OBLIQUE PERSPECTIVE

Silicon and the Silver Screen

Hollywood Enters the Computer Age

By John Wharton, Applications Research

> Good afternoon, gentlemen. I am a HAL-9000 computer. I became operational at the HAL plant in Urbana, Illinois on January 12, 1992.
>
> — from *2001: A Space Odyssey*

Now that HAL's projected birth date has passed, it's clear the makers of *2001* guessed wrong on some of the finer points. The real HaL Computer Corp. is based in Campbell, CA, not Illinois. Its flagship product is running in simulation only, not quite in the flesh. And while computers have gone through many revolutions since *2001* was released in 1968, we're still waiting for interactive, self-aware systems of HAL's sophistication.

But the industry has seen a different, much quieter revolution during that time, one that involves society at least as much as the remarkable technical advances. I'm referring here to the changing role of computers in the film industry, both on and off the screen.

Film as a Mirror of Public Opinion

Film is a key indicator of how society sees technology. While most "mass media" channels target increasingly narrow market segments, with radio stations offering "light, mellow rock for boomers under 40," and cable TV able to support a Pewter Shopping Network, feature-length films still aim for the broadest possible mass appeal. When you need $120 million in ticket sales just to break even, you try not to challenge or offend any market segment.

So big-budget films mirror prevailing cultural attitudes, and popular movies tend to follow public opinion more than they lead it. Film trends of the past, then, give perspective on the values and mores of their day. War films became more horrific as society tired of conflict, and Western cowboy epics began to reflect Native American sensitivities.

The same factors affect how film treats technology. Computers were once portrayed as powerful, foreboding monsters, attended by legions of white-coated technicians, prone to escape and run amok like King Kong; witness Colossus in *The Forbin Project* [1970] and Yul Brynner in *WestWorld* [1973]. As PCs entered the workplace, though, and the public saw first-hand how limited and frustrating they could be, computers in film mellowed out. The rogue computers in *TRON* [1982] and *WarGames* [1983] were at least not malicious, and R2D2, C3PO, and the robot in *Short Circuit* [1986] were downright cartoonish.

But whatever their other traits, film computers were always "different" from their masters, on a clearly lower rung of the evolutionary ladder. Arnold Schwarzenegger's cyborg in *The Terminator* [1984] had as little cultural sophistication as the "killing machine" shark in *Jaws*. The hero in *RoboCop* [1987] was burdened by servos, pistons, and hydraulic tubes.

Which brings us to the present. The man-machine caste system died with the release of *Terminator 2: Judgment Day*, the top-grossing film of 1991. To be sure, *T2*'s success relied heavily on ultraviolence and truly spectacular effects, but almost overlooked was how radically the Schwarzenegger role had adapted to changing times. Though still just a cyborg with a microchip brain, his character was scripted as a fully developed personality, as intelligent, resourceful, and border-line "human" as the living members of the cast.

At one point Sarah, the heroine, even mused that Arnold's new-age cyborg might be a kinder, gentler, and more attentive father-figure for her son than any of the real men she'd met. Sarah's closing words were that "the unknown future rolls towards us. I face it for the first time with a sense of hope, because if a machine, a terminator, can learn the value of human life, maybe we [humans] can, too." What I find revolutionary here is that Sarah's acceptance of man-like machines was portrayed as a natural outgrowth of each character's personality. We've come a long way since *2001*, in which HAL's obstreperousness was just a gimmick on which the rest of the plot was pinned.

Advancing the State of Motion Picture Art

Terminator 2 marked a second milestone for the computer industry, one more directly related to the state of technology: *T2* was the first feature film ever made that could not have been done without computers.

Any good thriller needs a good villain, and Schwarzenegger's nemesis in *T2* was the ultimate screen villain. This late-model T-1000 "mimetic polyalloy" cyborg (named, says Roger Ebert, after its great-grandfather — a Toshiba laptop) could transform itself to match the shape and appearance of other people and objects. The images of the T-1000 in its metallic state and during its transformations could only be rendered by computer, for which Industrial Light and Magic amassed several dozen SGI and other workstations.

Computers had been used to metamorphosize a princess in *Willow* [1988], and 2-D "morphing" has since added novelty and shock value to countless car ads and videos. In *T2*, though, the computerized interpolation of animated 3-D models became the root of the T-1000's strength and the core of its whole personality.

