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August 2004 www.cgw.com

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What Ryan has won and lost are equally astounding.

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for Best Short Film

Canale+ Award
for Best Short Film

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Short Film Festival
Sun Life Financial Award
for Best Canadian Short

SIGGRAPH 2004
Jury Award

PRIX ARS
Electronica 2004
Linz, Austria
Golden Nica
Computer Animation
Visual Effects category



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It's nice to be recognized. We know because the Academy of Motion Picture Arts and Sciences® was nice enough to recognize our Maya® software with an Oscar® for Scientific and Technical Achievement. So we would like to recognize Chris Landreth and his new animated documentary, *Ryan*, an incredible journey down the path of every artist's worst fear – losing it. We are proud that *Ryan* was Made in Maya™ and that we were involved in bringing Landreth's unique world of "psychological realism" to life. Visit www.alias.com/awards to view and learn more about *Ryan* and other examples of award winning creativity Made in Maya.

Ryan is a Copper Heart Entertainment Production in Co-Production with the National Film Board of Canada in Association with Seneca College - Animation Arts Center.



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I, Robot's all-CG character Sonny, created by Digital Domain, delivers a believable performance as a mechanical man accused of murder. See pg. 24.



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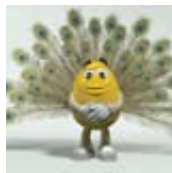
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**Phil
LoPiccolo**
Editor-in-Chief

Gaming: 2010

It may come as no shock to learn that video and computer gaming will continue to be the hottest market in the entertainment industry, at least for the rest of this decade. Even mainstream market researchers are now making this bold forecast. For example, PricewaterhouseCoopers—one of several mega firms that have weighed in on computer graphics-related markets recently—has released a study, “Global Entertainment and Media Outlook,” which predicts that electronic games will continue to be the fastest-growing segment of the industry during the next five years. The report concludes that the electronic gaming market will expand at a compound annual growth rate of 20 percent and will top \$55 billion in annual revenue by the end of the decade.

However, what may be more surprising to discover are the factors that will be responsible for this growth and the opportunities that will present themselves to digital content professionals as a result.

Clearly, the most powerful force driving the games market is consumer demand. According to a new study from the Entertainment Software Association (ESA), “Essential Facts about the Computer and Video Game Industry,” more than half (54 percent) of all US households have purchased or plan to purchase one or more games this year. Moreover, ESA’s latest research shows that today’s game players will likely be “gamers for life”—because a majority expect to play as much or more in the next decade as they do today—while each year the ranks of new players will continue to swell.

Of course, such demand for gaming is based on an assumption that we have come to take for granted, namely that gaming technologies will advance at the same dramatic pace we have seen in the past. For example, 10 years ago, the top-selling titles were

Donkey Kong Country and *Mortal Kombat*. But these games are “simple and charming by today’s standards,” says ESA president Doug Lowenstein.

Will gaming technology continue to advance at the same rate? Absolutely, and not just in computing power, but in a host of other areas that will enable the kind of innovation that will expand gaming’s popularity. In fact, a new assessment from Deloitte Research, “Moore’s Law and Electronic Games,” outlines the advances expected in technologies that could influence electronic gaming. A brief summary reveals the following trends:

Processing: Moore’s Law—which states that the transistor density of a silicon chip will double every two years—is alive and well in the game-console market. In fact, the next generation of consoles, which are expected to debut at the

end of 2005 or early 2006, will feature central processing units (CPUs) capable of more than one trillion calculations per second, nearly 10 times faster than current models.

Chip sets: Besides console CPUs, other chips—including graphics processing units (GPUs), random-access memory (RAM), and even mobile phone processors—will follow the same trajectory predicted by Moore’s Law, roughly doubling in capacity every two years. For example, processors in high-end mobile phones currently top out at 400MHz, but are likely to reach speeds of 1.5GHz by 2010, outpacing today’s PCs and consoles.

Digital technologies will advance by an order of magnitude during the rest of the decade, but the challenges for electronic game developers will expand at the same rate.

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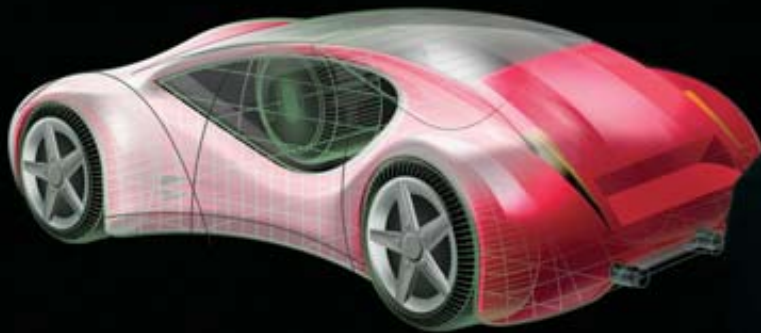
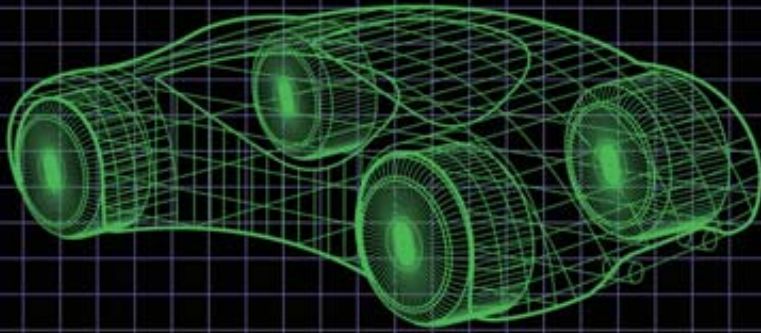
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Storage capacity: Since 1990, the growth in storage capacity has been outpacing Moore's Law by a wide margin, and advancing 12 times faster than processor density. At this rate—given today's PC hard-drive capacities of approximately 80GB—hard-disk storage for game systems will expand by far more than an order of magnitude, to between 1TB and 2TB, by 2010.

Broadband connections: By 2010, 450 million homes worldwide will have broadband connectivity at speeds greater than 1Gbit/second. In addition, of the more than 2 billion mobile phones in use, at least half will be connected to 3G networks, which will feature data transfer speeds in excess 100Kbit/second and make the downloading of games and assets practical.

These technological advances will certainly enable innovations in electronic gaming—just as the innovations will, in turn, generate revenues to fund further technology R&D. But in the meantime, what's the best strategy for game developers to capitalize on these enabling technologies?

For developers of high-end console games, the ante will certainly be raised. Advances in processors and storage capacity mean that games will become enormously more complex—with improved graphics, intelligence, and game play—but also far more expensive to produce. Some estimates place the expense of

developing a next-generation title well into the tens of millions of dollars, an order of magnitude higher than the cost of creating a game for current consoles. Fortunately, the returns may be higher as well. But in any case, it's clear that to make money, a publisher will need to spend money, and a lot of it.

For everyone else, perhaps the best strategy is to find a niche and fill it. As entry costs rise, smaller game developers will be forced out of the high-end market. Fortunately, evolving technologies and industry expansion will create unprecedented opportunities in other segments of the interactive entertainment industry. These will include programs that offer pure entertainment, as well as those that use gaming techniques for education, training, information delivery, cultural and social experimentation, and more. And it will present options for developing titles on a variety of platforms, not just for consoles and PCs, but also for online and mobile devices as well.

The options are many and the potential rewards are huge, perhaps more so than at any time or in any market. In each case, the key will be to become the recognized expert and leader in a given field, offer something of unique value, and act quickly before fast-moving technologies and fleeting opportunities pass by. It's a high-risk, high-stakes game, but those who place no bets may be taking the biggest risk of all. ■■

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Dell Expands Precision Family

Dell has amended its workstation line with the addition of two new desktop products, the Precision 470 and 670. Through the incorporation of Intel's Xeon processors with Extended Memory 64-bit Technology (EM64T), the Dell Precision 470 and 670 are capable of powering 64-bit computing, as well as running 32-bit applications. These dual processor-capable systems, designed for increased performance and future scalability, boast DDR2 memory and the PCI Express bus architecture.

The Dell Precision 670 is designed for the professional who requires high-end graphics, storage, and peripherals expansion. Well suited to environments

with limited space, the Dell Precision 470 is housed in a rack-mountable chassis that is smaller than that of the 670. Both models sport SCSI and SATA interfaces and support for RAID storage. Available with Microsoft Windows XP Pro (32-bit) and Red Hat Enterprise Linux (32-bit and 64-bit), the Dell Precision 470 and 670 are available now, starting at \$1399 and \$1699, respectively. —CEH

■ **Dell;** www.dell.com
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3D modeling
products

Discreet Debuts 3ds max 7

During SIGGRAPH 2004 in Los Angeles this month, Discreet is showcasing the latest version of its popular 3D modeling, animation, and rendering software, 3ds max.

Making its public debut at the show, 3ds max 7 now boasts Normal Mapping, a work flow-enhancement technique in which detail is added to low-polygon models using high-resolution maps.

Normal Mapping, designed to accelerate work flow primarily for game development, also proves effective in speeding film and design visualization processes.

Discreet also incorporated its Character Studio advanced character motion tool set, previously a stand-alone program priced at roughly \$1000, into the core feature set of 3ds max 7. Character Studio upgrades 3ds max with its constraint-based non-linear animation mixer, scalable behavioral crowd simulation, and motion-capture filtering and editing.

Version 7 adds Edit Poly Modifier, a new utility developed to speed and simplify the creation, modification, and animation of complex polygonal surfaces. TurboSmooth is an optimized smoothing algorithm, whereas a new Paint Deform tool enables users to modify—with Push, Pull, Relax, and Revert commands—polygonal objects through a brush interface. In addition to providing three new Mental Ray shaders for Sub-Surface Scattering, Version 7 enables the selection of Mental Ray 3.3 as the renderer behind 3ds max's Render-to-Texture tool. Moreover, a Skin Wrap Deformer permits character animators to lock clothing, props, and more to a model's existing skinning solution; users need not create new skinning data for each new element, which now adhere to the skinned surface.

Discreet anticipates shipping 3ds max 7 in the fall for \$3495. Reduced upgrade pricing also is available. —Courtney E. Howard

■ **Discreet;** www.discreet.com
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animation
products

Kaydara Upgrades MotionBuilder

Kaydara has announced its plan to unveil MotionBuilder 6—an updated version of its 3D character animation software for games, film, the Web, and broadcast—during SIGGRAPH.

Version 6 incorporates interchangeable character setups with support for props, constraints, and custom properties. Enhanced IK and FK keyframe capabilities, new tools for managing motion-curve dynamics, and a customizable user interface further contribute to the upgraded version.

Avid Premieres Xpress Studio

At SIGGRAPH, Avid is introducing the latest version of its DS Nitris non-linear video editing solutions, as well as its new Avid Xpress Studio system.

Version 7.5 of Avid DS Nitris and Avid DS Nitris Editor finishing systems are designed for use with standard-definition, high-definition, and digital intermediate 2K/4K projects. The upgrade also provides support for Avid DNxHD 10-bit HD encoding technology.

Avid Xpress Studio, an all-in-one content creation suite for video professionals, incorporates five of the company's popular video tools—Avid

Xpress Pro, Avid Pro Tools LE, Avid 3D, Avid FX, and Avid DVD by Sonic—and such hardware options as Digidesign Mbox, the eight-fader Digi 002 controller, and the Avid Mojo Digital Non-linear Accelerator (DNA).

