Movies of the Future: Storytelling with Computers

The concept is new, bold and certain to be controversial. Take a computer, infuse it with a detailed database of information about a story, and then let the computer present the story to the audience in its own way.

The storytelling computer -- responding to the background, interests and preferences of its audience -- decides what images or sounds it wants to use in the presentation. It allows the story to take different points of view, choose different characters and scenes, have different pacing and even sets the total running time.

Development of computational storyteller systems is a key research element into Movies of the Future at the Media Laboratory on the campus of the Massachusetts Institute of Technology in Cambridge. This new branch of research, led by Professor Glorianna Davenport at the Interactive Cinema Group, seeks to create a series of new cinematic storytelling forms.

Though Davenport and her half-dozen graduate students don't suggest an end of the linear narrative technique used in traditional films, they recognize that digital technology has created the possibility of new storytelling techniques that take advantage of variable, non-linear playout of image and sound.

The Movies of the Future research covers the gamut of traditional motion pictures -- including feature films, documentaries and home video -- yet spans to new narrative forms with unfamiliar names such as elastic media, "Thinkies," and multithreaded interactive movies. Along with the new storytelling forms come a range of tools designed to help creators shape their stories. These tools include prototypes of advanced new software for pre-visualization, writing, editing and the creation of human interfaces.

Why, some may ask, are computers needed to help tell stories? Because, says Davenport, there is a growing need to communicate in ways that speak to the opportunity and choice that now surround us in the emerging digital age. As the old boundaries between filmmaker and audience rapidly shift, the new story forms will have far greater complexity and will permit the audience to engage in various ways to shape their cinematic experience.

MULTITHREADED MOVIES

One promising new story form is the multithreaded movie. Here a story progresses in several ways simultaneously. Multiple "threads" are created and at times these threads intersect. As the movie gains complexity, it becomes a huge web of interaction.

Robert Altman's "Short Cuts" is a traditional film that might be compared to the multithreaded movie. Here Altman interwove multiple stories into a single linear motion picture. However, in "Short Cuts," the director chose when to cut from one story to

another. In the multithreaded movie, the computer -- using the filmmaker's instructions -- makes the cut.

But the influence of the computer goes far deeper. At any given presentation of the multithreaded movie, the computer can determine or select the basic story structure. It can pick from literally thousands of individual image, sound and music clips to assemble its own scenes. The relationships of characters (as well as their number) may change depending on the version of the story the computer decides to tell.

The computer gets its intelligence from the filmmakers. The creative work of the writer, director, editor and cinematographer is contained in the story engine, the software that allows the computer to make its choices. The task of the filmmaking team is to dream up the story, collect its parts and create a map the computer can act upon. This is called knowledge representation.

"We are moving toward knowledge representation as the basis for a computational agent who will put the story together for you," said Davenport. "The computer knows about how different elements of the story function. It knows what a scene is and what movement of a story is."

In order to create complex multithreaded movies, filmmakers need new tools. Kevin Brooks, a third year doctoral student in the Interactive Cinema Group, is designing a set of writing and presentation tools called Agent Stories. The goal is a suite of software that will allow filmmakers to create and present multithreaded movies.

Agent Stories is divided into several modules. The first, called the Structural Environment, deals only with story structure. It is pure structure without content. There are six elements:

- the speaker introduction
- the character introduction (intro of characters and setting)
- conflict
- resolution
- diversion (diverse elements from the plot driven by conflict resolution -- ending

By adding (or deleting) and re-arranging these six elements, the writer sets possible structures for the story. These structures are used by the software to create the final presentation. "The different structures represent different genres," said Brooks. "For instance, it might make sense to start off with the speaker introduction so you know who is telling the story. And then you give an idea of the setting and then present the first problem.

"However, if you were to move the speaker introduction down so it's the third element, then you'd have something more akin to a murder mystery," Brooks continued. "Or perhaps you might want to move the speaker to the bottom so you don't know who's telling the story. Another option is putting the ending at the top. 'Indecent Proposal' started off like that."

