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Everyone's Cinema: Towards the Future of Cinematics

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What is cinema becoming? All around us -- in the laboratory, in theme parks and museums, on CD-ROMs and home computers, across the World Wide Web -- stories are being transformed by technological possibility. The proliferation of VCRs, the remote control, and affordable home video cameras have already created a society of audience which expects a certain amount of individual control over their own information destiny. As new and more powerful devices appear and proliferate, storytelling media will transform into something more personalized and conversational; as "stories with a sense of themselves" come into being, narrative will evolve from fixed, monolithic forms into something more personalized and responsive to the wishes (and whims) of their audience.

A dynamically adaptive, interactive story can be likened to a shape-shifter which transforms its appearance by reconfiguring its component parts and perspectives. Sometimes it will also play the role of mentor, helping the audience discover the methods and "hooks" by which they can steer its playout.

A "story with a sense of itself' must posses thorough knowledge about its own parts, and it must be able to sense and respond to the desires of its audience. This requires a repositioning of the viewer, both psychologically and physically, from outside to inside the story form. We must offer the audience passage into an immersive environment where the real and virtual worlds meet to engage her mind and senses. As the audience becomes absorbed in the narrative experience, the story itself becomes a stronger, more immediate physical and spiritual presence in the environment.

The modem storyteller must construct her tale to best exploit the properties of the specific display and sensor technologies being used; at the same time, she must not forget that the audience's

appreciation of story depends as much upon the structure, form, and content of the narrative as it does on the technologies of display, channel, and interface.

As we create new participatory stories, we draw heavily from the lessons of the theme park as well as from movie and theatrical production. At the Interactive Cinema Group, we have frequently chosen to establish stories within an immersive physical environment which extends the sensory surround of the audience beyond mere seeing and hearing; touch, smell, the sensation of movement, and other visceral aspects of experience can greatly enhance the "realness" and communicative power of a story. We have also extensively experimented with the use of real and synthetic characters who can adjust their performance as needed, flexibly moderating the playout of story. By interacting with these characters, the audience's actions have consequence within the story world; and, the actions of the story world deeply engage its audience of "co-actors."

Participatory Environments

In 1988, we co-produced a participatory extravaganza called "Radio Interference" with Antenna Theater, a San Francisco-based theater troupe. "Radio Interference" consisted of 14 walk-through participatory environments. Each scenario played out in a specially-constructed theatrical set; a well-trained crew of barkers and crew portraying key characters made the audience active participants in short, lively dramatic sketches. As the audience worked their way through this distributed installation (which more closely resembled a street fair than an opera), they encountered a broad spectrum of role-playing opportunities -- at one moment they were part of a teeming crowd demanding the death of Billy Budd; in the next, they all became Andy Warhols (complete with pale make-up and blonde shock waves) enjoying their fifteen minutes of fame; in another, they were the subjects of paranormal surgical experiences. Occasionally, audience members would pass a dormant video screen which sensed their presence and clicked on to deliver personal messages, such as the distinguished face which announced, "I bet you left your keys in the car;" and, almost universally, the individual spectator instinctively reached to check her pockets.

"Radio Interference", while composed of many elements, especially excelled when it provided individual participants with opportunities to show off for the rest of the audience. Behind the scenes, "Radio Interference" worked smoothly because we employed the simplest, most rugged technologies possible, including multichannel infrared radio broadcasters/receivers and simple proximity sensors. In most cases, we included human beings as moderators and facilitators in the story scenarios. Virtually no ramp-up time was required for participating audience members to understand what they were supposed to do: the actors and support staff could quickly and flexibly offered guidance under the guise of their character roles.

In 1992, we produced another show of walk-through participatory environments called "The Wheel of Life", focusing on Zen themes of Life and the Universe. In this work, which was substantially more automated than Antenna Theater, we tackled many issues and problems which we had previously avoided. Each environment required the active collaboration of two groups of people, Explorers and Guides, who were unseen by each other but connected through mechanism. There were no human controllers driving the audience through their experience or explaining the technology to them; participants were "on their own" to discover what needed to be done within each fabulous, fanciful setting. Computerized sensing devices spoke across the network to the storyteller system, informing it of the Explorers' whereabouts and activities as they attempted to solve the mystery of each space. The system, in turn, could request the presentation of certain content elements at appropriate moments. As the Guides played special video games or exercised other paradigms related to the physical spaces, their actions had direct consequences on the Explorers' efforts; and, the actions of the Explorers directly affected the task of the Guides.