What's remarkable here is the production inertia that had to be overcome. Hollywood is notoriously slow to adopt new technology. Films succeed according to their makers' ability to communicate through words, sounds, and images — all distinctly right-brain skills. Good directors generally aren't inclined to experiment with technology for technology's sake. More importantly, film studios and financiers are very much averse to the risks associated with trying anything new.

Production delays that make a $50 million film miss its contracted release date can threaten the financial health of a studio, and schedule slippages get blamed on new equipment, no matter what the real cause. No one ever got fired for buying IBM, they used to say, and no producer ever got canned for advocating proven technology. The biggest change in film since talkies was the shift to color stock; the barbaric gear mechanism that still jerks film through the projector by its sprocket holes was patented in 1901.

Thus the complex graphics on HAL's displays used conventional hand-drawn animation, and *Star Wars*' Oscar-winning effects were done with miniatures and optical printing. Early computer graphics shots were short and sweet, like the "Genesis Effect" in *Star Trek II* [1982] and the pseudo-pod water creature in *The Abyss* [1989]. In the latter case, plans were made to shoot a backup creature using conventional methods, should the new-fangled software scheme fall through.

But the real power of software is its flexibility. Once computers began to be seen as a legitimate production tool, film makers found they could improve on effects previously done elsehow. This led in 1991 to an explosion in new on-screen computer applications.

The underwater scenes in *The Hunt for Red October* were actually filmed in mid air, with computers adding the murkiness and turbulence of the ocean depths. The flying scenes in *The Rocketeer* and *Hook* used "computer-aided wire removal" to erase the cables from which the actors hung. In *Backdraft*, computerized "difference matting" extracted the component pixels of actors sprinting across a runway and spliced their images into scenes of a roof-top inferno. In the *Beauty and the Beast* ballroom scenes, Disney's animation group used still more SGI workstations to render the marble walls, windows, and chandelier backgrounds on which hand-drawn dancers were superimposed.

And at least three of the films honored at the 1991 Telluride Film Festival used computers in ways unrelated to their plots. A series of nature films used image processing to show communications patterns among lightning bugs and to restore "accurate" colors to underwater footage. In *Little Man Tate*, director Jodie Foster superimposed graphics on shots of a game of billiards to show how her child-prodigy star might visualize momentum and spin vectors, much like the work of graphics guru Jim Blinn in the PBS series *The Mechanical Universe*. And Director Peter Greenaway's bizarre film *Prospero's Books* used computer animation and HDTV editing systems throughout.

Coming Soon to a Screen Near You...

Other new techniques will appear in films still in the works. *The Memoirs of an Invisible Man* promises a new level of realism thanks to computerized image masking and compositing; think of it as computer-aided face removal. Disney and Pixar are planning an animated feature prepared entirely on-line. And Virtual Reality (VR) will make its on-screen debut in a Stephen King film called *The Lawn-Mower Man*.

Meanwhile, computers are starting to be used behind the scenes to streamline planning and reduce production costs. George Lucas has invested heavily in digital post-production equipment. Director Francis Ford Coppola digitally-edited a full test print of *Dracula* using videotaped rehearsals to guide his primary shooting. VR systems are being used experimentally to prepare animated storyboards and to test camera angles for films otherwise unrelated to technology, and there's talk of using computers to salvage flawed footage and eliminate the need for costly pick-up shots.

As computer-drawn characters get more and more realistic, it may even become possible to add fully synthesized characters to an otherwise live film. Stars of the past might then be digitally exhumed and given new life; imagine the possibilities (as contributing editor George Morrow suggested years ago) of casting Cary Grant in the lead of a modern romantic comedy. Maybe someday they'll give Oscars for the Best Performance by a Workstation in a Supporting Role.

I hope so. At times it seems the computer business is in a rut, that innovation is on the decline, and that engineers keep solving the problems of the past. If so, Sarah's closing words in *Terminator 2* may contain a message for us all. If Hollywood screenwriters, producers, and the mass viewing public can see beyond the constraints and petty annoyances of today's systems, maybe someday we technologists can, too. ♦

Applications of computers in film will be discussed at Compcon in a session entitled "The Silicon Behind the Silver Screen." Brian Kelly of LucasArts will discuss digital post-production issues and Lincoln Hu of ILM will discuss the computer-generated effects in T2*; yours truly will chair. The session begins at 2:15 PM on February 27. For registration information see p. 24.*