Avid is offering its Xpress Studio in two configurations: Essentials and Complete. Avid Xpress Studio Essentials, priced at \$3995, includes the Digidesign Mbox, a two-channel, USB audio peripheral. For \$6995, Avid Xpress Studio Complete ships with the Digi 002 and Avid Mojo.



Avid also is providing SIGGRAPH attendees with introductory, hands-on training sessions for Softimage|XSI 4.0, Alienbrain Studio, and Avid Xpress Studio. —CEH

■ **Avid;** www.avid.com
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Nvidia Releases PCI Express Cards

While at SIGGRAPH, Nvidia is demonstrating its latest graphics accelerators, including four additions to its Quadro family of professional graphics solutions. The Quadro FX 3400, FX 1300, and FX 330 are based on PCI Express, whereas the Quadro NVS 280 is designed for professional 2D graphics and digital media applications.

Nvidia's flagship PCI Express offering, the Quadro FX 3400 features 256MB of G-DDR3 frame buffer memory, a 256-bit interface, and three-pin stereo support. Dual DVI display connectors and a memory bandwidth of 28.8GB/second round out the high-end Nvidia Quadro FX 3400, which will be offered in professional workstations from Dell, HP, and Fujitsu-Siemens. Like the 3400, the FX 1300 sports a 256-bit

memory interface, three-pin stereo support, and dual DVI display connectors. It differs in its 128MB of DDR frame buffer memory and 17.6GB/second memory bandwidth. The entry-level FX 330 includes 64MB of DDR1 frame buffer memory, 3.2GB/second memory bandwidth, and a 64-bit interface. Last, users of the new Quadro NVS 280 benefit from PCI Express, PCI, and AGP bus architectures. The four offerings share support for Nvidia Scalable Link Interface (SLI) hardware and software, and true 128-bit floating-point precision. The PCI Express-based Nvidia Quadro FX 3400, FX 1300, and FX 330 are available from PNY Technologies (www.pny.com) in the US and Europe. —CEH

■ **Nvidia;** www.nvidia.com
infoNOW 103



Kaydara's MotionBuilder 6 is offered in two versions, now available for Windows 2000, Windows XP, and Mac OS X 10.2 and higher. MotionBuilder Standard is priced at \$995, whereas the Pro edition carries a \$4195 price tag. —CEH

■ **Kaydara;** www.kaydara.com
infoNOW 104

film
user focus

Smooth Sailing

In mythology, Helen of Troy had a face that launched a thousand ships and sparked a war between the Trojans and the Greeks. But for the computer-generated armada in the feature film *Troy*, digital artists at Framestore CFC used SyFlex's cloth-simulation software to create the realistic sails and rigging that propelled those ships on their journey.

According to Carl Bianco, lead technical director, the artists needed to provide the sails in a range of states—billowing, hanging, furled, furling, and damaged. Moreover, they had to produce them in a sufficient quantity and variety so they could be seeded across hundreds of 3D boats that appear in the various shots.

Most important, the sails had to withstand prolonged scrutiny through the long sequences without showing obvious signs of repetition. This alone required Framestore to generate nearly

100 animation sequences ranging from 1000 to 2000 frames in duration.

"We created six different sail and rigging setups, three of which had to accurately match the full-size replicas on the real boats used on location," says Bianco. "The main shots of the armada at sea required the boats to be under full sail, while the beach and harbor sequences needed the boats stationary with the sails furled in different stages. In other shots, we had to show the sails in the process of being furled and dressed, as well as reacting to forces resulting from the boats beaching."

To accomplish this, the artists converted the sail and rope geometry within Alias's Maya to SyFlex cloth, and constrained it to an underlying rigid-body dynamics rig. Next, they added forces and generated wind and other effects.



Framestore's CG sails (shown in the background) for the *Troy* armada had to display a wide range of animation.

Animated springs, set up between individual vertices of the cloth, were used to add localized tension or force certain behaviors for the sails.

In addition to the ships, Framestore created other imagery for the film, including digital matte paintings and 3D elements for a city scene early in the movie, arrows and other effects for the ensuing beach battle after the boats land, and extensions to the beach encampment shots, such as boats, tents, and crowds. —Karen Moltenbrey

❑ **KEY TOOL: SyFlex cloth, SyFlex**
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Web
user focus

Build a 'Bot

In the 20th Century Fox sci-fi film *I, Robot*, set in 2035, robots like the NS-5 are commonplace (see "Hot 'Bots," pg. 24). To get audiences in the proper mindset for this futuristic concept, Fox teamed with Adobe to build the *I, Robot* interactive 3D Web experience (www.irobotmovie.com) that offers a virtual environment within which visitors can custom-build their own NS-5 by combining various body parts, colors, textures, genders, operating systems, mobility options, and strengths. Then, users can issue commands to see how their robots perform.

"It puts people in the middle of the *I, Robot* world," says Damian Hagger, Internet marketing manager at Fox. "In essence, it's a virtual robotic lab, where we could brand our film and the robots, and get people used to interacting with them."

To create the futuristic experience, freelance Adobe Atmosphere designer George Lippert built



Fox, with help from Adobe, is advertising the *I, Robot* film by letting Web users customize and test their own robots.

a 3D model of the robot in Alias's Maya, using as references production images of the practical robot model and a high-resolution 3D model from the film. To rig the new model for the Internet animation, he parented the individual parts to a basic skeleton rather than skinning the geometry, which made it easier to export the model and animations to Atmosphere through Viewpoint's Scene Builder.

Working from images of the movie sets, Lippert also re-created the site's 3D environments in Atmosphere, which acted as the hub for tying all the final elements together and provided the framework for the Java-scripted interactivity.

According to Hagger, the end result is more interesting than a typical Web "adver-game" where roles are strictly defined. "And there's no better way for us to spark interest in the film than to offer a bit of the future to our audiences by portraying this 'create-a-robot' experience as being real." —KM

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Double Exposure

The feature film *Van Helsing* is full of amazing effects, but from a technological standpoint, none can compare to the groundbreaking motion-capture work by Industrial Light & Magic (ILM).

To create a trio of hybrid vampire brides—characters with the heads and faces of actual actresses fused with computer-generated bodies—the studio

that allowed it to use motion-capture cameras for acquiring the movements of the actresses, while the film crew simultaneously shot the backplates of the women's facial performances.

Previously, a simultaneous capture like this was out of the question because the bright stage lights rendered optical-based motion-capture systems—which track reflective light from markers placed on an actor's body—

aid in the rotoscoping process—moved with the help of a harness and stunt puppeteer. “It was critical that the [mocap] information be exact when it came time to line up the computer-generated body with the real neck and head,” maintains Doug Griffin, ILM's motion-capture supervisor.

Acquiring precision tracking information on a live set, as opposed to a typical controlled mocap environment,



developed a first-of-its-kind technique that enabled it to acquire motion-captured data during a live film shoot.

For the sequence, Dracula's brides metamorphose from sultry females to bloodthirsty vampires who use bat-like wings to swoop through a Transylvanian town and attack the villagers. Despite the transformation, the creatures still had to have the same facial performances and look like the actresses, only creepier. The ILM group decided to accomplish this by applying makeup and prosthetics to the head and face of each actress, and then “marrying” the actual head to a digital body to give the team more control over the complex, acrobatic movements that animation director Daniel Jeanette was seeking.

ILM had done this type of work before using a more time-consuming procedure of manually tracking an actor throughout the shots and then replacing the person's body with a 3D version in postproduction—a process that may not extract all the nuances of the performer. This time, with Jeanette's prompting, the group devised a novel technique

Left: A CG body of vampire Marishka (played by Josie Maran) is driven by motion-capture data acquired during a simultaneous mocap/film session. Middle: The animation is blocked into the scene using data collected by the motion-capture cameras. Right: The hybrid live-action/CG character is added to the film plate in the final shot.

useless. And while magnetic mocap systems are not affected by lighting conditions, they can be influenced by metal, such as the film cameras and harnesses that were used in the scene.

To overcome these issues, ILM's principal engineer, Kevin Wooley, developed customized markers using high-powered infrared LEDs that could be tracked by the Vicon mocap cameras ILM was using. Because they worked outside of the visible light spectrum, the markers were invisible to the naked eye—and the film cameras.

The markers were fitted onto customized motion-capture suits worn by the actresses. A main cable fed power to 45 of the special markers through flexible, lightweight ribbon wires, enabling the actresses to move easily. On the set, the actresses—who were adorned with makeup, wigs, and special contact lenses, and completely covered in blue from the neck down to

was especially difficult due to all the activity that inevitably would bump one of the 24 mocap cameras. In the past, this would have made those cameras unusable. However, this is no longer an issue, says Griffin, because with Vicon's new IQ Camera Re-Section tool, the group can easily recalibrate affected cameras to avoid losing a vital camera view.

Aside from motion-capturing the movements of the actresses, ILM mocapped the movements of the film cameras—a procedure typically achieved in postproduction. This helped speed up and improve the matchmoving process, and helped to align the heads with the 3D bodies, which were created in Softimage|XSI.

ILM's new mocap process also required a great deal of development behind the scenes. For instance, motion-capture lead Andy Buecker wrote custom tools within Softimage|XSI to process the motion data so it could be

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applied to the 3D model. And, technical animator Jeff White devised a rig that allowed animators to manipulate the brides within the scene. The rig maintained the relationship between the 3D geometry and the 2D image, accounting for camera distortion as the imagery translated through the scene. Moreover, the system's flexibility allowed the director to choose different sections of the facial and motion-capture performances to be blended together.

According to Griffin, the team also devised a setup so the animators could tweak and even alter the mocap data without disrupting the alignment of the 3D torso with the real neck. Using reverse constraints—built from the neck down, rather than the usual pelvis up—the animators could match the director's vision for the shot while the rig maintained the 2D-to-3D rela-

tionship, notes Griffin. As a result, the animators retained the facial and body performances of the actresses as they layered on the dynamic flight motion.

"We didn't do motion control when we shot the mocap, so what we captured wasn't going to perfectly match the perspectives of the backgrounds shot in Prague," says Griffin. "So Jeff White developed techniques to distort the plates to match the backgrounds, without disrupting the crucial alignment between the 2D head and the 3D body."

In all, 45 shots were filmed with the new hybrid technique. According to Griffin, the motion capture saved almost two weeks of man-hours per performance compared to using more traditional techniques.

ILM hopes to advance this technology for future projects, notes Griffin, improving on what he calls practical



Key to the mocap breakthrough was the development of small, customized infrared LED markers that work outside the visible light spectrum so they're not affected by set lights.

issues, like the wires becoming caught in the stunt harnesses. "If we move forward, we'll probably develop wireless markers that do the same thing, but are easier to integrate on set," he says.

For now, ILM couldn't have been more pleased with the results for the hybrid vampire brides. "You look at these shots and you can't tell what's real and what's fake," Griffin says. "I spent six days a week for months working with them, and I can't tell."
—Karen Moltenbrey



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Virtual Swimming

Computer-user interfaces have taken many forms over the years, but few have made use of a person's entire body. Now a team of researchers at the University of British Columbia has developed a swimming simulation that enables a user to navigate a virtual environment while suspended in a hang-gliding harness. The swimmer is outfitted with a head-mounted display and eight sensors that track body movements and send motion data to a PC controlling the simulation.