In crafting a story that can be re-shuffled and told in different ways, the writer needs an environment where the each story element can be precisely defined and described. The writer's environment used in Agent Stories is built on a knowledge representation tool created by another of Professor Davenport's students, Michael Murtaugh. It's called ConArtist, which is shorthand for "Concept Artist." The software has been used in various storytelling projects.

Here the author is able to break a complex story into its underlying concepts and relationships. It's at this level that the filmmaker's "knowledge" is tied to individual characters and to the picture and sound elements that will communicate the story.

In Brooks' Agent Stories, ConArtist is used to tie a "clip" to a character. A clip is a single piece of information that helps define that character. Characters may have any number of clips. The more clips associated with a character, the more complex that character becomes and the more choices the computer has to choose from in telling the story.

Clips have linkages. "You can link clips by saying one clip should precede or follow another clip or that one clip must be included if another clip is included," said Brooks.

An important task for the storyteller is to insure that each clip in ConArtist either supports or opposes the main idea of another clip. It's here that conflict is built into the database that drives the story engine.

"When you have opposing points of view it's very clear," said Brooks. "There are two characters that -- at least for this one instant in time -- oppose each other. The information the writer provides in describing the scene is going to set up how the viewer understands what happens in the rest of the movie."

All of the elements of a traditional linear story are entered as the writer works with ConArtist. "The tool is attempting to capture what the writer knows," said Brooks. "The writer is slowly building a very complex web of clips. It's like the LA highway system. It's a complex web of streets and interconnections and the connections are of different types."

Brooks sees Agent Stories as following the natural creative process of the way films are conceived. "The process of writing is naturally non-linear," he said. "What I want to do is make characters through linkages of various kinds. The system navigates through the database of these linkages and creates a linear story."

Once the story creation process is complete, Agent Stories moves into its presentation stage. It's here that filmmaking "styles" come into play and the software "agents" take charge.

"The software agents have styles of behavior for what they do in every situation," said Brooks. "That's how the agent chooses a clip and how it navigates through the database."

So far, in his prototype system, Brooks has created five agents. Their names are Bob, Carol, Ted, Alice and Isadora. They each have a different storytelling style and each will determine -- in real time, on the fly -- how the same story might be told.

"Each of the agents chooses a main point of view," said Brooks. Bob is the kind of agent who can't decide what to put in the story except to support opinions with other opinions. Bob will try to make a very supportive story. He will pick a main point of view and then look for supporting points of view. He will then add that in the sequence and choose everything accordingly.

"Carol, on the other hand, is a one-sided story agent. She will choose a point of view and then try to invalidate opposing points of view. Her style is like that used in political commercials or propaganda. Ted is a point, counterpoint agent. He will be very fair."

Yes, Brooks admits, there is a strong temptation to create agents modeled after great film directors. Like a Hitchcock agent or a Welles agent. But, he said, "it's not there yet."

In the final stage of Agent Stories, the viewer chooses an agent to tell the story. "You come in, sit in front of the TV, and say I'd like Bob to tell me a story and I'd like it to be a 12-minute story. Bob goes through the material, assembles the movie and then shows it."

THINKIES

Another new kind of story is the "Thinkie," a form that drops the viewer into a non-linear, thought-provoking environment. The idea here, says Thinkie creator Lee Morgenroth, is to lure audiences into story experiences that force new ways of thinking. The key to making the Thinkie work is interactivity.

"Conventional linear cinema is terrific at relaying an emotional response to the audience," said Morgenroth, a masters student. "But one of the things that is really difficult to do in a linear medium is to get your viewer to actively think while experiencing the story. With interactivity I can let the viewer do some very interesting things.

"Currently cinema is separated into two main expressive elements: image and sound," he continued. "If you go back in history to when they first added the sound track to the film, the movies had a new name for a brief period. They were called Talkies. Now we've added interactivity, an entirely new medium for cinematic expression. That's why they are called Thinkies."

Morgenroth is now developing a Thinkie titled "Lurker." It uses two methods of interactivity for the participants: The World Wide Web on the Internet and electronic mail. In order to experience "Lurker," each participant must take on the role of a computer hacker.

