Your Own Virtual Storyworld

True interactive entertainment will arise once engineers and artists create virtual realities that can unfold improvisationally

by Glorianna Davenport

Virtual sheepdog named Duncan learns tricks in much the same way as his real-life counterpart.

WEBB CHAPPELL

It is a muggy summer day in 2004. I am driving my new car—an FEV (full entertainment vehicle)—along the traffic-clogged highway that leads to the kids' summer camp. Glancing into the rearview mirror, I notice a BMW convertible quickly gaining on us. I grumble to myself and pull into the slow lane to let it pass by. For me, driving is the usual tedious task. But for my kids, Jamie and Joy, the trip is an adventure of their own choosing.

From their position in the back seat, the kids see the speeding sports car as a *Tyrannosaurus rex* on the run, legs thrashing and tongue flailing. As the dinosaur roars past the holographic side "window," Joy slaps it with her lollipop, which sticks to the screen. The FEV's onboard computer responds to her assertive gesture by sending a message to the speeder's dashboard display: "Hey, slow down." Suddenly, a police car in hot pursuit appears on the holo-window as a screeching pterodactyl chasing the thunder lizard. The *T. rex* looks over its shoulder, stops and exhales a steamy sigh as the flying reptile perches on its tail. "Got him!" Jamie yells in satisfaction, as lightning and dark clouds invigorate the scene of Jurassic capture.

Does a family car that entertains passengers with

Evolution of Interactive Entertainment

Electronic entertainment has been inviting us to interact since the 1950s, but most forms still lack the capacity for improvisation or serendipity. Merging elements such as smart stages and synthetic actors with sophisticated graphics will give rise to virtual storyworlds that go far beyond anything we see today.

1967

Winky Dink and You (CBS)
Early experiment in interactive TV. Viewers place plastic sheet over the monitor, and cartoon characters lead them through drawing exercises.

1972

Pong (Atari)
Passive viewer becomes interactive player who uses a hand held dial to control a graphical Ping-Pong paddle on a TV screen.

1977

Adventure (Will Crowther and Don Woods)
Pioneering example of interactive fiction. Text-based story unfolds on the computer screen as player types commands to initiate the next action in puzzle-solving game.

1983

Dragon's Lair (Don Bluth, Cinematronics)
Laser-disk technology enables the step to the visually stunning illusion of a 3-D world. Player controls a human like character rather than an inanimate object.

an interactive fantasy world seem far-fetched? The technology is almost at hand. Global Positioning System (GPS) receivers, which employ a network of satellites to locate precise latitude and longitude, are available in many new vehicles, and automobile manufacturers are scrambling to connect drivers to the Internet. Within the next 10 years ultrathin, holographic monitors could replace windows, and miniature video cameras could track events on the road and inside the car. Special software would then translate the vehicles' relative movements, and the passengers' actions, into digital fantasy—a virtual storyworld. Although it is only one possible future scenario, the FEV heralds a new era of interactive d-entertainment.

Engineers have attempted to create interactive entertainment since the 1950s [*see timeline above*], but most of today's choices still force some kind of undesirable trade-off. If you want a compelling narrative, you must usually accept the passive experience of cinema or television. If you prefer to make decisions, as with computer and video games, you generally sacrifice a good story line. The future of interactive d-entertainment will bring convergence of fixed narrative and personal choice, combined with the computer graphics capabilities it takes to render the story in real time.