The system, which will be demonstrated in the Emerging Technologies pavilion at SIGGRAPH 2004 in Los Angeles, simulates the sensation of floating in water. As the virtual swimmer

travels through the water, the system tracks arm and leg movements and updates the display. A water-splashing algorithm adds to the realism.

The swimming interface could aid researchers in developing new ways of engaging the body to explore virtual spaces or knowledge bases. The researchers explain that body movement could take on new meaning when the setup is used to navigate various data spaces. For example, operations such as arm strokes, kicking, and diving could enable medical students to swim or fly through virtual humans to study anatomy.

The device could also be implemented as a controller in a variety of water-sports simulations. —Phil LoPiccolo



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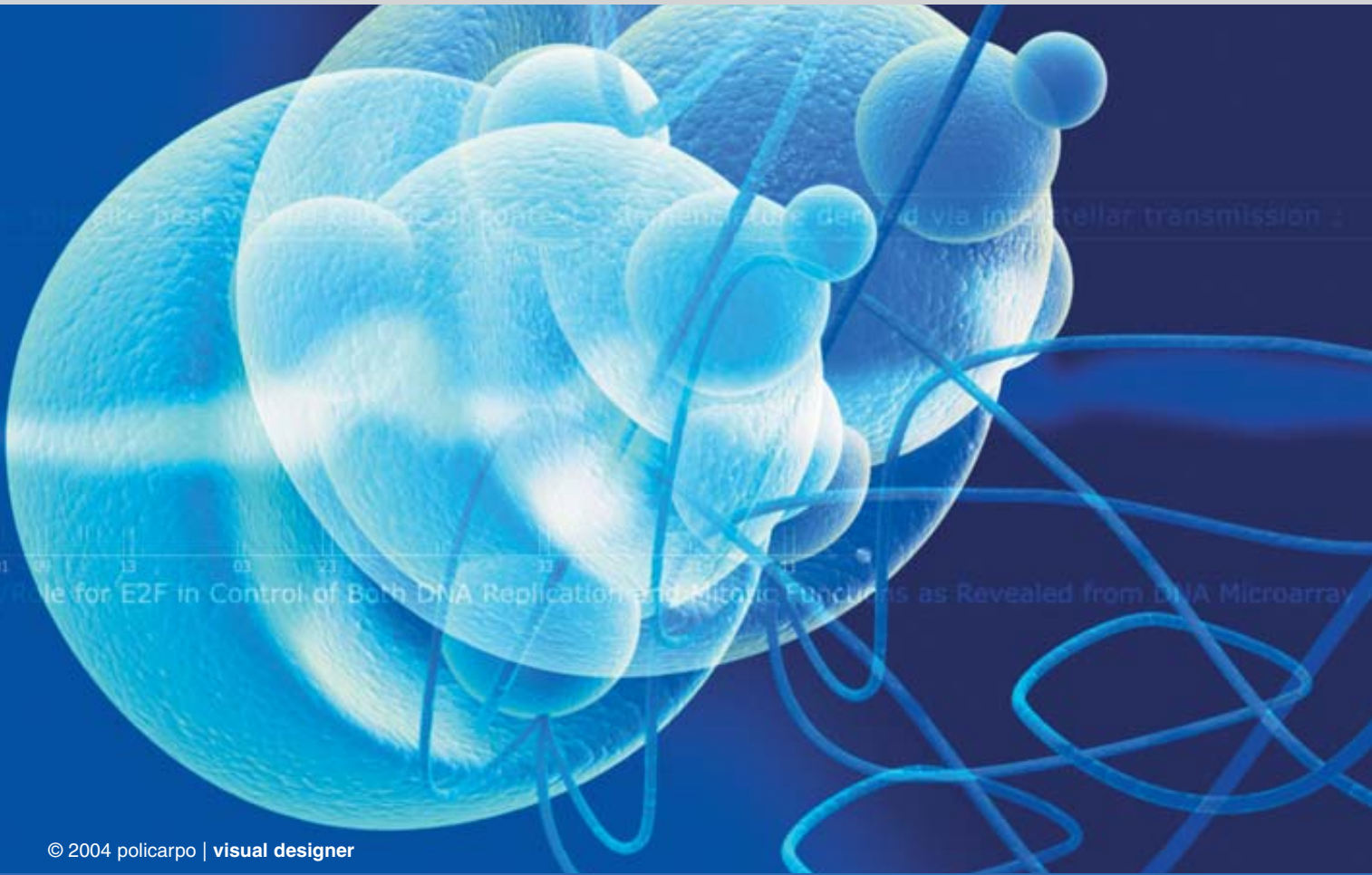
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The Balkanization of Animation

By Brad deGraf

Outsourcing has become an election-year battleground, as the American economy adjusts to a globalized world, where location is no longer a major factor in the search for the lowest-priced goods and services. While “Benedict Arnold CEOs” are criticized for “exporting America” by sending jobs overseas, the issue is not black-and-white.

The outsourcing of computer animation and game development provides an interesting lens through which to view the phenomenon. The industry is by no means immune; it is, in fact, very well suited to distributing production widely, and can provide a positive example of globalization.

My contention is that distributing production globally is both inevitable and beneficial to all sides. Among other benefits, the efficiencies from outsourcing: A. Democratize the financing of animation, opening it up to a much wider pool of independent creators; B. Expand the market (more movies, shows, and games will be made because of lower-cost requirements); C. Protect creative jobs in otherwise marginal businesses; D. Create more

and better work in the developing world that will benefit all; and E. Improve job stability by evening out the boom-and-bust cycle of big-budget productions.

Historical Context

One way to look at the issue is to remember one simple fact: We would not have television animation as we’ve known it for the past 40 years if Hanna-Barbera, et al, had not figured out how to outsource traditional cel animation back in the 1960s.

The “limited animation” techniques—such as animating “on twos,” cycling backgrounds, and so forth—developed in the ’40s and ’50s by UPA and others were driven largely by a desire to open up the medium to smaller studios. Until then, the large studios dominated commercial animation, theatrical shorts were the only practical outlet for others, and television was simply out of the question because the cost of production couldn’t be recouped. Those techniques were quickly adopted and were ultimately critical to the profusion of cel animation today, from *The Simpsons* to *SpongeBob SquarePants*.

By isolating the parts of the process that required great skill (such as writing, layout, and key animation) from those parts that didn’t (in-betweening, inking, and painting), it was natural for studios to seek out the least expensive way to produce the latter. Hanna-Barbera led the way in establishing studios in the Philippines and Taiwan, and in creating production processes that accommodated the shipping of designs overseas and finished cells back.

The combination of less work and lower cost for that work through outsourcing brought the costs down to a level that television could justify.

Democratizing 3D

Forty years later, the same cause (lower costs) and effect (more and bigger markets), accelerated by friction-free digital processes, are playing out today in the 3D animation and game worlds. Pixar, PDI, BlueSky, and Nickelodeon are analogous to Disney and Warner Brothers before UPA. They are the only ones that can afford the \$40 million-plus budgets of 3D features today.

However, just as with 2D in the 1960s, outsourcing 3D animation reduced costs dramatically. So it will no longer be necessary to own a production studio such as Pixar or PDI to be able to finance a \$40 million feature-film production budget.



Brad deGraf, a programmer, animator, and entrepreneur in 3D animation, founded deGraf/Wahrman, Protozoa, and the digital media division of Colossal Pictures. He consults for International Finance Corporation and the US Agency for International Development.

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That's great news for creative talent because it dramatically lowers the barrier to getting a great idea greenlit. It's a lot less risky to take a chance on a \$20 million film than on a \$40 million-plus one, and more choices of production houses means the big players don't have a monopoly on what gets made.

Expanding the Market

As budgets go down, the need for megahits also goes down, and content can be produced for more specialized audiences. For instance, the population of India represents a huge market, but little if any 3D animation is being created for it because the buying power of that audience is much lower than in the US and Europe. So they watch *The Simpsons* and *Finding Nemo*.

But if the cost of producing a film, television show, or game is cut in half, it becomes twice as easy to recoup costs and, thus, markets that would otherwise be out of reach suddenly become attractive.

Toonz Animation in India (www.toonzanimationindia.com) is beginning to prove that. And many such markets will open up as costs drop, thereby creating more demand for creative talent overall.

Protecting Creative Jobs

The natural "division of creativity" from outsourcing will tend to favor talent in developed countries that have the clear leadership in the high-skill parts of the process. The early stages of conception, writing, design, and production management will largely stay in Hollywood, Europe, and Japan, where the talent, infrastructure, and capital for it are solid.

As new markets open up because of lower costs, demand for that talent should actually increase, more than compensating for the less-creative work that moves overseas in search of cheaper labor.

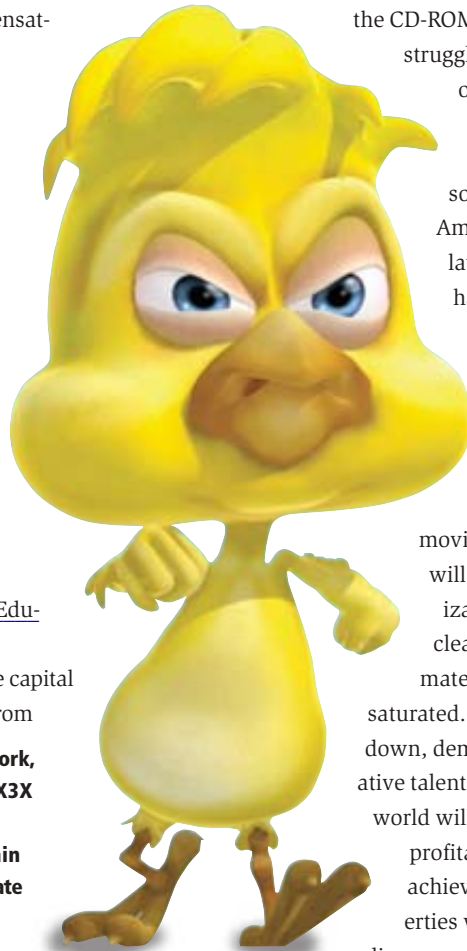
Work for the Developing World

Digital media work, even the rote work that outsourcing favors, is great for developing countries: It requires skill, and is clean and relatively well-paying.

Macedonia (the former Yugoslav Republic, hence the term, the "Balkanization" of animation) is an interesting case study. The country has low wages, high unemployment, but near-European levels of education and access to technology. In concert with the US Agency for International Development, the government has created E-Schools by wiring every school in the country with computer labs connected by broadband (for more information, see www.usaid.org.mk/educating_modern_macedonia/Education_Information_and_Technology_Project.asp).

FX3X (www.fx3x.com), an innovative studio in the capital city of Skopje, wants to grow the business it receives from Hollywood, but it needs more talent to support that. So it proposed 3D @ E-Schools, a distance-learning program to grow the 3D talent pool in Macedonia, using E-Schools as a training platform for Alias's Maya. It is considered a big

To attract US work, Macedonia's FX3X proposed 3D @ E-Schools to train students to create 3D animation such as this.



success, with more than 400 eager students going through the first level of training in the first 27 schools, and more are on the way.