"In 'Lurker,' the participant is confronted with the question of what a Hacker thinks like," said Morgenroth. "How does one operate as a hacker? By the time one finishes this

Thinkie my goal is they've had a new experience and actually done some hacking as a process of experiencing the story. You could never accomplish that in a movie theater."

"Lurker," which is played over a two day period, begins when a half dozen participants log on via computer to the game's home page on the Internet. It's there they encounter a cybergang of hackers who are recruiting new members. In order to join the gang, each participant must take a proficiency test. Taking the test begins a new cycle of "Lurker."

As the new participants begin to take the test, a series of diversions begin involving the gang members, who are really characters in the story. One of the gang members turns up missing and an emergency is declared, launching a mystery to be solved. Each of the new participants is asked to temporarily forget the test and help out in unscrambling the puzzle.

The participants now become "lurkers" within the system and work with each other to navigate the world of the story. While experiencing "Lurker," each participant is thrust into the culture of computer hacking. This includes reading e-mail messages between the gang members and intercepting video of their activities over a security camera network.

"The active part comes when all the participants do lots of communication with each other and a lot of net surfing to get information that's going to help them," said Morgenroth.

Though the participants in "Lurker" are not actually communicating with the gang members, these "cyber-characters" become far more personalized than any character in a traditional feature film. Each has an e-mail address and, as Morgenroth puts out, each has its own "virtual net personality."

Since "Lurker" can run in an automated mode or with a "game master," the participants can get some real surprises. "Most of the e-mail messages have already been scripted but if the situation is right the game master can throw in one or two real messages and change the whole perception of what's going on," Morgenroth said.

Once a participant has finished "Lurker," he or she is then allowed to modify the story in any way and put it back in a new form on the Internet. Those modifications can range from making small changes in the story all the way to adding one's self as a new video character. "Of course that would take a large amount of effort," Morgenroth said. "You'd have to really be motivated to do that. But there is space for the participant's imagination to work."

How does Morgenroth feel about others changing his story? "If I want people to see the kind of Thinkie I would make they can go to mine," he responded. "But then, if you re-purpose it -- make it your own version -- it doesn't annihilate mine. It just adds another."

Depending on the type of Thinkie, the filmmaker may or may not protect the "spine" of the original story from changes by audience members. "My guess is the interaction with

Thinkies will depend on both the Thinkie and the interests of the audience that is participating," said Davenport. "Some Thinkies might have a very strong spine. Others might keep diverging and making new spaces. In a Thinkie based on conflict negotiation, for the instance, the spine might get diffuse for a while and then somebody might come on the net and say let's make it stronger."

VIRTUAL REALITY

As a storytelling medium, virtual reality is tricky. The viewer, usually wearing a head-mounted display, is immersed in a synthetic "world." In this world, the viewer exists in the first person. "I am 'I' in the story. I am a character in the story. I am in the space and I am in control of the space," says Davenport.

One of problems with using virtual reality to tell a story, she says, is how to modify the story on-the-fly to fit the movements of the viewer.

"In the VR world the viewer can look in any direction at any time," she said. "What happens if the viewer is looking in the wrong direction, away from where the central action of the story is occurring?"

The answer, she said, lies in "smart" characters.

"The VR world is a computational world," Davenport said. "The characters in that world can be smart; they can have behaviors. The system knows that an important beat of the story takes place in a certain location and that you are not looking at that place. So the system feeds that information back and the story -- through the behavior of a character -- can be modified."

To explore smart characters, MIT student Tinsley Galyean created "Dogmatic," a virtual reality story that stars a dog with an attitude. The dog, created by student Bruce Blumberg, is actually a smart character with built-in behavior patterns.

In "Dogmatic," the smart dog rides along a desert highway with his owner in a car. As the car approaches the viewer, it pulls over to allow the dog to relieve himself. Once the dog leaves the car, his actions are determined by the viewer. "The dog," said Davenport, "might pee on the cactus, or it might just walk over and pee on you." (Fortunately, the dog chose the cactus presumably because the viewer gave him apt attention.)