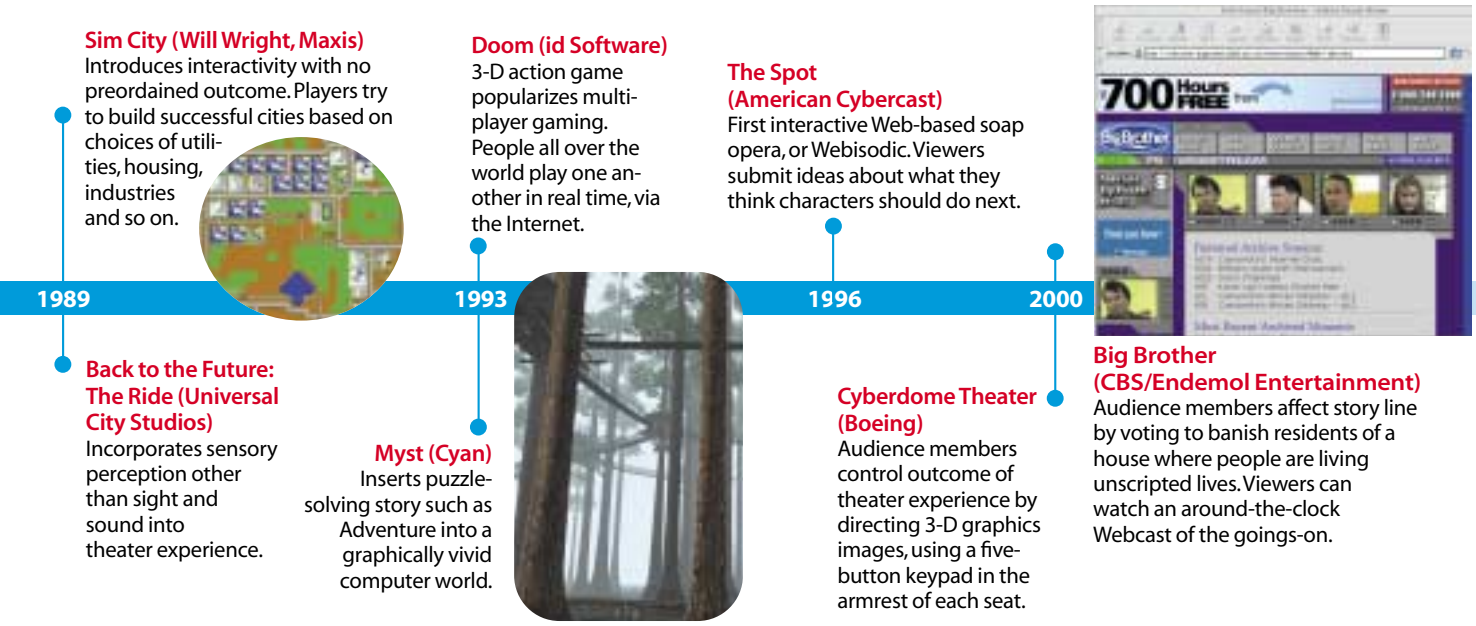
Several innovations are key to these imminent advances. Increasing bandwidth is beginning to allow people to choose personalized entertainment from central distribution networks, such as movies-on-demand. Novel input devices, such as touch screens and speech-recognition tools, are changing the way we can communicate with the Internet or other networks. New types of audio and visual displays are enabling ever more realistic sensory environments. And miniaturized wireless technologies are making computing and communications mobile, bringing d-entertainment to your handheld computer, your watch and even your car windows. As media technology moves from the specialized spaces of the theater and living room into the total surround of everyday life, d-entertainment will be available wherever we are, whenever we are receptive and on whatever devices are present.

By its nature, interactive technology will also offer a wealth of choices about how a story unfolds, so no two people's entertainment experience need ever be the same. Writers will not have to script entire tales ahead of time, because the people who enter the story will become the characters whose decisions move the story along. A writer may shape the initial circumstances, but the story will unfold improvisationally. The story environment—and characters within it—will respond to personal messages, news and other forms of information. What this kind of virtual storyworld will require is a database network that is embedded with enough story elements and decision-making algorithms to generate various serendipitous actions with unique content.

Smart Stages and Animated Actors

Another necessary component of the virtual storyworld is an interactive stage where the action can take place. This stage is where content can be found, made and shared as needed; where informational messages can be sent and received; and where virtual characters can engage in their own business or interact with the audience. No such milieu exists, but a new type of cyberspace portal—currently under development at the Massachusetts Institute of Technology Media Laboratory—may be a promising first step. Called Happenstance, it is an animated computer graphics landscape that manages information according to the preferences and situation of a particular user.

As we know from cinema, landscapes provide



the illusion of continuity in space and time. Graphical representations of weather, plants and other features of the natural environment provide the same illusion in the cybersurround of Happenstance. Your window into this world is your computer monitor, and you use a mouse and keypad to navigate and send commands, but the similarity to current graphical interfaces ends there. This ecological interface translates common computer activities, such as conducting Internet searches, into movement through the landscape.

If you decide, for instance, that you're hungry for Chinese food, you could type a query that gets attached to an icon of a tree seed. You could then plant the seed in the cybergarden of Happenstance to begin a search for nearby restaurants. Today's Internet browsers would list the query results as hyperlinked blocks of text, but inside Happenstance the results appear as leaves sprouting on a tree. Before you can examine the leaves, a volcano begins erupting in the distance—a signal that news relevant to your search is about to arrive. Happenstance is programmed to search for serendipity; the query for Chinese food has also brought you documentary film elements about China. A cinematic editor-in-software directs a graphical sequence that pans away from the tree and zooms in on the cloud of smoke that is emerging from the volcano. The cloud moves overhead, and details from the films rain down into a river that identifies them by their keywords.

Even a stage as smart as a future-generation Happenstance cannot tell a story with all the complexity one would want. For interesting narratives to unwind, characters must be added to the mix. Imagine a fortune-teller sitting beside the tree of Chinese restaurants or a dog fetching various story elements from the river. Some characters could be mapped from nonhuman elements of real life, such as a *T. rex* from a BMW. Human actors—playing the part of characters that they design—could enter the story via their personal computers or other input devices. A third set of actors—semiautonomous, virtual beings that are part of the environment—could also work to move the story forward.

Creating convincing synthetic actors is no easy task. A satisfying interactive narrative requires characters that can convey emotion and improvise actions. They must have minds of their own, and they must be able to surprise us. Such characters contrast sharply with the best of those from the current generation of computer games. These dronelike beings can execute impressive, programmed actions, but they cannot improvise, and they cannot develop relationships with the players.

