Agent Stories:
Authoring Computational Cinematic Stories

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BACKGROUND

Writers of stories for both print and screen have a deeply ingrained tendency to construct stories for an audience to experience the finished work in a fixed linear fashion. Although there are starting to be some examples of fixed non-linear multimedia works, viewing a cinematic story must always be linear, as a linear sequence of pictures and sounds conveying some meaning. However, it should be possible to structure a story non-sequentially for the purpose of providing many different sequential playouts. Computational processes can assist and affect both production and viewing. With this purpose in mind, the focus of my research at the MIT Media Laboratory has been to examine cinematic story construction through the use of computer based storytelling systems. Some questions guiding this research are:

1) How can computational processes assist in the development and presentation of stories?

2) What computational processes can meaningfully affect different presentations of a story, and therefore, different audience experiences of it?

3) How can user input feed into these processes?

The word "story" is frequently used as a reference to some general or abstract description of a meaningful collection of events, people and/or things. Meaningful, in this case, denotes a linkage, either causal or temporal, between people (characters), events and things. By stating that a certain event happened either before or after another event, or that a certain person caused an event to take place, a structure is described within which story elements are interconnected. Story, then, can be thought of as a system of associations between such elements. Given this description, it is this abstract form of story which is instantiated into different media (Chatman, 1978), and into a form which we enjoy as readers and audience members. But given this definition of story, where does the computer fit in as part of the story generation process?

Computers have already been incorporated into the story writing and production processes -- most notably with the use of word-processing tools. Beyond just an easier way of capturing story in the written form, there are software tools that give feedback to the writer based on some simplified knowledge of written language. Spell checkers and grammar checkers for instance, have a representation of word spelling and sentence grammar which allow them to use written text as the input for comparison with their rules. The software offers the writer feedback regarding where its representation of correctly spelled words or proper grammar do not match up with the writer's text. These actions compose a feedback loop between writer, the story/text and the computer. However, these systems have little to do with the narration of the story and nothing to do with the audience.

MY RESEARCH

The goal of my current research project, called Agent Stories, is to provide a story design and presentation environment for nonlinear, multiple-point-of-view cinematic stories. The approach taken with *Agent Stories* is to assemble narratives in either textual or QuickTime movie form by making use of three key components of computational storytelling:

1) The structure of the narrative;

2) The collection and organization of story pieces with some representation of their meaning;

3) A navigational strategy through that collection of story pieces, with *style* and *purpose*; that is, the narrative construction is a product of deliberate decisions and not random choices.

The hope is that by designing a tool that knows something about the writing process and about what has been written, a symbiotic relationship can develop between writer and writing tool which will foster the process of nonlinear writing.

While this paper focuses on the theoretical foundations of *Agent Stories*, efforts have been made toward implementing such a system. A prototype of *Agent Stories* was written two years ago using the software development environment HyperCard for the structural and presentational environments described below. For the representational environment, a tool written by Media Lab research assistant Michael Murtaugh for describing content-bases called *ConArtist* was used. [See http://murtaugh.www.media.mit.edu/people/murtaugh/acm-context/acm-context.html] For story content, a collection of stories written by this author entitled *Crossing the Street* was used as the navigated story material. Work is now underway on creating a more functional version of Agent Stories using a more a powerful software development platform on the Power PC and with new or augmented story material.

THE THREE ENVIRONMENTS - PLUS ONE

Agent Stories tackles the task of narrative construction, or more accurately - narrative sequencing and orchestration - by separating the job into three parts, each with its own construction environment. A fourth environment is then used to help manage the task of author feedback, that is, relaying information back to the story author(s) about the constructability of the story material written for the system. Each of the first three environments map to one of the three components of computational storytelling mentioned earlier. These environments are called:

1) The **Structural Environment**, in which the structure of the narrative is described in simple abstract terms;

2) The **Representational Environment**, in which knowledge of the various story elements is captured in the form of relationships between story events;

3) The **Presentational Environment**, in which software agents work as text/video editors, intelligently sequencing and orchestrating the different story elements according to an agent's individual stylistic preferences.