In stories of the future, storyteller systems must coordinate the behavior of real and synthetic characters and, wherever possible, bring together a community of audience -- even if individual participants are scattered throughout the world. In 1995, we explored this concept with "Lurker", a World Wide Web-based interactive narrative for a broadly dispersed, collaborative society of audience. "Lurker" used a soap-opera-like "framing story" (an engineering student's abduction by evil scientists) to present the audience with a series of learning tasks. When an audience member signed on for the "Lurker" experience, she immediately became a member of "the Hackers" and entered into e-mail dialog with other

participants and synthetic story characters. Over six days of "real time", the participants had to master several skills (such as the use of e-mail and pap encryption) in order to gather clues and collectively solve the mystery.

In "Lurker", the story itself acted as taskmaster: through the use of QuickTime movies and fictitious, robotically-dispatched e-mail messages, the computer presented story events in their proper temporal sequence, assigned problems for learning, and otherwise worked to keep the story moving ahead.

Several of Interactive Cinema's projects have grappled with the problems of using real or synthetic characters (who often serve as a surrogate for the audience) to browse and navigate through various types of information landscapes. An interesting related challenge is the author's desire to generate real emotional responses in the audience. Tinsley Galyean's interactive movie, "Dogmatic" (1994), addresses these issues in the context of a 3D virtual environment. In "Dogmatic", the system tracks the viewer's head position and uses that information to modify its presentation. The central character, Lucky the Dog, is a synthetic creature endowed with low-level, semi-autonomous behaviors. Lucky can inject diversions or otherwise influence the playout of the story without altering the underlying story arc: he literally grabs you to draw your attention to a significant detail or plot point among several ongoing activities in a wrap-around scene. In the shocking conclusion of the story, the previously amiable Lucky suddenly attacks the audience, rendering them unable to move or exert any type control over the environment through which they had freely roamed just moments before -- a genuinely surprising and disturbing loss of power. The story itself becomes the antagonist.

In artificial environments where real and synthetic characters meet and co-act, the mediating computer must possess the ability to sense the actions of the audience in real-time and use that information to control the narration of story. Today, a host of interesting and affordable sensing devices are becoming available to serve this need: radar, sonar, infrared beams, laser scanning, pressure-sensitive grids, directional electromagnetic antenna arrays, etc. The task of mapping the output of these sensing devices into a computer model of audience activity can be daunting; this is an area where much fundamental work remains to be done, but it is a key component of the "user model" which informs and regulates any interactive story

engine. For a higher price, video-based computer vision systems can be used to track individual people and objects within a space and attempt to identify their actions. These devices currently work best when the audience uses a standardized set of gestures to convey their desires to the computer; however, as the technology improves, vision systems are likely to become the sensors of choice for the "unencumbered full-body participation in artificial experiences" which visionaries such as Myron Kruger have so passionately advocated.

"The Wheel of Life" installation inspired several people at the Media Lab and elsewhere to explore the virtues of combining virtual presentation with a more physical "sensed" space. In 1993, Media Lab professors Pentland and Maes collaborated to create the "ALIVE" space, a combination of vision tracking and an immersive, rear-projection display driven by powerful SGI graphics engines. The participant's actions are perceived in terms of her body's relationship to a simulated world; the system then generates sights and sounds which convincingly convey the illusion of participating in that world. One especially noteworthy property of the "ALIVE" system is the so-called "Magic Mirror" effect: the audience sees a high-resolution, full-motion image of themselves mapped into the synthetic space.

Bruce Blumberg used the "ALIVE" space to explore how human beings and synthetic characters can meaningfully coexist within a synthetic reality. The "Magic Mirror" image of the participant interacts with Silas, a computer-generated dog; by using clear gestures, you can command Silas to play, sit, etc. How do you make a synthetic character which is interesting and knowledgeable about its world? In the case of Silas, the answer is: drive the character with a collection of competing needs and desires, such as hunger and fatigue; endow the character with a set of semi-autonomous behaviors so that it can react to stimuli in a characteristic, unscripted, and context-influenced manner; and build in learning algorithms so that the character can learn and grow through experience over time. Blumberg sought advice from the study of ethology before creating the dog's low-level behaviors, which include: moving with many degrees of freedom, seeing, eating, peeing, barking. Silas' ability to "see" allows him to navigate complex spaces and to recognize objects and gestures. Silas' ability to learn allows him to be trained as a living dog would be: by the repetition of signaling gestures, reinforced by punishments or

rewards of food for his performance. The audience has the ability to take on the role of master, and Silas the role of a pet.

More recently, Flavia Sparacino has adapted the Silas code to create typographic actors and other types of "Media Creatures." She has demonstrated that all types of objects in the virtual world -- including text, pictures, and sounds -- can be imbued with self-contained intelligence, motivations, and a set of semi-autonomous or autonomous behaviors. Thus, any media object is capable of becoming a responsive, improvisational co-actor with the human audience.