Though virtual reality is part of the research for Movies of the Future, Davenport does not believe it's the ultimate goal for computational filmmaking. "I would say VR is a very small amount of where it's all going to go. I have big arguments with my students about that. But that's OK."

SYNTHETIC IMAGERY

More promising as a storytelling medium -- at least in the near term, says Davenport -- is synthetic imagery. Unlike virtual reality, the viewing environment here is usually not immersive. There are no head-mounted displays. Viewing is done on a more traditional video display.

Synthetic imagery is comprised of synthesized, composited pictures. Characters are shot as 2-D images against a blue screen. They are then composited with a 3-D background. Layer upon layer of images can be transformed into multiple objects within a 3-D database.

The key component here to storytelling is interactivty. The viewer can control the angle of view in this synthetic universe. "The viewer can move within a certain domain a freedom through the set," said Davenport. "One can follow a character and change the angle of view. This really means the viewer is moving the camera."

To explore synthetic images, Davenport's students, who specialize in storytelling forms, joined students of Professor Michael Bove, who specialize in media technology, to create a video short titled "The Museum." It uses a "particle database," a type of 3-D database that can be built from 2-D images.

"The Museum" is comprised of four components: a room, an empty picture frame and two figures. The action follows a script but it is possible for the viewer to intervene and redirect the figures through the scene. In the future the viewer will be able either to change view point of the camera or -- for certain stories -- actually influence the character's action.

"Museum" is also contributing to the Media Lab's work in intelligently scalable (resizable) video, where the originator can specify the framing and composition of a video sequence at differing display sizes or aspect ratios. Thus a single video sequence might be successfully displayed on an LCD wristwatch, a standard TV or a large screen projector.

As a technology for storytelling, Davenport is enthusiastic about the prospects of interactive synthetic imagery. "Creation of these types of stories, I'd bet, is going to be one of the first big successes in the area of interactive cinema. I think the film industry already understands these types of stories very well."

ELASTIC MEDIA AND THE EVOLVING DOCUMENTARY

A key difference between the documentary and feature film, says Davenport, is the documentary develops as the filmmaker discovers a world. No script is required in advance. The documentary is an instantly unfolding multithreaded story by nature.

"Life is complex," said Davenport. "Life is not the simple Hollywood story of a single hero and their tangle through life. Life is this web of people and events that kind of intercept and combat each other and fall apart and come back together again."

Because of these elements, the documentary form was the initial guinea pig for a computational media story at MIT. The first documentary to use a computer to navigate different scenes was "City in Transition," a filmed look at the city of New Orleans during a period of intense urban change. Filming began in 1982 and the three-hour production was completed in 1987. It's an early example of hypermedia and included a scene-by-scene database. The project helped define many of the issues later to be addressed in computational storytelling.

In 1989, came "The Elastic Charles: A Hypermedia Journal." This documentary about the Charles River in Massachusetts was termed "elastic media" because it contained stories which one could stretch, compress, interrupt, bend and annotate.

For a user interface, it introduced "micons," which are dynamic representations of video segments. Shorthand for "moving icon," a micon -- comprised of about 60 frames of video -- appears on a computer display as a miniaturized endless movie loop. (Micons pre-date Apple's Quicktime, Davenport points out.) Micons are easily programmed, using a link tool, to appear and disappear dynamically in relation to content.

More recently, the lab's work in documentaries has focused on evolving stories. As with the multithreaded movie, viewers gain greater control over presentation and are allowed to explore and discover new aspects of the story.

To create "It was a Knowledge War," Gilberte Houbart conducted interviews about the impact of information technology on both the military and media during the Gulf War. The database includes viewpoints of reporters from the Boston Globe newspaper and the former director of information at the Pentagon on such topics as why the war was so short, how the Pentagon filtered news for the press and what it was like to be a journalist covering the war. In watching the presentation, the viewer specifies which headline story and whose viewpoint should be emphasized and how long the playout should be.

Today, the lab's work has taken the evolving documentary form even further by creating that stories that are never completed. Using the ConArtist database and a story engine, a documentary can continue to grow as journalists add new story elements over time.