Agent Stories allows a story designer to create a simple structure or *framework* for a story and then use that framework to create multiple narratives from the same collection of story elements. The multiple narratives are created when different software agents, each with unique editing/sequencing styles, make clip sequencing decisions in accordance with the story framework, the viewer's preferences, and the existing story material. These three environments are designed for constructing narratives composed of first person accounts. That is, the task accomplished by the story agents in the presentational environment is to construct a full story (and perhaps a multi-threaded story as well) using the large collection of first person story elements represented in the representational environment, according to the framework designed in the structural environment. By viewing a narrative composed of multiple first person stories, the audience can play an active viewing role by not just getting to know the different characters and their point of views, but also figuring out which characters they believe and which they don't at various points during the playing of the narrative.

The fourth environment for producing author feedback, called the **Author Support Environment**, functions as the voice of the system for the author. This environment brings together the functionality of the first three environments in order to construct a simplified narrative for the author. This simplified narrative is presented in storyboard form, utilizing key still frames or text chunks to represent chosen story clips. Included with each chosen clip of this environment is a description of the logic used in making the decision to include it. What the author is presented with is a simple sequence of clips and the reasons for their inclusion. With the machine's reasoning at hand, it is hoped that the author will have ample information to go back to the writing itself with clear notions of how the story is functioning, what is and is not being chosen, why, and where in the work improvements can be made.

STRUCTURAL ENVIRONMENT

The Structural Environment introduces the notion of *Story Framework*. A story framework is a construction of abstract story element, referred to as narrative primitives. Such constructions are nothing new. Edward Branigan uses one for film narratives in his writings (Branigan, 1992); while Joseph Campbell offers another in his interpretation for hero myths (Vogler, 1992). In the early part of this century, Russian formalist Vladamir Propp proposed a set of 31 narrative schemes in order to provide a method for understanding and cataloguing Russian fairy tales

(Propp, 1968). Each of his narrative schemes work like functions or classifiable actions taken by characters in the fairy tale. Much of the power behind Propp’s work is that it offers detailed patterns of narrative events with a mathematics-like symbol system of representation. However, it is difficult to accurately apply Propp’s work to modern narratives, let alone computational narratives, because its form of sequencing is quite rigid.

The primitives used in Agent Stories reflect more of Branigan’s influence and thinking about narrative construction and are designed for use in telling primarily first person stories. These primitives are:

1) Speaker Introduction

2) Character Introduction

3) Conflict

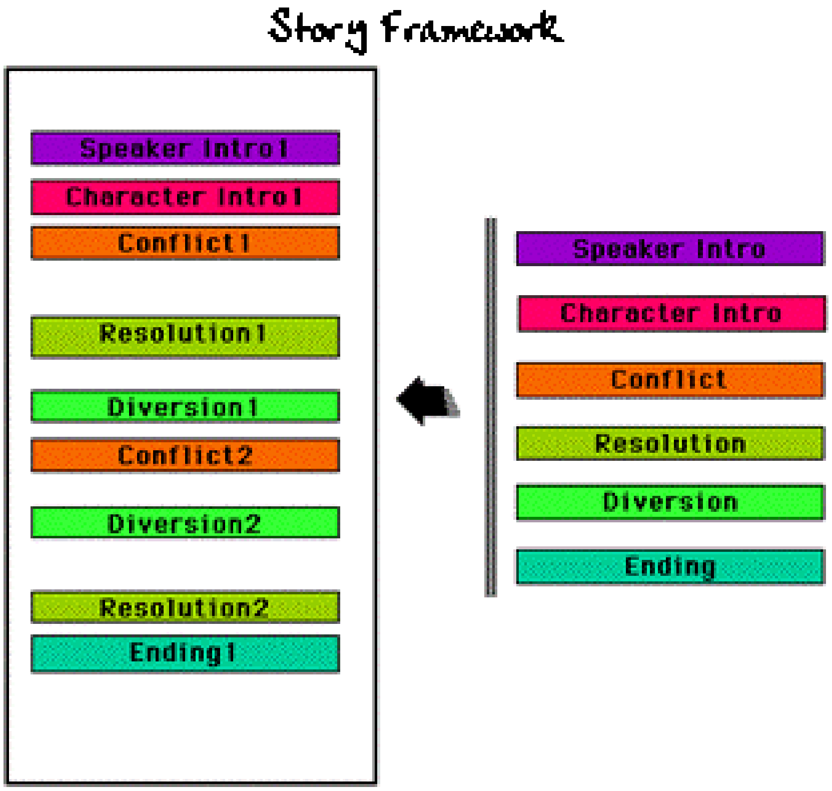
4) Negotiation

5) Resolution

6) Diversion

7) Ending

Each of these narrative primitives describe sections of the writer’s intended story. The writer builds the framework using simple colored blocks on the screen, which act as class prototypes for the seven narrative primitives. When the user clicks and drags a primitive block, a new instance of that block type is created, numbered, and able to be spatially ordered along with other narrative element instances. It is the order of these elements which determine much of the flow or narration of the final narrative. For a more detailed description of these elements and implications of their arrangements within the framework, please see:
http://brooks.www.media.mit.edu/people/brooks/academic.html
or (Brooks, 1996).



REPRESENTATIONAL ENVIRONMENT

The goal of the representational environment of Agent Stories is to express a useful and efficient way of intelligently reasoning about the elements in a story domain. In the representational environment, a *clip* is defined as a story element with its information conveyed from a single point of view (POV) and with a single or limited number of narrative meanings. For instance, the meaning (and title) of one clip might be: ***Anne decides Michael is a klutz***. This specific meaning is not literally represented by the system. For the purposes of sequencing this clip in a way which makes sense, it is not important to try to have the computer understand what a *klutz* is or what *decides* means. Instead what is represented is each clip's relationship to other clips. By defining different types of relationships or links between clips, the interconnected clips become members of a web of story elements, which all relate to one another. In other words, clips are defined in terms of themselves. Each clip is connected to at least one other clip with the use of links defined as:

1) follows

2) precedes

3) must include

4) supports

5) opposes

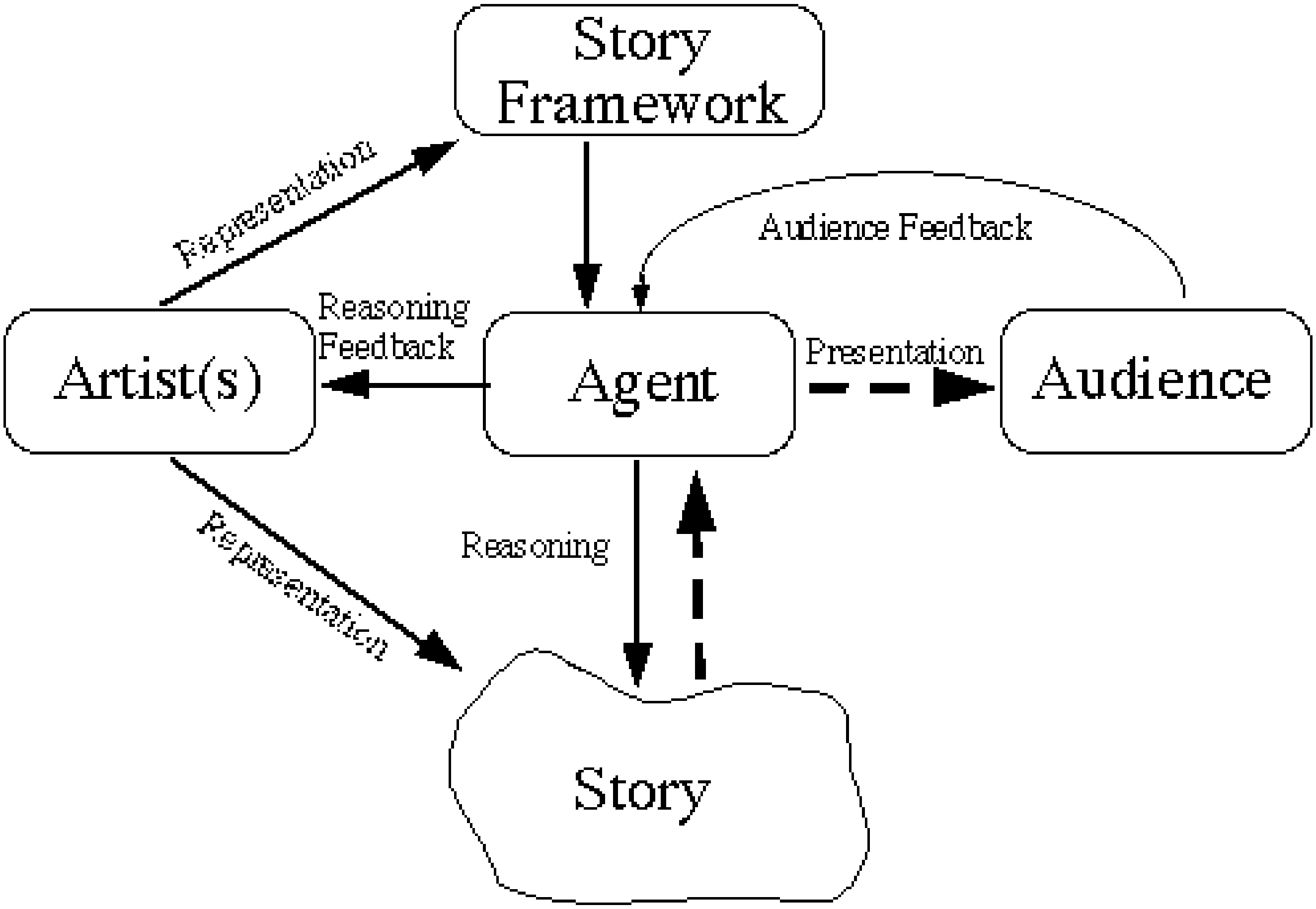
6) conflict <->resolution

Each of these links describe a type of relationship between two clips, and each clip can have many such links. The *follows* and *precedes* links are sequence specifying links meant to identify pairs of clips, where information contained in one absolutely needs to be seen before the other. However, these links do not specify that one clip must immediately be followed or preceded by the other or even that the second clip must be included in the story, but simply that if both clips are chosen, then there is an order in which they must appear. The *must include* link specifies that if one clip is chosen, then the other must also be chosen, with no specified order to the clips. The *conflict* <->*resolution* link specifies that a conflict clip is resolved by a specific resolution clip or clips. Conflicts can have multiple resolutions and resolutions multiple conflicts. The *supports* and *opposes* links offer the system a way of "understanding," to some extent, the relationship between the story's characters by specifying that the meaning or message offered in one character's clip is in opposition to another character's clip, or that two conflict clips from different characters are supportive of each other. Through this collection of clips and links, a web of story pieces is defined which can be navigated by traveling its links using narrative reasoning. The navigation of these paths happens in the presentational environment.

PRESENTATIONAL ENVIRONMENT

In the Presentational Environment, story agents are the embodiment of the reasoning necessary to construct narrative in this computational model. They perform the sequencing work by making logical choices from among the collection of story pieces. Because each story piece or clip is linked in some way to one or more other clips, there are many different ways in which a story agent can navigate the story web.

Once a framework and story web have been constructed, the *Agent Stories* software allows an audience user to sit down in front of the monitor and choose one of the story agent by name and have that agent construct a cinematic story. To do this, the chosen story agent looks at the characters in the story domain, chooses one as a main point of view character, then weaves a narrative by making successive clip choices. Once all the clips have been chosen, the system plays them in sequence. In a sense, the story is viewed through the chosen story agent. In this way, the audience has a global way of interacting with the story.