So far, artificial environments such as "ALIVE" lack any real sense of story, although the types of activity they support are certainly conducive to the telling of tales. Storytelling involves more than just setting intelligent, semi-autonomous characters free to roam about in a synthetic setting. Similarly, one cannot massage any bland occurrence into a good story merely by changing camera perspective, moving freely about in space and time, shifting among various characters' points-of-view, and tracking the development of specific events or themes. To tell an interesting story, the story engine needs an agenda to pursue: that agenda must be designed to trigger palpable emotional responses -- reverie, fear, curiosity, paranoia, love, etc. -- in the audience.

Bits and Pieces

In order to understand the relationship between a particular story engine and a story-rendering technology, we must examine the "box" which constructs, filters, and otherwise mediates the story experience. Does the system itself possess any Narrative Intelligence, or must that be provided entirely by the author and the audience? How do we structure Plot so that it can recover gracefully from the interruptions and redirections which "interactivity" implies? How do we inject Plot into an environment in which some audiovisual manifestation of the audience is allowed to interact with "semi-autonomous" characters?

Often, computer-assisted storytelling involves the fleshing-out of a script or template (either pre-made or generated on-the-fly) with specific audiovisual story materials. Many of Interactive Cinema's experimental systems draw from an archive of pre-made media

objects -- movie clips, still pictures, text, sounds, etc. -- and present them for view as the system (or the audience) demands. Selecting the most appropriate materials for display typically involves searching a parallel database of keyword terms which describe useful aspects of the content and composition of each story element -- "Who", "What", "Where", "When", "Close-Up", "Medium Shot", etc. -- and retrieving whatever material best fits the query. This approach was carried to its logical extreme in the "Log Boy / Filter Girl" system and the "Agent Stories" project. Once a collection of story elements has been shot, digitized, and encoded with descriptive tags, the system uses relatively straightforward filtering techniques to piece together a story with the appropriate twists and turns. These systems were designed to address the problems of sequencing a narration, seamlessly constructing a presentation from pre-made video and audio clips, and preserving story continuity. However, these particular projects maintained only a minimal knowledge of the user and did not include the use of semi-autonomous characters. Experience has shown that these "filtering" approaches work best for customizing the playout of pre-scripted fiction where each take has been shot from a variety of camera angles and distances. These methods are somewhat less successful in crafting stories about complex, real-world topics where the available audiovisual material is sparse and the coverage uneven.

Another lively area of research is the use of "structured video", where all characters and objects exist as individual entities, often stored in separate, far-flung locations. These individual elements are brought together as needed and combined on-the-fly to create a single composite scene. Thus, it is possible to manipulate the content and composition of story at a much smaller granularity than the shot or single-frame level. Some researchers view this as a key component in customizable commercial drama of the future: for example, for a fee, an advertiser could specify that a demographically-targeted audience would always see the hero drinking a Coca-Cola rather than a Pepsi.

In the "Yellow Wallpaper" project, we used the Cheops structured video system (a specialized assemblage of hardware and software) to select and seamlessly combine real characters captured on video, 3D computer-generated furniture. and synthetic architectural backgrounds. The resulting playout was a pre-scripted dramatic scene where visual perspective and character point-of-view could be interactively chosen and manipulated.

A great deal of pre-production planning is required when pursuing a "structured video" project. During the "Yellow Wallpaper" shoot, we became acutely aware of the tendency is to postpone difficult creative decisions until post-production, with the assumption that any problems could be compensated for with computer post-processing. However, the task of precisely matching the scaling, perspective, and shadows of many individual elements into a seamless whole proved to be a formidable task. We discovered that narrative intelligence and decision-making must be distributed throughout the entire process -- from pre-production to playout -- rather than being entirely clustered around the back-end of presentation.

Bringing It All Together: the Dream Machine

As electronic architectures become increasingly decentralized, we can begin to think of scenarios in which a widely dispersed audience -- separated by distance, time, and culture -- meets as a community within an interactive story environment. Currently, the Interactive Cinema Group is engaged in the "Dream Machine" project, a multiplatform narrative presence designed to engage a large, widely-dispersed society of audience. It uses the techniques of cinema, theater, and architectural space design to improvisationally craft a playful, lyrical, emergent story experience in close collaboration with a networked audience of "co-actors."