Improved Job Stability

The increased use of low-cost overseas production should actually create more job security in the 3D animation industry. Studios will have reduced economic pressures that might threaten their existence, and less of a boom-and-bust mentality that creates big swings in hiring and firing. Large effects houses already "outsource locally" for just that reason. Dozens of small studios provided effects for *The Matrix* movies, in fact.

Glass Egg (www.glassegg.com) in Saigon is an excellent case in point. Phil Tran, its founder, was born in Vietnam and moved to the US after the war. He returned to Saigon to establish an off-shore studio for CD-ROM pioneer Morgan Interactive. With the volatility of the CD-ROM business, Morgan was

struggling to survive, and everyone's job was at risk because the studio's costs were too high. In that case, outsourcing actually saved American jobs. Glass Egg's latest work entailed creating half the race cars in Microsoft's new racing game, *Forza Motorsport*.

I believe that what is inevitably happening in the outsourcing of 3D animation production for movies, television, and games will be a great example of globalization done right. It seems clear that the appetite for animated entertainment is far from saturated. The more we can bring costs down, demand and opportunity for creative talent will grow, the developing world will gain high-quality new jobs, profitability will be more easily achieved, and more creative properties will get made for more diverse audiences. ■■

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•••• Film

Hot 'Bots

By Barbara Robertson

Digital Domain and
Weta Digital create
animated CG robots for
the film *I, Robot*

The Three Laws of Robotics

1
A robot may not injure a human being, or, through inaction, allow a human being to come to harm.

2
A robot must obey orders given it by human beings except where such orders would conflict with the First Law.

3
A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.



50

years ago, Isaac Asimov's collection of nine stories about evolving generations of robots and mechanical men was published in book form as *I, Robot*. One of those stories, "Liar!," introduced the three laws of robotics, which Asimov used to present intellectual puzzles, as have many books and movies since—including the 20th Century Fox film *I, Robot*, scheduled for release this month.

Although "three laws" puzzles are at the core of this film, director Alex Proyas gives moviegoers looking for more than brain candy plenty of action scenes as well. Based on Asimov's book, *I, Robot* stars Will Smith as Del Spooner, a technophobic cop investigating the murder of Dr. Miles Hogenmiller, a scientist at U.S. Robotics (USR). Could Sonny, a new model NS-5 robot, have violated the first law? The answer is not simple and not simply intellectual. Set in Chicago, 2035, the film features a robot war between two generations of mechanical men and scenes of Spooner fending off truckloads of robots.

Images © 2004 20th Century Fox.



The production and robot designs by Patrick Tatopoulos, who designed the visually stunning film *Dark City*, also directed by Proyas, brought into sharp focus one of the first laws of digital visual effects: An effects studio can never have too much compute power. Indeed, consider the processing capabilities required to create and render CG buildings made of stainless steel, glass, and white marble populated with animated robots made of mechanical parts inside translucent shells that reflect and refract the bright luminous environment.

All told, five studios worked on 1000 visual effects shots, but of those, two studios, Digital Domain and Weta Digital, did the heavy lifting—the shots with 3D characters and digital environments. “We used CG throughout,” says John Nelson, visual effects supervisor, “from the inception of the movie, to conceptual art, all the way to final renderings. We had many scenes that were completely CG.”

Image Engine handled previz before and during location filming in Vancouver, BC; Pixel Liberation Front took over when the crew moved back to Los Angeles. “We prevized all the big action beats,” says Nelson,

who won an Oscar for *Gladiator*. “We have huge action sequences. So I was like a short-order cook, designing sequences by cutting the previz on the Avid. We almost had *I, Robot*, the animated version.” Nelson gave all shots with Sonny and most shots with the other NS-5 robots to Digital Domain; Weta Digital handled set extensions, shots with the NS-4s, and “anything big and wide.”

Transparent Motives

For Sonny, Proyas had two requirements, one physical, one emotional. “Alex wanted Sonny designed so he couldn’t be a guy in a suit,” says Nelson. Thus, Sonny is translucent and has a one vertebrae-wide waist. “And he wanted Sonny to be very emotional so you would connect,” Nelson adds. “Cinematic robots tend to be foolish or cold. So, even though we had a cast of thousands and huge set extensions to do, job one was creating an emotional performance for Sonny.”

To help create that emotional performance, actor Alan Tudyk, wearing a green suit, acted alongside Will Smith during filming. Later, his performance was motion-captured. “Alan was our Andy Serkis,” says

Andy Jones, animation director at Digital Domain, referring to the actor who played Gollum in the *Lord of the Rings* trilogy.

In addition to Tudyk, Proyas directed other actors playing NS-5s on set. For these secondary robots, Digital Domain motion-captured one actor and various stunt people and then created performances to match the green-suited actors. “For each shot, we had five setups,” says Nelson. “Rehearse with the proxies [green-suited actors], shoot with the proxies, shoot with lead actors acting to air, shoot the clean plate, and shoot a reference pass.” In the latter setup, a stand-in robot and gray and shiny chrome balls were used for CG lighting reference. Also, the crew took multiple-exposure shots for High Dynamic Range Images; Digital Domain built a compact, portable, fish-eye motion-control head that they called “Robotile” to shoot the multiple exposures.

At left: The new, translucent NS-5 robots created at Digital Domain look identical coming out of the factory, with one exception: The lead character, Sonny, has blue eyes. Below: Bloodied digital robots attack Will Smith’s digital Audi in an all-CG sequence created at Weta Digital.



•••• Film

For motion capture, Digital Domain used equipment and software from Motion Analysis; for animation, Alias's Maya. "Motion Analysis handled retargeting of the data onto a moving skeleton, and we built a Maya plug-in that transfers that onto our puppet—an FK/IK switching skeleton that animators use," says Jones. "Animators often hate mocap because it's all FK. But if you take the FK out of the joints, you end up with smooth, spongy movements. Our plug-in transferred the data and kept the hardness, the impact from the motion capture."

Jones continues: "We have a series of controls that animators can use to rotate the feet, hands, shoulders, and head that reduce the number of curves animators have to deal with, and this speeds things up. The plug-in baked the mocap data onto these controls."



One thing the group learned was that the robot needed a new shoulder joint. Originally designed as a simple ball joint, it limited Sonny's movement "When Sonny shoots a gun, we used his shoulder to give him a lock-and-load feeling," says Jones. They also played with his spine, twisting Sonny 180 degrees at his waist to reinforce the fact that he's a machine, not a man.

For Sonny's facial animation, Digital Domain animators used a combination of shape-blending tools and clusters to pull points as they emulated video reference of Tudyk delivering lines of dialog. Because Tudyk's face didn't match Sonny's, the animators had to interpret Tudyk's performance. Also, the robot's design made creating an emotional performance difficult. "Erick Miller wrote tools that allowed us to blend with spline interpolation, which created a more organic curve movement on the skin," Jones says. "We couldn't put too many wrinkles in his face because they wanted an innocent baby look."

Thus, bringing Sonny to life became a dance between animation and light. "He was difficult to light without making his expressions disappear," says Jones. "He had a physical eyebrow, but because there was no dark line for the shape, we were always moving the specular hit to form the brow."

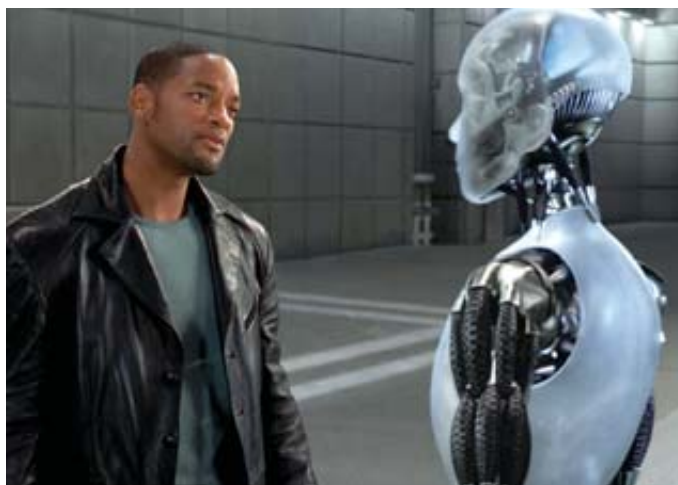
More than Skin Deep

Erik Nash, visual effects supervisor at Digital Domain, managed the lighting. "Andy [Jones] was the keeper of the emotion," says Nash. "I was the keeper of realism. A lot of the time the two goals would be in direct opposition." Adding to the mix was the need to see the machine man's internal mechanisms while keeping enough opacity in the face to allow subtle nuances of expression.

Most of Digital Domain's 520 shots included Sonny; some had thousands of the NS-5s look-alikes. The studio worked for 14 months to create them. "I asked the crew if it was the most complex CG creation they'd worked on, and they all said absolutely," Nash says.

For flexibility in creating the NS-5 look, the team opted for rendering the robots in many layers that were composited in D2 Software's Nuke, developed at Digital Domain. "Other than bak-

Sonny's body was animated using mocap data from actor Alan Tudyk's on-set performance. The robot's intentionally bland face made it difficult for animators to give the robot an emotional performance, but the lighting crew helped with specular hits that defined otherwise non-existent eyebrows.



ing in the key-light direction and the ratio of key light to fill light, all the aspects of how the robot looked were adjustable in compositing," Nash says. "If we had tried to render the robots with a final look, we would never have finished."

The metallic understructure of the robot and the translucent shell each had diffuse, specular, and reflection layers. In addition, the shell had a Fresnel layer that told the compositing software the angle of the surface to the camera. "The optical proper-



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Frame from animated short "No Class"
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•••• Film

ties of the shell were very complicated because of the refraction, reflection, and diffusion, so we had to find clever ways to get around doing real raytracing and refraction calculations.”

The robot layers were rendered with Pixar’s RenderMan using the EXR format, which extended the range of possible colors, creating details in the bright and the dark areas. “We wrote a special plug-in for Nuke, which we dubbed ‘Make Bot,’ that handled the 40 or 50 layers that make up each robot,” says Nash.

Reflections

Once the team had all the layers working together, it began working on the problem of putting the robot into the environment. “Alex wanted the robot to be a chameleon,” says Nash. “His appearance changed dramatically in different lighting conditions. So for each environment, we had to go through the process of discovery.”

Unfortunately, the sets were not lit with the robots in mind. “The robots looked best in three-quarters backlight,” Nash says, “which is not how you’d light people. We’d wheel our stand-in onto the set, shoot a couple feet of film, and invariably the director of photography would lean over after seeing the robot in the set lit for the actors and say, ‘Now you’re going to make it look better than that, aren’t you?’”

Although much of their effort went into Sonny, Digital Domain worked on a sequence near the end with crowds of robots climbing buildings, shots with a one-armed robot fighting Will Smith, a factory floor shot with 1500 robots, and “a ton” of set extensions. Both Weta and Digital Domain had shots in a dig-

ital glass skyscraper that was USR’s corporate headquarters. Digital Domain’s version was built and rendered in NewTek’s LightWave. “It looks like a glass wing standing on end,” Nash says. “The whole inside of the building reflects everything.” In a sequence on an elevated walkway, the robots are surrounded on three sides by glass that reflects the opposite wall, the walkway, the city outside, the robots climbing the building, and the robots inside, which are also reflecting and refracting everything. “It’s a big action sequence with the camera always moving,” he says, “so we had to render motion blur into the background plates. We brought in extra renderfarms for a couple of months.”

