Dramatic Flow in Interactive 3D Narrative

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ABSTRACT

The concept of dramatic level is crucial for a model of dramatic flow. We present a framework to maintain optimal dramatic flow in an interactive 3D environment where both linear and emergent narratives co-exist. Unlike all other interactive narrative prototypes the framework advanced focuses on the optimal dramatic flow of the emerging user narrative so that although fragmented, it can be engaging and make sense. Using a sample narrative from Ovid's *Metamorphoses* [18] we demonstrate a method to evaluate dramatic levels as plot points so that movement across narratives retains a strong dramatic flow. Although users may never choose to explore any given linear narrative in its entirety, the result is an engaging and rich narrative experience.

Categories and Subject Descriptors

H.5.1 [**Information Interfaces and Presentation**]: Multimedia Information Systems—*Animations, Artificial, augmented, and virtual realities*[Evaluation/methodology]; I.2.1 [**Artificial Intelligence**]: Applications and Expert Systems—*Games*; I.2.10 [**Artificial Intelligence**]: Vision and Scene Understanding—*Representations, data structures, and transforms*

General Terms

Measurement, Design, Experimentation, Theory.

1. INTRODUCTION

Even with continued advances in rendering, 3D game physics, characterizations and modeling, interactive narrative in 3D environments is limited by interactions that often do not advance the narrative, are loosely connected or even disruptive to the narrative flow. Consequently, the appeal of 3D environments is driven by spectacle and shallow representations of conflict.

As Barros & Musse [2] point out, conciliation of interactivity and narrative is important to foster the desirable characteristics of narrative, such as consistency, conflict and surprise. Szilas et al [24] also note that the effective facilitation of user interaction in 3D narrative is more often than not identified as a difficult if not impossible problem. Crawford [6] observes that the author's control of the narrative seems in opposition to the player's freedom. Louchart & Aylett [13] call this contradiction *the narrative paradox* between authorship and participation.

In this paper we go some way in addressing this contradiction by advancing a model for structured dramatic flow in an interactive narrative framework for 3D environments. This flow links to a formulaic structure that does not hinder, but facilitates emergent events and complex characterizations within an interactive narrative. Our interpretations for central concepts including narrative, scenario, emergence and drama are outlined before describing the model.

Narrative is taken to be a linear story or account of events. Scenarios are smaller chunks within a narrative that have settings, actors, plots and descriptions of what people do and experience. Schank [20] writes that humans think in terms of stories, the world is understood in terms of stories and we approach problem solving and new ideas by referencing stories we already understand. Szilas [23] comments that stories seem to be a fundamental, universal way to organize and communicate complex knowledge. Stories capture and convey knowledge, especially tacit knowledge, and communicate ideas and abstract concepts.

Reconstructed narratives are accounts of events that have already occurred or a description of a movie or book for example. Interactive narratives are those where the user has some or full authorial role. Branching narratives such as that advanced by Iuppa et al [12] are fully authored interactive story structures where a user has a finite number of possible directions to choose from a set of pre-authored story branches.

Emergent narrative is closely linked to branching narrative. Louchart & Aylett [13] describe this as managed by both the user and embodied Intelligent Agents, and depends entirely on the interactions between each other and their environment. A fully emergent narrative is where authorial control rests entirely on the decisions the user makes.

The interactive narrative framework advanced here centers on drama. Drama is narrative that typically involves conflict

and contrasts of character. It is a series of causal events (the plot) that evoke vivid, emotional, conflicting interest or results. Freytag [9] writes that the dramatic is that which stirs deep emotional arousal through deed or course of action.

Drama consists of structural elements such as plot, and phenomenological elements like the patterns that emerge from the actions of the characters. The drama, according to Freytag, represents human nature striving to represent itself in deed, with a transforming effect. Conflict, sentiment, violent will, achievement hindered through passionate desire, according to Freytag, are the stuff of drama.

A 'proper pleasure' as Hiltunen [10] writes, was Aristotle's [1] measure of the success of a drama and the organization of its parts. Reversal of fortune, followed by a moment of audience catharsis for example was for Aristotle, the appropriate goal and impact of drama, resulting in the proper pleasure of the audience.

Mateas [15] compares the structural elements of the drama defined by Aristotle [1] and the phenomenological categories defined by Murray [17]. Murray's categories relate to the subjective experience of a user engaged in an interactive story. These are:

1. *Immersion.* The feeling of being present and engaged in another place in such a way as to accept and participate in the logic and events that occur.
2. *Agency.* The feeling of involvement that comes from being able to take actions that have a real effect on the unfolding events.
3. *Transformation.* Mateas suggests that this should be interpreted broadly. Any type of physical or personal transformation fosters experiential variety.

