R. 2005. Story Games and the OPIATE System: Using Case-Based Planning for Structuring Plots with an Expert Story Director Agent and Enacting them in a Socially Simulated Game World. PhD diss. University of Dublin, Trinity College. <http://www.cs.tcd.ie/publications/tech-reports/reports.05/TCD-CS-2005-59.pdf>

Grasbon, Dieter, and Norbert Braun. 2001. "A Morphological Approach to Interactive Storytelling." *cast01//Living in Mixed Realities*. Bonn, Germany. <http://netzspannung.org/version1/extensions/cast01-proceedings/pdf/by_name/Grasbon.pdf>

Inform. <http://www.inform-fiction.org/inform6.html> Last accessed: 15 Jul 2011.

Johnstone, Keith. 1979. *Impro: Improvisation and the Theatre*. New York: Routledge.

Mateas, Michael. 2002. Interactive Drama, Art, and Artificial Intelligence. PhD diss., Carnegie Mellon University, Pittsburgh, PA. <http://www.cs.cmu.edu/afs/cs.cmu.edu/misc/mosaic/common/omega/Web/Groups/oz/papers/CMU-CS-02-206.pdf>

Pizzi, David, Marc Cavazzz, and Jean-Luc Lugrin. 2007. "Extending Character-based Storytelling with Awareness and Feelings." Agent-Based Systems for Human Learning and Entertainment Workshop. International Conference on Autonomous Agents and Multiagent Systems. Honolulu, HI. <http://www-scm.tees.ac.uk/users/f.charles/publications/conferences/2007/aamas07_pizzi_short.pdf>

Spierling, Ulrike, Dieter Grasbon, Norbert Braun, and Ido Iurgel. 2002. "Setting the Scene: Playing the Digital Director in Interactive Storytelling and Creation." *Computer & Graphics* 26: 31–44. <http://netzspannung.org/version1/extensions/cast01-proceedings/pdf/by_name/Grasbon.pdf>

Tomaszewski, Zach, and Kim Binsted. 2006. "A Reconstructed Neo-Aristotelian Theory of Interactive Drama." *Computational Aesthetics: Artificial Intelligence Approaches to Beauty and Happiness: Papers from the 2006 AAAI Workshop*. Menlo Park, CA: AAAI Press. <http://zach.tomaszewski.name/argax/pubs/2006-TomaszewskiBinsted-Drama.pdf>

Tomaszewski, Zach, and Kim Binsted. 2009. "Demeter: An Implementation of the Marlinspike Interactive Drama System." *Intelligent Narrative Technologies II: Papers from the AAAI Spring Symposium*. Menlo Park, CA: AAAI Press. <http://zach.tomaszewski.name/argax/pubs/2009-TomaszewskiBinsted-Demeter.pdf>

Tomaszewski, Zach. 2011. Marlinspike: An Interactive Drama System. PhD diss.. University of Hawaii-Manoa. <http://zach.tomaszewski.name/argax/dissertation/2011-Tomaszewski-Marlinspike.pdf>

Young, R. Michael, and Mark Riedl. 2003. "Towards an Architecture for Intelligent Control of Narrative in Interactive Virtual Worlds." International Conference on Intelligent User Interfaces. <http://liquidnarrative.csc.ncsu.edu/pubs/iui2003.pdf>