Cast of Thousands

Meanwhile, Weta worked on the big, wide shots, including the film’s “establishing” shot. “The old-style robots were getting replaced with the new robots that had the translucent faces over mechanical skeletons,” says Joe Letteri, visual effects supervisor. This sequence involved placing robots into plate photography, but as the movie progressed, so did the complexity of the shots.

Of all the 310 shots created at Weta, the tunnel chase sequence was, arguably, the most interesting. The sequence, comprising some 90 shots, takes place in a completely CG environment—a 10-lane tunnel running under Chicago where Will Smith, driving a futuristic Audi, is attacked by two gigantic truckloads of robots.

“We’re equipped for doing big scenes with lots of layers and interaction between lots of elements,” says Eric Saindon, CG supervisor at Weta, “but the tunnel sequence really put our pipeline to the test. Most of the shots were all CG, including Will

REAL-TIME ON-SET COMPOSITING

While *I, Robot* was being filmed, the crew used General Lift’s EncodaCam system to put live-action actors on greenscreen stages into CG environments. With this system, encoders on cameras sent data through motion-control heads into a virtual set system that provided real-time renders of digital sets based on the camera move. Those sets were mixed with the videotape feed from the film camera. “It was great to look at Will Smith on the greenscreen stage and then look at the monitor and see him amongst a thousand robots,” says Erik Nash, visual effects supervisor at Digital Domain. “It helped people keep their bearings.” That helped the director and actors, but it also helped the camera operator who could, for example, look 50 floors down from the 12-foot ledge on a greenscreen stage.

“We could start with the actors on set and in real time follow them into full-digital set extensions. That enabled our camera operator to find shots on CG sets,” explains John Nelson, visual effects supervisor. “Being able to see shots on set

brings a whole new hands-on approach to something that’s usually decided in a dark room late at night by tired people.”

The system gave editors something more to work with than people in green rooms, and gave the visual effects crew shots with complete camera moves in them. “Normally, when the camera operator pans off the greenscreen, the camera stops and the half-finished shot goes to editorial, but they can’t see anything,” says Brian Van’t Hul, the on-set visual effects supervisor for Weta, where many of *I, Robot*’s huge digital sets were created. “So the visual effects vendor has to figure out what the camera move should be. But with this, the editors get quick composites created and recorded on set.” —BR



General Lift’s EncodaCam system made it possible to see digital proxies of robots with actor Will Smith on a virtual set during Smith’s greenscreen performance.

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•••• Film



Smith.” The studio borrowed Digital Domain’s digital double of Will Smith. “We used the textures for the digital double, but not the shaders because they use a different method for rendering and compositing,” says Saindon.

Weta uses a combination of Maya for modeling, RenderMan for rendering, and Apple’s Shake for compositing, preferring to create more of the lighting and the look in rendering than in compositing. “We hammered on Gollum for months, so we could put him in a scene and light him, and he would work like a real character,” says Letteri. “But we couldn’t do that with the robots because of all the translucency and transparency, so in this film we finished the lighting in Shake.”

In the tunnel, for example, the crew had to deal with hundreds of light sources. “We had to light it with as many lights as there would be in a real tunnel,” says Letteri, “hundreds and hundreds of lights because it’s so huge, and the car is moving at 200 mph.”

While the car is moving, light is bouncing off its shiny silver exterior, off the stainless steel trucks, the walls and ceiling of the tunnel, and, of course, the robots. “It was quite a process,” says Saindon. “We had lots of raytracing—the car into the truck, robots into the truck into the car—and lots of movement. If we had too much straight lighting, it looked like a good video game, not a tunnel, so we used global illumination on the tunnel to fill in the areas and make it feel like light was bouncing around. With the new RenderMan, we were able to cache the occlusion passes, so we cached the lighting into the geometry without calculating it on every frame.”

Much of the work went into making the environment look

Weta Digital created the tunnel, trucks, car, robots, and sometimes Will Smith's double for this fast-moving, sequence with hundreds of lights and reflections.



imperfect. “We started going toward ‘Utopian,’” says Erik Winquist, compositing supervisor at Weta, “but it looked too fake.” Also, the crew developed a rig to pulse lights on the CG objects and added color by making some of the lights orange and some slightly green.

In addition to the neighborhood robots and the tunnel sequence, Weta handled the robot wars, using Massive Software’s Massive crowd program and Jon Allit’s Grunt rendering software much as the studio did for *Lord of the Rings*. “We did hero animation for about 70 robots,” says Saindon, “and then used Massive for the war with the NS-5s fighting the NS-4s. When the robots are turning, looking, and walking, that’s all mocap and Massive, but the big fighting shots where they’re ripping heads off are all hero-animated.”

The studio also created the battleground. “One of the biggest things for these shots was building the environments,” says Letteri. “We used Lidar data of Chicago, then added hero buildings and background buildings.”

For Digital Domain, the film provided the studio a chance to flex its character muscles, and for Weta, a chance to leave organic Middle Earth and enter the future. “I think this film is pushing the state of the art,” says Nelson, “particularly the subsurface of the robot and the kind of action shots we were able to do. We have thousands of robots and a very emotional performance by a robot that is a digital character.”

Using a 50-year-old, 20th-century story and 21st-century computer graphics, these studios and the rest of the team have advanced the future of visual effects. ■■

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Visual

The sound, and look, of music changed forever in the 1960s when British bands started the pop-music revolution and, unwittingly, jump-started the music video craze. Initially, groups such as The Beatles, the Rolling Stones, Procol Harum, and others created films to promote new releases, especially for locations where they weren't touring. But it was the band Queen that set the stage for the first true music video in 1975 when it used videotape instead of film to accompany the song *Bohemian Rhapsody* and, exploiting the more economical and creative-friendly format, introduced a conceptual rather than concert-like style containing effects created in camera. The video, which aired on the UK's *Top of the Pops* took notice of the video's success, but without a the music video bandwagon—that is, until MTV only had to focus on creating beautiful music, music. With no clear standard to emulate—create—and innovate. A few years Jackson, expanded the music short films, like the one for chord in the medium, musicians that concentrated on "shock creativity was the sheer number of video format by creating videos that resembled late, musicians and producers were free to later, some performers, including Michael Jackson's hit *Thriller*. Still trying to strike a new value" rather than creative style. • Further eroding music videos that performers were producing. What once started as an artistic statement, a visual interpretation of a song, became little more than a requisite advertisement for a record or an album. As a result, a number of bands have taken a mass-production approach to their music videos by using inexpensive shots of the group performing a song. • Yet, there are some who have continued to innovate within the medium, most recently through the inventive application of digital effects, whether to create a unique style or to advance a song's story line. • The first part of this series examines how leading-edge effects houses are reinventing the medium with original and elaborate CG-driven projects that are music for the eyes as well as the ears. Next month, Part II will show how some vanguard studios are pushing the traditional definition of music videos into other realms—perhaps creating the next music video evolution.

Notes

Musicians 'band' with CG artists to release inventive video hits

By Karen Moltenbrey

On August 1, 1981, music was reborn when the fledgling cable broadcast station Music Television (MTV) began playing music videos around the clock, augmenting the auditory experience with a visual one. When MTV kicked off what eventually became a momentous event in music history, its playlist was limited because bands, until this time, had little, if any, reason to make videos. So the station chose the song *Video Killed the Radio Star* from the disbanded Buggles as its inaugural selection.

Today, that title couldn't ring less true, as nearly every recording artist—from struggling newcomer to veteran with an armful of Grammys—creates an accompanying music video right after cutting a potential hit song. And leading them from the recording studio to the production studio are the record-label executives, who recognize the value of the medium for generating album sales. "A music video, after all, is an advertisement for a band, and it's one of the group's biggest marketing tools," says Ken Locsmandi, visual effects supervisor at FilmworksFX, which recently finished 116 effects shots for Key To Arson's *One Last Night* video, with Locsmandi directing.

Aside from the obvious commercial aspect, the medium also allows musicians to "explain" their songs. "Music and storytelling fit so well together, and they always have," says director and digital artist Kevin

Carrico, whose Skylight Digital Images facility recently created what he calls a "musically based short film" for Robb Roy's *What If*. "Your ears will lead you to an understanding that a thing exists, but your eyes will make you feel and believe that it actually does. The visuals can provide an extended level to the music."

Helping audiences "visualize" an artist's music are postproduction houses, hired by the director of the video. Often, the two will forge a close working relationship and collaborate on a number of projects, as is the case with Riot and director Dave Meyers. One of their projects was for the Ludacris video *Stand Up* (which recently won a Music Video Production Association award for best effects), followed by a number of others, including an effects-heavy project for Dilated Peoples' *This Way* video. Another successful pair is Kroma and director Joseph Kahn, who created unique music videos for Britney Spears's *Toxic*, the Chemical Brothers' *Get Yourself High*, and Ricky Martin's *Juramento*. (See the accompanying sidebars for the visual high notes of these and other recent cutting-edge music videos.)

"Joseph Kahn is constantly testing new effects and pushing limits in music videos," says Bert Yukich, visual effects supervisor at Kroma. "He's always trying to come up with something that hasn't been done

before, and it's our job to figure out how to accomplish those things in the most efficient and effective way possible."

While some facilities have been producing music videos for several years, others are fairly new to the space, having added them to their commercial and episodic television projects dur-

ing the past few years. Conversely, at some effects and production houses, including Moneyshots, music video projects exceed broadcast work. Because the equipment, tasks, and approach are similar, studios can transition between the two types of work easily. Generally, both require similar composition, lighting, and form, and entail



A successful music video, like a song, must rock audiences. So for *One Last Night*, artists created a surreal digital set (bottom) for Key To Arson by adding CG to plain greenscreen shots of the band (top).

•••• Music Videos

a tremendous amount of 2D and 3D compositing, in particular, adding special effects and digital imagery to live-action scenes. But unlike episodic TV, commercials and music videos are shorter in length and require effects artists to perfect almost every frame, notes Jason Fotter, lead artist at Encore Hollywood, which completed a number of recent music videos, including Limp Bizkit's *Behind Blue Eyes*.

The Same, But Different

While the work may be more similar than disparate, there are some significant differences between commercial and music video projects. Commercials, which run 30 to 60 seconds, are far shorter than their 3- to 5-minute video counterparts. And whereas a fast-paced 30-second commercial may have 30 shots, a video will have between 300 and 400 shots, and a good portion of them can include

effects, notes Kevin Fanning, effects supervisor at Shooters Post & Transfer, makers of Wyclef Jean's *Industry* video. As a result, he says, videos tend to have a lot more edits, effects shots, imagery, and locations that, like shorter works, must follow a theme.

While videos may be longer than commercials, they require a faster turnaround. A large commercial project can run four to five months, whereas a large music video project will have a two- to three-week deadline, and an average-size video will require a week or less, though many studios report having just a single day to complete some work. "It all depends on what the record-label executives are trying to do. They may want to time the video release to the release of a single on the radio or on the Internet, or coordinate the video with the release of an album or a movie, if it's a sound-track video," says Les Umber-

For 99 Problems from rapper Jay-Z, Encore digitally enhanced the video's black-and-white imagery, giving it a gritty look reflective of the emotionally charged scenes.



ger, visual effects supervisor and artist at Riot. "Record-label execs make decisions quickly, and they want [a product] just as fast."