Aristotle's six elements describe the parts of a drama and how those parts relate to each other.

1. *Plot.* What happens, the order of events, rather than the meaning.
2. *Theme.* The meaning of the story rather than the events (plot).
3. *Character.* The characters required in the drama are determined by the plot.
4. *Diction/Dialogue.* The dialogue is determined by the kind of characters depicted and the thoughts that these characters would have.
5. *Music/Rhythm* The patterns determined to a large extent, by the dialogue and actions of the characters.
6. *Spectacle.* The visual elements. the sensory display that results from the patterns of the characters.

Drama encapsulates a flow of dramatic circumstances and events. Optimal dramatic flow strengthens the narrative and the probability that complex plots will succeed. Measures for optimal dramatic flow can be traced at least as far back as Aristotle [1] who defines beginning, middle and end as core to drama.

Freytag [9] elucidated Aristotle's early representation of dramatic flow by presenting a pyramid or triangle where beginning, middle and end are represented by (a) an inciting moment or *exposition*, (b) action rising to a climactic moment followed by (c) a reversal of fortune that resolves into a cathartic moment of last suspense.

More recently, dramatic flow has been implemented for example, as the Hollywood story arc that is discussed by Iuppa et al [12]. Others such as Campbell [5] and Murray [17], advance a dramatic sequenced structure of scenarios or stages necessary for the telling of engaging stories; and Propp [19] further develops the idea of the dramatic flow structure by advancing a mathematical formula for the sequencing of dramatic events.

There are more recent approaches to interactive drama such as the *Façade* prototype, presented by Mateas & Stern [16]. This succeeds as an essentially dramatic environment where the user becomes involved in conflict between husband and wife. The interaction however is limited to typing in dialog that is processed by the system and the next dialog event calculated. Although engaging, Façade depends on thousands of authored prewritten segments for just one scenario - the conflict between husband and wife. This, like most branching storylines, is a huge authoring task. Despite the added challenge of facilitating emotion-rich, dramatic conversation behaviors within this authored environment, *Façade* as Szilas [24] notes is one of the few systems to have gone beyond the conceptual phase.

Mimesis, Young et al [25], is an architecture that integrates a range of intelligent components within conventional game engines. The design is intended for run-time behavior generation for specific sets of in-game goals while maintaining coherence with unanticipated user activity. As Szilas observes, this is a theoretically well founded approach to interactive narrative yet to be demonstrated.

Like *Façade* Crawford's [7] *Erasmatron* uses a Drama Manager. There is a parallel with the interaction-based Dramatic Flow model we present in this paper, however Crawford's approach to plot is rule-based rather than event based with the focus on character development.

The prototype *Idtension* [23], uses mostly Aristotelian definitions combined with an evaluative methodology. This prototype implements non-linear narrative management; however the model we present facilitates both linear and non-linear narrative.

Damiano et al [8] advance *Drammar*. This is a drama-based approach that acknowledges (a) the necessity of directional dramatic flow through the parts of the drama, and (b) that the full execution of the author's narrative often hinders user engagement. Although the inclusion of a *dramatic value* in a 'Dramatic Unit' is discussed, the approach to this and its instantiation is in contrast to our work next discussed.

2. INTERACTION FRAMEWORK

Computational narratives require clearly defined ontologies in conjunction with dramatic structure to facilitate engaging and believable phenomenological events. However implementing the abstraction of environmental ambience that responds to the changing levels of drama in an interactive 3D world is very different to implementing this in theatre, cinema or in the telling of an engaging story.

This research presents a two tiered interaction framework for 3D environments that (a) uses a formulaic and structural approach to the plot and dramatic sequence and (b) facilitates emergent phenomenological elements of the drama that can be managed with existing AI engine modules to control characterization, behavior and emotional representations across one or many connected linear narratives.

This framework was introduced by Macfadyen, Stranieri & Yearwood in [14]. It uses an online lexical resource, the Berkeley FrameNet Project [3]. This is based on frame semantics. Its aim is to document the range of semantic and syntactic combinatory possibilities of English words in each of their senses. The major product of the project is a database of lexical units comprising a word and its meaning and semantic frames. Although a linguistic and ontological resource, the semantic frames incorporate elements or descriptions of a word that encapsulates the flow of an interaction that can be computationally mapped into a sequence to represent dramatic narrative elements for interactive story telling.