It is intended that eventually the story agents will not just build a narrative in time, that is, not just sequence story events, but also build a narrative in space. The computer screen can be treated as a two or two and a half dimensional stage, on which characters live and struggle through their narrative events. There is no reason to fill the screen with a single frame stream of visuals if their is no technological or aesthetic reason to be so restrictive. Just as sounds in a movie theater may come and go, overlap each other, and "appear" in a particular spatial location in the presentation field, there is no reason not to do the same with visuals on the computer screen. Therefore, as part of their set of behaviors, story agents will have additional behaviors which describe where on the screen visual elements appear, how long they will persist, and how many can be on the screen at one time. The expected result could be thought of as a story mosaic or dynamic narrative collage, whose nature or style is dependent on the agent managing the process.

For a more in-depth discussion of story agents and the area of Behavior-Based Artificial Intelligence which greatly influences them, please see: http://brooks.www.media.mit.edu/people/brooks/academic.html or (Brooks, 1996).

AUTHOR SUPPORT ENVIRONMENT

The Author Support Environment functions as the author's personal presentation screen which provides not only a bare bones version of the constructed story, but also allows inspection of the logic and agent motivation or reasoning behind a story construction. The challenge of this environment is to make it genuinely helpful to the author without making it dictatorial and overly confining. Another way of describing this environment is as the system's sketch-pad for the author. The author support environment provides the author with a way of seeing what the agent is "thinking of" with regards to the story, so far as it has been completed. Here, the author may give each agent the opportunity to say, "This is how I see your story and how I would tell it." This type of feedback from the system seems most appropriate, given that the user receiving the feedback is a writer. The data input to the system is story, therefore the data output from the system should also be story.

It is my belief that the authors task of creating story pieces and filling the narrative space will be made easier mostly by jumping back and forth between the Representational and Author Support environments - as they each offer unique views of the narrative data. The representational environment offers a true nonlinear vision of the data, while the author support environment offers more of the linear constructionist view. However, it is the feedback environment which should inspire the author toward improving the story element collection and its representation.

THE WHOLE SYSTEM

The first three environments, Structural, Representational and Presentational, together form a system for organizing and orchestrating the presentation of story elements. The three work together and work off each other to perform the task of narrative construction. The individual design of each places design requirements on the others. Also, the design of the representation, as well as the collective design of the entire system, specifies ways in which to think about or reason about everything the system represents. (Davis, Shrobe, &; Szolovits, 1993)

The knowledge representation of the representational environment offers us a web of represented story elements, all of which are connected in some way to other story elements. The web of connected story elements represents a way of thinking or reasoning about the story domain. The framework of the structural environment offers us a simple structure or guide for constructing a narrative. Together, these two environments go a long way toward defining a narrative. But the task of actually building the narrative involves filling out the framework's requirements by searching through the web of story representation until their are no unknowns or "holes" in the framework - thus the presentational environment or story agent's task.

Story agents are not like human storytellers, in the sense that they do not have the same power of control over the narrative they relate. Human storytellers have the capacity to connect as they tell. Part of the storyteller's special magic is that they are able to make an emotional as well as physical connection with their audience. For instance in oral storytelling, that connection is made through the teller's words and the rhythms of voice and body. The storyteller maintains those connections throughout the story, modulating them according to their sense of the audience's responses. So when we listen to storytellers, we are not just listening to the words, but also experiencing that connection between teller and audience.

What Agent Stories offers is a way for the audience to make such a connection with the author of a non-linear work through the intermediary of the story agent. Agent Stories provides a method of non-linear story design, construction and presentation where the author(s) maintain a certain amount of control over what is intrinsically an uncertain domain. Additionally, the audience is offered a simple method of choice for controlling a narrative experience as well as a way of giving feedback to the narrative system.

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