Despite the record pace and required work, music videos carry a relatively low price tag compared to the more lucrative commercials. Although some big-budget videos, such as Britney Spears's *Toxic*, can cost upward of \$1.5 million, most fall into the \$300,000 range. And there are the "one take, no edit" projects that run only a few thousand dollars.

Wyclef Jean's Industry
For Wyclef Jean's *Industry* video, Shooters Post & Transfer replicated a complex technique from the feature-film industry to create a realistic moving background for the outside of a cab in which the former Fugees front man is riding.

The video, which was supposed to be shot on location in New York City, was instead shot on a greenscreen set due to logistics and weather-related issues. As a result, Shooters was charged with compositing moving street-scene film footage outside the car's windows, similar to the technique used in the movie *Road to Perdition*. The group accomplished this complicated effect using Discreet's Flame and Fire, and Adobe's After Effects. To make the scenes look more natural, the group also added realistic shadows and reflections to the windows and glass divider separating the front of the car from the back. Color correction was done using a Da Vinci 2K Plus system.



As a whole, music video budgets have declined by one-half to one-third in recent years. "Yet directors continue to write treat-

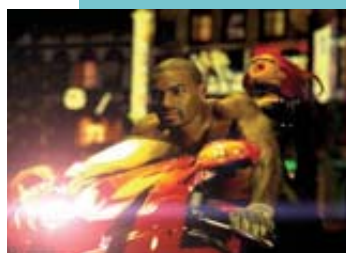
singer to race through Paris streets on the back of a motorcycle driven by model Tyson Beckford. Instead, a team at Kroma created a photorealistic digital double of the singer and of Beckford, which were built, animated, and textured using Softimage|XSI, and composited into the live action using an Avid DS Nitris system.

In addition, the artists built a virtual Paris and London, which were constructed from 2D drawings. Though they contain recognizable landmarks, the locales were given a futuristic cast through the addition of colorful CG neon signage and other accents. The artists later integrated the real actors into the digital environments by gathering HDRI lighting information from the live-action shoot and from scenes they filmed in downtown Los Angeles at night. They then used the information to apply natural urban lighting to the 3D street scenes.

Britney Spears's Toxic

In the intoxicating, effects-heavy *Toxic* video, pop star Britney Spears assumes the role of a femme fatale, performing super-spy activities thanks to the challenging "undercover" work by Kroma, which used a wide range of sophisticated digital imagery for nearly every scene in the action-packed, story-driven video.

Among the characters Spears plays are a sexy blonde stewardess, a red-haired spy, and a black-maned superhero. Yet some roles that she didn't have to assume were for a number of intense scenes, including one that called for the



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•••• Music Videos

ments that involve inventive storytelling techniques and complex visual effects,” says Chris Eckardt, lead artist at Moneyshots. “On the post side, we’re constantly challenged to deliver new and innovative looks in less time for less money.” The reason budgets are shrinking, he speculates, is because of alternate distribution methods such as the Internet, which cannot support the lavish budgets of the once-novel medium. Even MTV, he points out, is increasingly replacing music videos with reality-based shows and other programs, and this is reflected in a project’s bottom line.

Despite those obstacles, music video production is not slowing down. One reason is because the videos are finding alternative airtime, either on other music video stations or on the Internet. “We’re now facing double deadlines,” says Eckardt, “AOL one day and MTV the next.”

Creative Quest

With nearly impossible deadlines and little return on investment, why do postproduction houses readily accept these projects? One reason is the creative license that a client is willing to offer. Indeed, a large portion of the postproduction process typically involves “beauty work” to show musicians—most often female performers—in the best possible light. But when money is not an overwhelming factor, clients tend to give studios more creative freedom because having a specific number of band shots and close-ups becomes less of an issue. This, in turns, allows the studio to use a narrative format, for instance.

According to Riot’s Umberger, music videos generally pose no creative boundaries for his group. “You receive a treatment from the director that is sort of explicit, but when you get into the effects, it’s up to the artists and their imaginations to decide how far to take the concept,” he says. “Unlike commercials, which are conservative, subtle, and have a specific targeted message, music videos are open doors, allowing the artists to get

as crazy and abstract as they want. As long as it’s cool, it’s totally acceptable.”

FilmworksFX’s Locsmandi concurs, noting that another factor contributing to this artistic freedom is the “mystery” of computer graphics. “Many directors and producers realize that CG is powerful, but most don’t understand the minute details of the technology,” he

notes. “CG is still black magic to many people, so they just let the artists do what they do—make cool images.”

Limp Bizkit’s Behind Blue Eyes

For *Behind Blue Eyes*, a music video from Limp Bizkit, Encore Hollywood decided to break with traditional technology by using high definition rather than the usual standard-definition format, allowing the group to reach a higher octave with the sharper-focused imagery. In turn, the cutting-edge video required a substantial commitment from Encore, whose color correction, visual effects production, and post work had to be flawless in the “unforgiving” format, which is being pushed hard by certain networks, though not by MTV at this time.

In the video to the song, which is featured on the sound track for the film *Gothica*, actress Halle Berry and Limp Bizkit’s front man Fred Durst share a 45-second kiss that ends with the



pair having exchanged identities. The scene opens with Durst and Berry in a dream-like setting where they appear engulfed in a thick, white mist. The two were filmed against greenscreen lip-syncing the lyrics of the song. Encore later composited the couple into the synthetic environment of artificial haze using Eyeon Software’s Digital Fusion.

The artists then had to ensure that the greenscreen elements blended into the ethereal environment. This required the imagery to undergo an elaborate color-correction process so that the couple’s skin tones reflected the white environment. Complicating this task was the disparity in Berry’s and Durst’s skin tones, a challenge that required the artists to use multiple windows to color each person separately. This enabled the Encore group to achieve a silvery, metallic look while keeping the skin tones intact.

Complementing the song and the overall graphic style of the video was a soft, pale-blue glow, added by the artists in postproduction.

Nelly Furtado’s Powerless

The complexity of the digital imagery used in Nelly Furtado’s *Powerless* (*Say What You Want*) video is masked by its understated presentation. Yet the imagery proved essential in providing a unique visual reference to depict the classic psychological metaphor on which the song is based: the singer trapped in a box from which she tries to escape. Inside, the box is plastered with digitally crafted posters that act as doors or windows to the singer’s imagination.

The video was shot on a greenscreen set with a large crate prop. To create the approximately 25 posters, Moneyshots designed the elements in 2D using Adobe’s Photoshop and Illustrator. To build the digital crate environment for the posters, the artists used the 3D capabilities within Discreet’s Flame. Later, the team roto-scoped the actual box prop from the scene using Discreet’s Combustion and Flame.





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•••• Music Videos

**Ludacris's Stand Up**

Riot artists had their work cut out for them when creating an imaginative, larger-than-life scenario using a range of digital and practical imagery—including traditional cel animation, 3D computer graphics, matte paintings, and in-camera effects—for Ludacris's *Stand Up* video in which the rapper appears in a number of strange guises, including that of a dancing baby boy.

Receiving a Music Video Production Association award recently, the video features diverse, stylized visuals—oversized LPs, beer bottles, pieces of fried chicken, and more—blended into a bizarre array of scenes reflective of the performer's own wild and eccentric style. Through the use of digital wizardry, Ludacris himself appears in even stranger forms, including one in the final scene where he is sporting a 5-foot-tall Afro.

The team also generated a lengthy animated digital sequence that is used halfway through the video in which stylized images of Ludacris and others appear

over a series of pop-art backgrounds. To achieve this result, the artists shot Ludacris and the other performers against greenscreen, and then imported the images into Discreet's Flame. Within that program, they grabbed colors from the clothing and turned them into solid geometric shapes so that the images became flat and simplified, thereby resembling primitive animated characters. The backgrounds, meanwhile, were created as digital matte paintings. Last, the elements were composited in 3D space, giving the animation depth of field. The group further enhanced the animated look by altering the frame rate of the sequence.

The group created the baby Ludacris by employing a compositing technique within Discreet's Inferno, in which the rapper and the baby were filmed separately against greenscreen, with a green-clad stagehand holding the baby and making him appear to dance. Then, Riot shrunk Ludacris's head to fit the baby's body, and digitally altered his neck to resemble the thickness of an infant's neck.



In addition to independence, music videos also offer post houses an opportunity to test new tools and techniques. "If there is an idea I've been toying around with, if there is a new way of doing something, or if I have a new plug-in, music videos make the perfect testing ground," says Riot's Umberger. "Artists want to be the first to do something. So if you can come up with something that's never been seen before, everyone seems to go crazy over it."

When time is limited, though, artists often must revert to more tried-and-true techniques, but that doesn't mean that serendipity cannot be achieved. "Deadlines have to be met," maintains FilmworksFX's Locsmandi. "Yet, there's a wrong way to do some-

thing, and that's to do it slowly and without using aesthetics."

Fortunately, with more sophisticated tools and technology now available, studios are able to offer compelling and photorealistic images faster and cheaper than ever. Ten years ago, \$100,000 would have gotten you about 10 CG shots, says Kroma's Yukich, whereas today you can get an entire video done [in CG] for that price.

However, more doesn't necessarily mean better. According to Skylight's Carrico, the earliest music videos were highly experimental; there were no rules, so anything went. Today, however, music videos as a collective whole have lost that early appeal, he

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**Chemical Brothers' Get Yourself High**

In a unique visual approach, Kroma used a complex, inventive digital remix process to integrate 3D imagery into live-action footage gleaned from a 1978 martial arts film for the Chemical Brothers' hip-hop *Get Yourself High* video. So in addition to wielding swords and knives, as they did in the original film, the actors are now handling vinyl records, microphones, and headphones while they appear to be singing the lyrics of the song.

To accomplish this scenario, Kroma first motion-captured an actor singing the song, which allowed the artists to record the lip, jaw, and cheek movements. They then applied the resulting data to a CG head crafted in Softimage|XSI that they textured, modified, and blended into various scenes.

For other shots, the artists were able to use CG mouth replacements, which they composited onto the live actors in the original film footage. In all, the team generated nearly 60 jaw replacements, which were morphed into the altered scenes with Avid's Elastic Reality.

To augment these shots, the artists modeled a number of 3D objects, which they added to the footage using an Avid DS Nitris. To replicate the degraded look of their poor-quality copy of the movie, the artists employed approximately 50 filters so that the CG appeared to be a natural part of the film.

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•••• Music Videos

**OutKast's Hey Ya!**

The complexity of the effects in OutKast's *Hey Ya!* video is deceiving, but the creative work didn't go unnoticed, as it landed Moneyshots a Visual Effects Society nomination and a Grammy nod.

"The director wanted a smooth, seamless presentation of [vocalist] Andre 3000 appearing as various band members, wearing different clothing and playing different instruments," says Elad Offer, creative director at Moneyshots.

"The characters had to mirror one another in terms of Andre's stylized move-

ments and appearance, yet provide the illusion they were different people."

To accomplish the desired effect, the group filmed the singer eight times on a real set, rather than against greenscreen, so he would retain his energy and synergy throughout the performance. During each shoot, Andre 3000 donned various costumes and ran through the song as a specific character, from lead singer to backup singer to bassist to keyboard player and more. In post, the team roto-scoped him from each sequence using Discreet's Combustion, then the artists tracked the image into the final live environment using Discreet's Flame.