Currently the English FrameNet project lists about 800 frames. For example, the verb *chase* is described by the frame *Cotheme*. This frame contains words that indicate the motion of two distinct objects. A structure we call an Interaction Frame is an instantiation of the FrameNet frame for a specific lexical unit. For instance, the *Chase* Interaction Frame describes a chase scenario using representational elements such as actors, environment, physical descriptions and actions. The circumstances, stimuli, spatiotemporal information and the event depicted are also described by the frame. Further, emotions are sometimes referenced. However, an Interaction Frame that is derived from FrameNet frames does not include the dramatic template elements necessary for a model of dramatic flow for 3D environments. Put simply, FrameNet does not model drama.

The concept of dramatic level is crucial for a model of dramatic flow. A scenario can be regarded to have a dramatic level that ranges from quite undramatic to very dramatic. The flow of drama in an entire narrative can be described by the ebb and flow of dramatic levels arising from the dramatic level in each scenario in the sequence. A simple story of a dog chasing a cat shown in Figures 1 and 2 illustrates this.

In Figure 1: *A dog is snoozing under a shady peach tree on a hot summer afternoon. The dog lazily opens one eye and spies the cat crouched in long grass nearby. A noisy chase follows, ending with the dog in disgrace.*

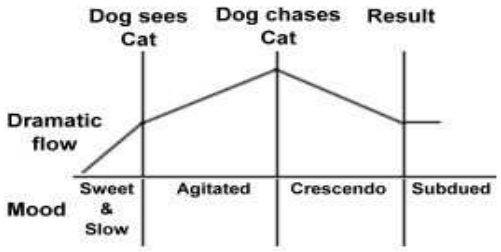

Figure 1: Dog chases cat: Example 1.

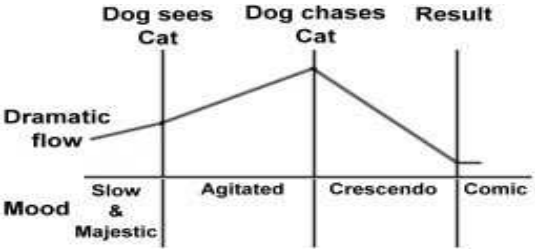

Figure 2: Dog chases cat: Example 2.

In Figure 2: *The cat walks past swishing its tail, just out of reach of an excited dog on a leash. Provoked by the cat's teasing, the dog breaks free. A noisy chase follows - the resulting scenario is the dog wearing a bandaid over one ear.*

Although stories have the same two key Interaction Frames, *See* and *Chase*, the dramatic level and mood drawn in the first interaction, *See*, is different. Further, the resulting scenario in each example demonstrates difference in both dramatic level and mood, even though the plot of the dog chasing a cat is the same.

A linguistic approach to 3D interactivity has already been introduced by Crawford in [7] who defines sets of verbs as actions that characters can execute. In this study, the examination of interactions from a linguistic perspective has two advantages. Firstly, the FrameNet lexical ontology describes in detail the essence of a verb (or interaction) and returns the elements or arguments that are core, peripheral and descriptive of the interaction in an annotated data structure with usage examples. Secondly, from the simple lexical query, the ontology returns a rich description easily applied for three-dimensions. Figure 3 demonstrates the simple query *To Chase*.

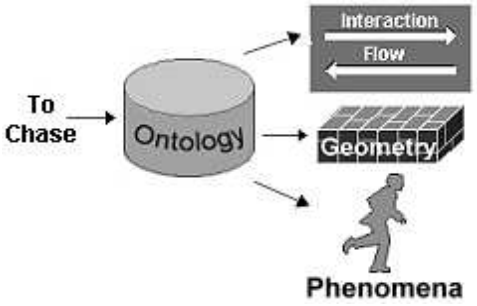

Figure 3: Flow from one to three dimensions.

The FrameNet data includes (a) geometries that can be managed by the physics engine in a 3D application, (b) phenomenological data relate to the emergent events tied to AI systems and characterizations, and (c) fields that facilitate the cognitive and experiential flow from one key interaction to another. Table 1 in the next section shows FrameNet data divided into (a) core interaction flow, (b) geometric requirements (often implicit) and (c) emergent concerns that cannot be proscribed.