The Dream Machine's presence simultaneously spans and interconnects several venues in both the real and the story world. It is accessible through the correlated, distributed environments of the World Wide Web, sensor-filled live-performance Public Spaces, and pager networks (which provide small, highly portable alphanumeric windows into the story world). All of these interactive venues are networked to a single, central story engine and to each other; audience activities in one venue can affect the playout of story in another.

The Dream Machine project is designed to enhance the communication between and among people as they shape, personalize, and navigate their way through information-rich environments and dynamically-adaptive emergent stories. It

presents its audience of co-actors with multiple, interconnected options for interaction, including:

* encounters with interesting transcultural characters

In a large-screen architectural venue, sensors alert the system to the presence and activities of passers-by. These signals influence the appearance and subsequent behavior of real and virtual characters; we interact with them at this meeting point, "the edge" of DreamLand.

* dream submission and processing

Visitors contribute their dreams to an evolving dream landscape. These dreams become objects with their own semi-autonomous behaviors, actively manifesting themselves in the story world. Dream objects can be traded, used, and modified by others; the contributor has the ability to follow her dream's progress and transformation over time as the environment and other co-actors touch it.

* information ecology, geology, and geography

The Dream Machine immerses its audience of co-actors in storylike information environments. Streams of information affect aspects of these story worlds, impinging visually and conceptually on settings. A Dream Image cycle, similar to the Earth's water cycle, is instantiated through the environmental metaphors of weather and "water flow." Over time, current events become history, captured in stratified layers of soil or in the root-and-branch systems of plants.
The Dream Machine project focuses on our awareness of information flow as intervention, and on our interpretation and use of information as adjustment. Both forms of engagement are used to generate transformation at the individual as well as the collective level.

Conclusion: The State of the Art

Today, technology is changing the face and the soul of media stories. Powerful, sophisticated computational engines can massage all types of media objects -- video, audio, text, etc. -- into meaningful, cohesive, aesthetically pleasing narrative experiences.

These media objects can be manipulated at any level of granularity: as complete stories; as scenes or events; as shots and sounds; as individual elements within a frame. In the digital story world, even individual "bits" can be made graspable and manipulable. Plots are devised and interactively revised by software which emulates the knowledge and expertise of human storytellers. Presentations are customized and personalized by software which embodies the skill and judgment of human editors. Synthetic characters -- free to perform with some degree of autonomy, driven by their own internal needs and desires, and behaving with their own idiosyncratic personalities -- act out their roles within artificial environments and customizable information spaces.

Modern computer-assisted storytelling systems are embracing a wide variety of devices which sense the actions and desires of their audience and adjust the playout of story accordingly. Electronic communications networks and "remote presence" technologies are bringing together a broadly dispersed, virtual "society of audience" which can share a common story experience without actually being present in the same room at the same time. The audience can choose their own level of engagement, ranging from a passive, "couch potato" level of activity to a vigorous, frantically-paced physical involvement with the playout of story. Through role-playing and other types of interaction, the audience themselves are becoming significant "co-actors" (with the author and the machine) in the construction of narrative meaning. Behind the scenes, increasingly sophisticated user modeling and tracking is transitioning the participant audience from outside to inside the story form.

Story itself is evolving from fixed, monolithic forms to flexible, conversational models of encounter.

Work

"Radio Interference"; Co-producers: Antenna Theater, San Francisco and Film/Video, The MIT Media Laboratory, 1987.

"Wheel of Life: A Transformational Environment" ; Co-directors: Glorianna Davenport, Larry Friedlander, MIT Media Lab, 1993.

"Lurker"; Author: Lee Morgenroth, Executive Producer: Glorianna Davenport, MIT Media Laboratory, 1995.

"Dogmatic"; Author: Tinsley Galyean, Executive Producer: Glorianna Davenport, MIT Media Laboratory, 1995.

"Alive"; Principal Investigators: Sandy Pentland, Pattie Maes, MIT Media Laboratory, 1994-present.

"Silas, The Dog"; Author: Bruce Blumberg. Advisor: Pattie Maes, MIT Media Laboratory, 1996.

"Typographic Actor"; Author: Flavia Sparacino, Advisor: Sandy Pentland, Glorianna Davenport, MIT Media Laboratory, 1996-1997.

"Log Boy; Filter Girl"; Author: Ryan Evans, 1994, Advisor, Glorianna Davenport, 1994.

"Yellow Wallpaper"; Author: Stefan Agamonolis, David Tames, et al Advisors: V. Michael Bove, Glorianna Davenport, MIT Media Laboratory, 1994-5.

"Dream Machine"; Authors: Brian Bradley, Flavia Sparacino, Alexander Kim, Stefan Agamanolis et al; Executive Producer: Glorianna Davenport, MIT Media Laboratory, 1996-7.