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contends, and cinematic independence has been replaced by projects that are "copycatted, rubber-stamped, or derivative."

One reason for this, according to FilmworksFX's Locsmandi, is the economic decline in the music industry. "Even with all the new technologies, music videos have become less creative," he says. "Directors are trying to shoot with what little money they have available, and post work is expensive." As a result, music videos have become a mixed bag because the record labels want more of everything but want to pay less for it. So you have to do innovative things that are cost-effective and visually stimulating, he adds.

Pumping Up the Volume

After enjoying a spot at the top of the entertainment chart for more than two decades, music videos are no longer the novelty they once were. Still, they continue to proliferate, and with good reason: The fans enjoy them, and the bands reap valuable advertising from them. And while some musicians opt for the unexciting "plug-and-play" performances, as Encore's Fotter calls them, there are those who are continuing to find new and inventive ways of visualizing music through the use of cutting-edge digital tools

and techniques that enable them to turn up the creative volume.

"Creativity is crucial, no matter whether you are shooting a video in camera or doing it all in post using special effects," says Fanning of Shooters. "The end result can be spectacular as long as there is something interesting."

Eckardt of Moneyshots concurs, pointing out that on a recent trip to Asia and Europe, he had tuned in to local music video stations



Busta Rhymes's *Shorty* video soared after Moneyshots added spatial perspective to the footage shot from inside an airplane by integrating CG scenes.

and found that despite having tight budgets, the videos were very imaginative, with strong narratives, beautiful cinematography, and digital imagery that complemented a particular concept. "The producers seemed to step out on a limb, and inventive things were happening within the videos," he says.

And for the most part, these inventive moments are occurring within post-production. "Post coupled with CG is the last frontier for music videos,"

Locsmandi states. This is evident in a number of projects by Kroma and others that promote the medium's creative and wild sides. Among these are cinematic videos, such as Britney Spears's *Toxic*, that focus on storytelling. Although these videos tend to be more expensive, they are usually better received by audiences, claims Riot's Umberger. "If people feel like they get lost in the video and in the song, and it's a great dramatic or comedic moment, then the public latches onto that," he says.

Video hasn't killed the radio star. But to make music videos the gold hits they once were, all the artists—the performers, the directors, and the digital content creators—must continue pushing the creative boundary in order to hit a high note with audiences. ■■

Karen Moltenbrey is a senior technical editor for Computer Graphics World.

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mobile gaming prepares for takeoff

Attitudes toward mobile gaming have amounted to a kind of gold fever over the past couple of years, with the media describing the technology in terms such as “set to explode.”

Certainly growth looks substantial, if not explosive. According to a recent report titled “Winning and Losing in Mobile Games” from wireless communications analyst Alexander Resources, worldwide revenues from mobile games are forecasted to grow from just under \$500 million in 2002 to nearly \$2 billion by 2006.

Without a doubt, there are game-related riches to be mined by companies that make mobile hardware, provide wireless service, or write software for mobile platforms. And many companies are now looking beyond the vein of 2D applications currently available in the US, toward 3D, which will demand a new generation of 3D-enabled devices.

“We have an interest in seeing that graphics devices continually improve,” candidly notes Brian Murray, system architect for Freescale Semiconductor, a recently formed subsidiary of Motorola. Freescale produces application processors, including the iMX family that is being incorporated into many of the next-generation mobile devices enabling small-screen 3D graphics. From the carrier standpoint, companies such as Verizon are preparing an expanding menu of 3D content in the hopes of

enticing customers into extending their phone usage beyond voice calls.

These plans are not based on analyst predictions and wishful thinking alone. Consider the success of 2D mobile gaming: Blue Lava’s *Tetris*, for example, enjoyed its one-millionth paid download earlier this year. If 2D titles are so popular,

A huge potential user base, a standard API, and some hot new hardware fuel an emerging market

By Jenny Donelan

then 3D titles will be even more so, goes the conventional wisdom. This could be the case, because 3D game titles have more or less eclipsed 2D on the PC and console platforms.

The most tantalizing aspect of the market involves the sheer number of potential 3D game users. Industry firms estimate that between 500 million and 600 million wireless handheld devices, including PDAs and phones, are sold each year worldwide, notes Robert McNair, Intel’s director of marketing for handheld graphics. These figures compare to a mere 100 million to 200 million PCs sold annually. “It’s analogous to what happened to PCs [when these became standard items], but half an order of magnitude larger,” says McNair.

Perception Versus Reality

Despite the fanfare—which is considerable, with announcements of new mobile 3D processors, handsets, and game titles as numerous as cicadas this summer and

nearly as buzzy—there actually isn’t a great deal of mobile 3D gaming going on yet in the US. It’s not that the announcements are without basis—game developers are developing, and processor and phone manufacturers are ramping up production of 3D-enabled devices. It’s just that not many of the actual hardware or software products have arrived yet.

What exists now in terms of commercially available products are phones and handheld gaming devices that can handle some 3D, but more often what game developers refer to as “2.5D”—in which height is modeled by storing a Z value at each point. The effect is that of 2D graphics with some depth.

The mobile gaming devices with the highest 3D capability at present include Nintendo’s Game Boy Advance, Nokia’s N-Gage game deck, and some 3D-capable wireless phones. Game developers have been busy at work providing 3D, 2.5D, and 2D titles for these platforms. Sony Pictures Mobile, for example, is currently developing several 3D games for mobile phones, including a 3D version of *Spider-Man 2* (it also has 2D *Spider-Man 2* games), a first-person shooter called *S.W.A.T. the Movie: 3D Game*, and a 3D *Ghostbusters*. These titles will be available in Asia first, and then in the US in early fall as capable hardware comes to market, according to Rio Caraeff, vice president of Sony Pictures Mobile.

But 3D mobile games, and especially those on phones, don’t approach console or desktop quality in terms of graphics. That quality will begin to appear, say many experts, when a new generation of hardware and software begins shipping at the end of this year to the early part of next. That’s when phones that can handle 3D, and the software that works with the phones that can handle 3D, will begin to appear in sufficient numbers to spark even further development.

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The phones themselves are a major gating factor. Wireless 3D content requires a handset of a sophistication that the average cell phone in the US currently lacks. Many, for example, still use black-and-white displays. In Korea and Japan, where mobile technology is more cutting-edge, the situation is a bit different. Japan's HI Corp., for example, has been creating and selling mobile 3D content for well more than a year (see "Graphics to Go," April 2003, pg. 28). Most experts say that users in the Far East, and even in Europe, are more inclined to mobile technology than their North American counterparts. Whatever the reasons, the US lags behind Korea, Japan, and Europe when it comes to wireless applications.

The OpenGL ES Standard

Users and their attitudes toward wireless aside, a few hurdles must be cleared before 3D mobile technology can take off in a big way in North America. New phones represent just one obstacle. Other components—the processors, service providers, operating systems, and the content itself—must mesh to enable 3D on cell phones and other devices. To help ensure that they do, the Khronos Group, an open standards body with more than 50 members from the graphics industry, has established OpenGL ES (OpenGL for embedded systems), a low-level API (application program interface).

"There are certainly some core issues that a low-level API like OpenGL ES can solve, just as it [OpenGL] did on the PC," says Neil Trevett, senior vice president of market development at 3Dlabs and president of the Khronos Group. "It's the contract between the hardware and the software community. Once the industry can agree on a standard, suddenly everyone is enabled. The hardware vendors, particularly the graphics vendors, can go off and implement it in



Image courtesy Intel.

The new PXA27x processors from Intel (upper left), incorporate the company's Wireless MMX technology for better 3D gaming and video performance, as well as extended battery life.

their silicon. And the software vendors know what functionality the hardware platforms are going to provide to them. This is even more important in the embedded space than it was on the PC, because the embedded space is much more fragmented and diverse."

A laundry list of who's behind the OpenGL ES reads like a who's who of hardware graphics technology. "It has all the right people," says Freescale's Murray. First, there are the cell phone vendors: Nokia, Sony-

Ericsson, Motorola, and Samsung, among others. There are the silicon vendors that supply the chips and accelerators that power the devices, including ARM, Motorola, and TI. The graphics accelerator community is represented by Nvidia, ATI,

and 3Dlabs. Wireless OS developers, such as Palm and Symbian, belong to the Khronos Group, as well as such wireless middleware vendors as Hybrid Graphics and Fathammer. Discreet (whose 3ds max 3D content creation tool is already well entrenched in PC and console game development houses), is a member, and so is Sun. Sun's JSR 184, a high-level API for Java-based mobile 3D, is another important factor in the future of high-quality 3D on the mobile platform. JSR 184 is designed to mesh smoothly with the lower-level OpenGL ES API, in much the same way that Java3D sits atop OpenGL on the PC platform. (For developers that prefer a low-level graphics interface, Sun also has JSR 239.)

We even have our first service provider member, which is SK Telecom [out of Korea]," says Trevett. "Korea seems to be ground zero for handheld gaming. You can already walk into a store in Korea and buy an OpenGL ES-enabled cell phone. It will be possible everywhere else, but it's happening there first."

OpenGL ES doesn't have any competition from other standards bodies, which is one reason why experts are predicting that wireless 3D will blossom quickly. One major player is noticeably absent from the initiative, however: Microsoft. The company has announced plans to build its own API—Direct 3D Mobile—into its Windows Mobile operating system. However, just as on the PC, OpenGL ES will be made available on Windows platforms by third-party hardware and software vendors—easing the portability of games titles between Windows and other platforms.

Some of the game developers themselves are taking a wait-and-see approach with regard to the emer-



Image courtesy Sony Pictures Mobile.

Spider-Man 2 vs. Doc Ock is a 2D game title from Sony Pictures Mobile that is available now for wireless platforms. Sony is preparing a 3D Spider-Man title for release later this year.

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gence of the market and OpenGL ES-based content and devices in the US. Though many support OpenGL ES, it is possible, they note, to create high-quality 3D content without it. "We follow OpenGL ES. We support it, but aren't participating in it," says Chris Ruff, vice president of marketing at UIEvolution, a platform developer for mobile games and other wireless content recently acquired by Square Enix. "We think it's a great initiative, but the problem with standards is that to get everyone to agree, the specs get watered down." Keeping the customer in mind, the company would, for example, potentially deviate from the spec to ship a better product.

It is also possible that 3D game graphics may not prove popular on little screens. Cell phone users, who represent the great majority of potential customers, may not care whether the game they're playing is 3D or not. As Kari Pulli, a research fellow for Nokia, points out, the play is the thing, not just pretty graphics. "You can make lots of compelling and quite good-looking games with 2.5D," he notes. But 3D in general could be helpful to game developers, according to ARM's 3D graphics product manager Ed Plowman. "There are significant advantages to developing mobile content in 3D. For example, it scales nicely [to small screens]," he observes. On the other hand, notes Sony's Caraeff, "3D games cost more and take longer to develop."



The Nokia N-Gage QD game deck can run 3D games, but also handles tasks such as personal information management, Web browsing, and e-mail.

Next-Gen Mobile Devices

The next generation of 3D-enabled mobile devices, which will probably, though not necessarily, be OpenGL ES-based, is poised to ship around the end of this year or the beginning of

the next. Nokia, for example, is releasing a number of high-end "smart phones" that will run on the Symbian mobile OS and be OpenGL ES-compliant. A number of new mobile devices will be based on Intel's new 2700 graphics processor line, which will support both OpenGL ES and Microsoft's Direct 3D Mobile. Names are hard to come by at this point in time, however. With the exception of Dell, which is coming out with a 2700-based Axim handheld, PDA-type device, Intel could not at press time name partners creating products with its new processor.