Drama in interaction is lacking in FrameNet lexical units. The aim of this paper is to present a methodology that calculates dramatic flow points within 3D narrative as a means to maintain an optimum level of dramatic flow while key plot events are experienced, and user decisions affect the narrative.

In the model we present, key interaction frames specify the parts of a plot that must be experienced by the user to make sense of the story so far if a linear progression is chosen. This facilitates an intermediate emergent dramatic sub-narrative between each key frame. In this intermediate state, similar to the multi-quests presented in the computer game *Oblivion* [4], the user actively participates in creating an emerging story that links to and enriches the narrative plot framework.

In the Cat & Dog scenario for example, the chase may be interrupted if the dog suddenly realizes it is dinner time, races home, has dinner and then returns to the pursuit. The chase can be made more complex if the dog follows the cat down a tunnel that leads to an entirely different world. However, regardless of intermediate sub-plots and activities, the key plot points *see* and *chase* are necessary for the narrative or experience to make sense. This approach (a) facilitates interactive narrative, yet (b) adheres to the Aristotelian [1] and Proppian [19] tenets that a plot must be a series of *poster hoc* events that are directly linked to, or are consequential to the previous event.

The Interaction Framework model strikes a balance between (a) fully authored interactive narrative that greatly reduces the potential for user interaction and engagement, and (b) unauthored emergent narrative that, as pointed out by Szilas [22] and Steiner & Tomkins [21], is poorly dramatic with almost no plot at all, and where important narrative plot events may never be experienced.

Although the dramatic flow arc is well documented by most authors that discuss drama, other than Damiano et al [8], it is difficult to find any work that defines a dramatic level or variable for computing the level of drama at a given point in an interactive narrative. Further, it is reasonable to expect that most people will agree on the level of drama inherent in any single scenario given that most people are drawn into the dramatic flow of a narrative. Indeed, if a single scenario can be described by a verb, noun or simple phrase as it is in an Interaction Frame, it is reasonable to expect that most people will agree on the level of drama inherent in a single verb, noun or simple phrase.

The hypothesis that most people agree about how dramatic a particular verb, phrase or noun is has not previously been studied. Preliminary results from a pilot study using an online survey seem to confirm the hypothesis. In the pilot study, participants were asked to indicate the dramatic value on a scale from 1 - 4 associated with a set of verbs, phrases and nouns. Value 1 indicates a *Not dramatic* response. The remaining values 2, 3, 4 respectively indicate increasing levels of drama; *A bit dramatic*, *Dramatic* and *Very dramatic*.

An anonymous online survey was constructed (http://www.rosiemacphee.com/survey/) and respondents were drawn from university colleagues, family and friends. Each respondent was presented with 38 single word nouns such as *the air, the blood, death, the door, the father, the forest, the lute, the quest, the viper, the train* and single word verbs such as *to perceive, to reveal, to shiver, to slip, to struggle,* and *to devour*. Respondents were also presented with 20 phrases including *He looked back, He is dragged into the blood-stained room, She attempts to conceal herself but is discovered, All who hear him sing are entranced, He rests in a quiet glade, On her wedding day she is slain by a viper*. The verbs, nouns and phrases were randomly drawn from the text of sample myths.

Responses within the pilot group illustrated a very high level of agreement about the level of drama on the four point scale for phrases. Indeed, all of the pilot group rated the 20 phrases identically except for 2 respondents who provided adjacent ratings on two phrases. On single words, all pilot respondents rated the same nouns and verbs a value of 1; non dramatic. However, there was some variation between respondents on nouns and verbs that were dramatic. Even here, the variation was not frequent and never greater than adjacent scores. Initial results indicate there is no difference in gender, but more data is needed to determine any differences that relate to a respondents' proficiency with the English language.

Results from the pilot study have been sufficiently promising to advance to the full study where the sample size will enable statistical tests of significance.

3. MODEL

Unlike all other interactive narrative prototypes, the model we present focuses on the optimal dramatic flow of the emerging user narrative so that although fragmented it can be engaging and make sense. In a 3D game environment where the user has authorial control of his or her own narrative within the constraints of that virtual environment, the execution of any authored linear narrative or sets of linear narratives in their entirety is unlikely. We present a set of narrative myths that are thematically linked and share spatial geometry. A user is likely to partially participate in one narrative and at any time can decide to explore a different one. Although the user may never fully experience *any* of the narratives in a linear manner, the user's own narrative can retain a strong dramatic and immersive flow by matching dramatic level point to dramatic level point. The experience of *tasting* a set of thematically and spatially linked narratives can be educationally interesting and a rich narrative experience.