An evolving documentary-in-progress at the Media Lab tells of neighborhood change in downtown Boston. Over the next few years, an elevated roadway, the Central Artery, will be rebuilt as an underground highway. The documentary database, which includes still photos, maps, sound and video from interviews with residents, politicians and planners, will grow as construction proceeds and the neighborhood changes.

At each viewing a different story emerges, either because it is seen from a different point of view or because the database itself is altered. Principal designers for the complex

software needed for the Central Artery documentary include Dave Tamés, Mike Murtaugh, Katrin Silberberg, Mike Massey and Natalia Tsarkova.

Of special interest on this project is the human interface. Moving away from point and click menus, the Central Artery documentary displays a series of images based on the story interests of the individual viewer.

"As the story plays out pertinent themes, characters, locations and times will come to the foreground and less relevant items will diminish into the background," said Murtaugh. "Basically what you see at any given moment is a collage that represents the context of the story."

Just as with Brooks' Agent Stories system for feature films, information is assigned to each piece of new material as it is added to the documentary database. The primary themes in the Central Artery story are character, time, location and story theme.

"On this project what we've had a hard time figuring out is what the interface for the user would be like if we no longer have a television screen," said Davenport. "If we no longer have a single frame and we want to create a story with multiple people, multiple characters and multiple interaction, how do we create an interface that gives the viewer some influence over the story?

HOME MOVIES

Lest one believe that the Media Lab's work is focused solely on the most esoteric new forms of moviemaking, Davenport insists that a top priority of her department's research agenda deals with the needs of home videomakers.

Specifically, the problem for camcorder owners is one of what do after the video is recorded, says Davenport. "Most home movie buffs don't have the time to look at all their footage and they certainly don't have the time to make the cut for Uncle Charley of the kids playing," said Davenport. "Many probably also have a rough time developing stories."

Part of the lab's focus is on how to help home videographers shape their stories. "The same issues arise for the maker of a home movie story as for the maker of a feature film," said Davenport. "Just as with the feature film, the story engine for home video software has to understand how to juxtapose characters, where the conflict is, where is the middle of the story, where is the crisis and so on."

To start, the lab has created a new way to view video tape. It's called the video streamer. Here a succession of video frames is portrayed as a stream in a solid opaque block. (see photo) By simply pointing to a "cube" of video as it moves by, the video editor can quickly scan and identify images on tape.

The lab has also designed some prototype logging systems that draw out a story template and pull shots automatically from a database of scenes. These systems might be combined with "smart" camcorders that could identify a tape's content by location, voice of subject and type of shot (wide, medium, close-up).

"At some point you start to get these layers of information," said Davenport. "You are then pretty close to being able to have the computer make a movie about activities on Christmas morning. You might not get a very tight edit the first time you run a story model like that on your database because your data isn't well enough described. But the computer can learn as you go along. Instead of having rows and rows of tape on the shelf, you start to have a database in your computer that's intelligent enough to build stories in the future."

"WE'RE NOT THERE YET"

Whenever she describes the various research projects under the Movies of the Future banner, Davenport is quick to point out that many of the software tools are only in the early stages of development and much work is still to be done.

In the feature film area, most of the stories done so far are very simple and lack the complexity needed to make a satisfying entertainment experience.

"As we develop more complexity we have to be able to represent to the (computer) system what is the motivation of the characters," she said. "The system has to understand that the character is always being driven toward the goal of finding something.

"As it gets even more complex we need to represent more, such as back story and subtext," Davenport said. "These are motivating forces for the character and we are not at a level where we can do that yet."

However, Kevin Brooks -- who studies under Professor Davenport -- has some doubts about how far the computer can go as a creative storyteller. Take subtext, for example. "I've thought about it a lot and it's hard to represent subtext," said Brooks.

"A computer will never be a perfect storyteller nor will it ever do a really good job of creating proper subtext," he said. "What I'm trying to do with this tool (Agent Stories) is to try to develop a good relationship between the writer and the computer so there is a definite line of responsibility.

"On this side of the line the computer will handle these tasks. On the other side of the line humans will handle the other responsibilities." Right now, said Brooks, "that line is blurry."

Frank Beacham

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