Media Lab researcher Bruce Blumberg is trying to scale the technological barrier between drones and actors by giving virtual beings the "brainpower" to respond to unscripted situations. He creates computer models of cognitive processes—sensory perceptions, learning, emotions and motor skills—and installs them in animated characters. Most recently Blumberg's team designed Duncan H. Terrier, a virtual sheepdog that they hope will one day emulate his real-world counterpart, a lively Silky Terrier named Sydney [*see illustration on page 79*].

People who enter the story become characters whose decisions move the story along.

Duncan's brain is a catalogue of action "tuples"—probabilistic statements that guide his behavior—that the programmers based on the ethology of how real dogs behave and learn. Each tuple defines a particular action and the conditions under which it should begin and end. Some tuples encode appropriate reactions to emotions, to phys-

COURTESY OF EDWIN BRIT WYCKOFF (*Winky Dink*); COURTESY OF DAVID WINTER (*Pong*); DIGITAL LEISURE, INC. (*Dragon's Lair*); MAXIS, INC. (*Sim City*); CYAN, INC. (*Myst*); CBS TKTTK (*Big Brother*)

ical needs or to sensory perceptions. The key to making Duncan's responses expressive, Blumberg says, is adding a modifier to each programmed action: "If you see food, then eat it *quickly* until it's gone," or "If you get kicked, then run away *whimpering* until you are a safe distance away." Each tuple also has a value that derives from its consequences. Gobbling a dog biscuit results in a change in hunger, which in turn reduces the value of eating.

Much of Duncan's programming makes him instinctively inclined, as are real dogs, to please his master. Duncan "watches" you from a large video monitor; software translates your presence and your voice into sensory perceptions that Duncan can understand. You stand before him on a surfboardlike device that monitors the direction in which you shift your weight to move you through the virtual Scottish moors where Duncan lives.

Like a real dog, Duncan initially has no idea that performing actions in response to specific verbal commands will lead to good things. Rather he discovers this reality through experience. (Indeed, Duncan is trained using a technique borrowed from real dog training, called clicker training.) Initially, Duncan randomly chooses actions to perform such as "sit" and "shake." When he does something that you want to encourage, you click a button that sends him a signal of praise—a virtual doggie biscuit. Because sitting led to a good thing, its value is increased, making it more likely that Duncan will choose that action in the future. Duncan's statistical memory also keeps track of what seems to be true about the world when he performs the action and tries to find contexts in which he is most likely to get a treat. So if you give Duncan a verbal cue right as he is beginning to sit, and if you preferentially reward him in those cases, he will eventually learn that sitting when you say "sit" is a more reliable strategy for getting a treat than simply doing it when you happen to be around.

A convincing interactive character must convey emotion and improvise actions.

Duncan's 30-odd tuples, which represent both learned and innate behaviors, are always competing. Just when you think that you have Duncan's full attention, he may chase a squirrel that scampers by. The possibilities for surprise behaviors grow when you add sheep and wolves to Duncan's world, each of which are individually programmed. Perhaps ironically, computer power will probably not be the biggest challenge in developing characters more advanced than Duncan. The biggest hurdle will be figuring out how to integrate motivation, emotion and learning abilities in a convincing way. Characters such as Duncan are the first step toward creating synthetic actors who can enliven the interactive, virtual storyworlds of the future.

Getting There

Merging smart, iconic stage sets and synthetic actors within a vast computational network will open the door to interactive d-entertainment scenarios that we cannot imagine now. But as the simple case of Duncan shows, programming all the imagery that could result from the various serendipitous interactions among characters is itself a daunting task. The d-entertainment industry will also have to agree on standards that encourage the building of infrastructure and the mass-production of new devices that can all work together.

Even if engineers and artists can develop the technology, infrastructure and ideas, the economics will still need to be worked out. Who will contribute to these evolving stories, and who will pay for them? One possible strategy would be the use of microtransactions: you pay for the parts of the story you watch, and you are paid for your contributions. Another possibility would be to market a theater experience in which the audience controls the story as a group. In contrast to today's passive cinema experience, a storytelling database could allow a movie experience to be generated at run time. The pieces could be chosen based on the computed sum of the audience members' collective prior theater experience. Stored on a theater key card, this list of prior experiences would ensure that the new theater experience was different from everything any audience member had already seen.

A virtual storyworld where interactive d-entertainment waits for us around each bend of our daily lives might be years off. But projects like Duncan and Happenstance, as well as near-term possibilities such as the FEV, are beginning to take us there. Along the way, we get to enjoy the ride. SA

The Author

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Further Information

Visit the Massachusetts Institute of Technology Media Laboratory at www.media.mit.edu

Read about the history of Pong at www.pong-story.com/intro. htm

Find information about Myst at http://sirrus.cyan.com/Online/Myst/Myst Home

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