A sample narrative drawn from Ovid's fable of Orpheus and Eurydice [18] illustrates how the model of dramatic flow can enhance interactivity in 3D environments.

> Orpheus, singing son of Calliope married his beloved Eurydice. On their wedding day, while walking in the meadows with her handmaidens, Eurydice was slain by a viper and fell lifelessly to the ground. In his grief, Orpheus resolved to descend to Hades to bring her back. On his journey he passed thin ghosts and wraiths of the dead until he reached the lord of the underworld Pluto. With his lute, Orpheus sang of his beloved Eurydice. All who heard his song were entranced. Even the bloodless ghosts were in tears. The King and Queen of the underworld could not bear to refuse his pleas and called Eurydice forth. If Orpheus took Eurydice back to the land of living without looking back at her, she would be restored. Up the steep sloping path they rose until they had almost reached the surface of the earth. Orpheus eager to see his beloved, looked behind, and straightaway Eurydice slipped back into the depths.

Scenarios using Interaction Frames are defined as follows. The interaction is presented in uppercase.

1. Orpheus MARRIES Eurydice.
2. Eurydice is SLAIN by a viper.
3. Orpheus DESCENDS to Hades.
4. All who HEAR him sing are entranced.
5. Pluto ALLOWS Eurydice to RETURN to the land of the living.
6. Orpheus must not LOOK at Eurydice.
7. The light of the world begins to SHOW.
8. Orpheus LOOKS at Eurydice
9. Eurydice SLIPS back into Hades

The simple sentence "Orpheus descended to Hades" drawn from Ovid's *Metamorphoses* [18] yields the agent Experiencer *Orpheus*, the Interaction *to descend* and a location Object *Hades*.

To make links within a series of interaction frames, the interaction *To Descend* must contain some implicit variables. In this example, we can use the FrameNet core arguments (a) agent; *descender*, (b) source; *the land of the living* and (c) direction; *down*. Further, FrameNet also identifies data fields that are specific to the interaction, such as distance, path, path shape and the goal (Hades).

In Table 1, rows 1 and 2 contain the core interaction units *agent* and *object*. Rows 3-5 are implicit since these continue the thread already established in the previous scenario. The remaining rows 6-10 are FrameNet data that are geometric or phenomenological. This means they predicate a spatial geometry in the world, and/or are characterizations specific to the dramatis personae driven by the user and the emergent sub-narratives nestling between the overarching plot key frames.

1	Core	Agent	Orpheus
2	Core	Object	Hades
3	Implicit	Source	Land of the Living
4	Implicit	Direction	Down
5	Implicit	Purpose	Rescue
6	FrameNet	Manner	Grieving
7	Framenet	Distance	Many fathoms
8	Framenet	Path	Towards Hades
9	Framenet	Path shape	Winding
10	Framenet	Vehicle	Legs

Table 1: Orpheus Descend Taxonomy Unit.

A user may start their own narrative walking with Eurydice in a meadow on her wedding day. This is a linear narrative that has its own dramatic flow and sequence of dramatic levels. When the viper appears for example, the user may choose to wander off and enter into [11], the Cyclops narrative - the system calculates the current dramatic level in the user's narrative and matches that with a similar level in the Cyclops narrative; possibly at the point where the Cyclops devours the Achaeans.

Even though the user may never experience either narrative linearly, an engaging and potentially educational experience is likely, since an optimal dramatic flow in the emergent user narrative has been maintained.

4. CONCLUSION

We have presented a model that maintains optimal dramatic flow in an interactive narrative 3D environment where both linear and emergent narratives co-exist.

Existing studies attempt to resolve the paradox of interactivity and authored narrative in 3D environments even though a user's engagement with pre-authored narrative environments is shown to be limited and immersion unlikely. Recent studies conclude that even partially authored environments inhibit user interaction, and fully emergent narrative environments are poorly dramatic and without plot.

The Interaction Framework advanced in this paper maintains a user's optimum dramatic flow even when only fragments within a series of narratives are experienced. Inserting key interaction frames as dramatic plot points for a series of narratives that share a virtual world, yet are complete in themselves allows exploration *across* narratives. This is a very different approach to a linear exploration where each narrative must experienced to its end before the next narrative is presented.

Further work involves extending the study with a larger sample size survey to determine dramatic values for Interaction Frames. Sets of user driven narratives can then be analyzed and resulting scenarios tested in a 3D narrative environment.

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