Though manufacturers are reluctant right now to divulge dates, and consumer demand remains an unequivocal wild card, the general consensus from hardware providers to software developers is that 3D mobile gaming is now more than a gleam in the eye of the service provider.

"My prediction," says Intel's McNair, "is that the mobile gaming market [including 2D and 3D] will be as big as the console market in five years' time, then even bigger."

"It's picking up," says Ville Miettinen, CTO for mobile platform middleware developer Hybrid Graphics. "Once the critical mass of devices in this market is reached, there will be loads of games. Trust me. It'll be huge." Companies and experts have predicted wrongly before, but the stage does seem set for a large-scale graphics revolution on some very tiny screens. ■■

Jenny Donelan (jdonelan@adelphia.net) is a contributing editor of Computer Graphics World.

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Farmer of the Month was one of 14 finalists in a mobile game prototype contest sponsored by Discreet this past year. For more about Discreet's contest, see "Mobile Gaming Goes 3D" on page 80.

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Now making its debut in a number of products, PCI Express technology is well on its way to becoming an industry standard By George Maestri



Workstations and servers in the graphics community are well known for being the fastest machines on the market. Graphics professionals demand of their systems cutting-edge speed. Whereas processor, graphics, disk, and networking speeds have increased dramatically over the past decade, the PCI (Peripheral Component Interconnect) bus used to connect those devices, has remained the same in terms of speed for nearly a decade—and it's showing its age. Developed by Intel, PCI Express completely revamps PCI and provides an upgrade path fast enough for the next generation of workstations and servers.

PCI has been the standard bus for PCs for roughly a decade, eclipsing the original ISA (Industry Standard Architecture) bus in the mid-1990s. Over the course of the decade, faster graphics, networking, and hard disks have all pushed the PCI bus to its limit. To remedy the bottleneck, a number of stop-gap solutions have been introduced over the years to add more bandwidth. Graphics were the first to get some relief, with the introduction of the AGP (Accelerated Graphics Port) slot now common on all PCs. PCI-X (not to be confused with PCI Express) was another solution that enhanced PCI's bandwidth, primarily on servers for Fibre Channel and Gigabit Ethernet cards.

While these solutions provided much-needed bandwidth, the wide variety of slots

and bus types complicated matters significantly. Today, a PC can have as many as three or four different types of card slots, making upgrades difficult. To confuse the issue further, even the new interfaces are starting to get tapped out. High-end graphics cards already are bumping up against AGP 8x's performance limits. And PCI-X is expensive, requiring a separate controller for each slot, essentially limiting it to the server market. Over the past few years, it became clear that the PCI bus needed to be totally revamped.

A Long Journey

Creating an entirely new interface standard is not easy, but Intel got together with a number of manufacturers a few years ago to create a robust and upgradable path for PCI. Called PCI Express, or PCIe, the new interface completely changes and unifies the way peripherals connect to the motherboard. The flexible interface not only provides increased bandwidth, but also enables devices that are normally found inside the PC case to be connected externally, opening up the possibility of new PC designs.

The first PCI Express systems and motherboards, introduced this summer by major manufacturers, look fairly standard. Dell, Hewlett-Packard, Alienware, IBM, and Boxx Technologies recently started shipping PCI



Industry-leading manufacturers of high-end graphics accelerators have begun debuting PCI Express-enabled boards, including such innovations as (top to bottom) ATI's FireGL 5100, 3Dlabs' Wildcat Realizm 800, and Nvidia's Quadro FX 3400.

Express systems. Graphics vendors, including ATI and Nvidia, also began offering PCIe cards this summer, and more vendors are sure to follow as the year progresses.

PCI Express has broad industry support and is poised to become the new standard. Vijay Sharma, marketing manager at ATI, indicates that it is likely to be the fastest ramp-up of a new bus in history. He estimates that 40 to 60 percent of all new PCs will be PCI Express-compliant by the end of 2004, and nearly 100 percent of the machines will be compliant by the end of 2005.

Bus Stop

PCI Express dispenses with the parallel interface that has been part of the PC bus since its inception. Instead, PCIe is based on serial communications. Serial interfaces suffer from much less interference than parallel connections, and they can be scaled for much higher speeds. In PCIe, a single serial connection can handle up to 500MB/second of data transfer, which is more than quadruple that of the PCI interface. Jeff Wood, director of workstation marketing for HP, notes that PCI cannot take full advantage of Gigabit Ethernet's bandwidth, whereas a single channel of PCI Express can.

To add even more bandwidth, PCI Express enables multiple serial connections to a single device. Called lanes, these connections determine the upper limit of a card's speed. A graphics card will accommodate up to 16 lanes, for example, while a network card may accept one or two.

This fact actually introduces a little bit of confusion into the equation. The ability to have multiple lanes means a PCI Express machine may have several different types of PCIe card slots. All systems will have a 16x slot for the graphics card, but manufacturers may divide up the remaining lanes as they see fit. Initial PCI Express chipsets provide for 24 lanes, so you will see a 16x slot for the graphics card, with other lanes filled by an 8x slot or any combination of 4x and 1x slots.

While this may be a little confusing, it is heartening to know that PCIe allows any card to fit into any slot, just as long as the

slot has enough lanes. A 1x card can fit into any available slot, for example, while a 4x card requires a 4x slot or higher to work. The 1x PCI Express card slots can coexist with a standard PCI slot. The connector sits in front of the PCI slot, allowing for a slot to be used either as a PCI or PCI Express slot. This is, of course, if OEMs design the motherboard to take advantage of this feature.

HP's new line of PCI Express workstations, for example, includes a variety of configurations. The low-end machines have several 1x slots, and the higher-end workstations have 4x slots, along with a 16x graphics slot and a handful of normal PCI slots. As for original PCI slots disappearing, HP's Wood says, "I doubt we'll see PCI go away completely anytime soon. It still provides sufficient bandwidth for many applications, and some customers will want to hang on to their older cards."

Technology Highway

Because PCI Express is serial-based, it allows for devices to be attached to the system via a serial cable, much like a FireWire or USB connector. While it's not set to compete directly with these standards soon, devices such as disk arrays or video decks could easily incorporate PCI Express to get increased bandwidth and speed.

In the future, PCI Express could cause the entire architecture of the PC to be reimagined. Intel has shown interest in making servers, and even workstations, modular, placing devices where they are needed.

This modularity could streamline the case of the PC, making it smaller and quieter, and also improving its upgradability. A network card could be integrated into a router or the graphics card could be integrated into the monitor, for example. Nobody has plans for breaking apart the PC just yet, and these sorts of configurations will need support from a wide range of vendors.

PCIe Arrives

The first companies to take advantage of PCI Express will be the graphics vendors, which need the added bandwidth. PCI Express will quickly eclipse AGP as the graph-

ics slot on most new workstations, and vendors such as 3DLabs, ATI, and Nvidia have already announced support for the standard across their product lines.

3DLabs has jumped into the PCI-Express world with the new Wildcat Realizm 800, which is expected to be a strong contender for the fastest card on the market. With such features as 512MB of video RAM, dual GPUs, and 128MB of geometry memory, along with genlock capabilities, the Wildcat Realizm 800 promises to be a robust and ultra-high-end card.

Nvidia's latest offerings include the Quadro FX 3400, FX 130, and FX 330. To maximize bandwidth, Nvidia announced the Scalable Link Interface (SLI), which enables multiple graphics cards in a PCI Express machine to work as one.

ATI has implemented PCI Express across its entire product line, from entry-level cards all the way up to the workstation-class FireGL series. ATI's Sharma notes that all new ATI cards will be PCI Express-based, demonstrating the strong commitment vendors have to this new technology.

PCI Express offers immense bandwidth gains, as much as 15 times that of AGP. According to Jeff Brown, general manager of professional graphics at Nvidia, one of the biggest benefits is that it is equally fast in both directions, enabling data to be read as fast as it is written. In addition to enabling new applications, this capability will allow the powerful graphics processors on graphics cards to be used almost as a second processor. "PCI Express enables high-end applications, like real-time HD editing," says Sharma.

PCI Express is, without a doubt, the future of workstations. Those shopping for workstations will want to add PCI Express to the list of requirements, as it will be the standard within the next 12 months. The added performance and flexibility it affords will be of great benefit to anyone working in high-end graphics computing. ::

George Maestri is president of Rubberbug, a Los Angeles-based animation studio specializing in character animation.

Portfolio

SIGGRAPH 2004 Electronic Theater

**Clockwise from top left:**

Birthday Boy (Best Animated Short), directed by Sejong Park of the Australian Film Television and Radio School, captivates audiences with a compelling story of a little boy celebrating his birthday in wartime Korea.

Ryan (Jury Honors), directed by Chris Landreth, uses a novel rendering and animation style, achieved in Maya, for this "docu-animation" about Ryan Larkin, a once-influential animator who now panhandles. The short uses bizarre 3D characters to reflect the film's world of psychological realism.

Boundin', directed by Bud Luckey and Roger Gould of Pixar, shows what happens to a proud lamb, modeled in Maya and rendered with RenderMan, when it loses its lustrous coat.

During the past three decades, the SIGGRAPH Computer Animation Festival has evolved from informal screenings by a handful of artists showing their own films to one of the industry's top international venues for CG animation and visual effects. This year, a seven-person jury reviewed a record number of submissions, 643, and narrowed the selections to 83 pieces. Thirty of these will be featured in the prestigious Electronic Theater, while 53 will be shown in the Animation Theater. In addition, 18 animations will appear in the Art Gallery as part of the Synaesthesia exhibit.

According to chair Chris Bregler, this year's festival includes examples of edgy, experimental storytelling and filmmaking through innovative visual styles and, in some instances, "just good captivating stories with heart." Highlighting the Electronic Theater is what



Van Heeling Images © 2004 Universal Studios.

Bregler calls "amazing short stories," in particular, the two award winners: Chris Landreth's "Ryan" (Jury Honors) and Sejong Park's "Birthday Boy" (Best Animated Short).

This year's Electronic Theater also contains an unusually high number of studio pieces utilizing new technology. "For instance, there are a lot of CG effects incorporated into 'life actions' involving faces and full bodies that look very real and are difficult to distinguish from real-life footage," says Bregler. "We have one piece, 'The Parthenon' from Paul Debevec and his colleagues at the USC Institute for Creative Technologies, that blew me away because we thought it was a smart way of combining real film footage with CG, but after reviewing the materials, we found out that the entire piece is CG."

Selections of still images from the theater appear on these pages. —Karen Moltenbrey

Clockwise from top left:

RockFish, directed by Tim Miller of Blur, uses blended keyframe animation atop mocap for enhanced character performances.

Output-Sensitive Collision Processing, from Carnegie Mellon, illustrates a new collision-detection bounding algorithm.

Parenthese, directed by F. Blondeau, T. Deloof, J. Droulers, and C. Stampe from One Plus One, uses global illumination in this story of a man affected by time.

ILM R&D series contains feature-film segments illustrating the studio's recent R&D work for achieving photoreal performances.

The Parthenon, directed by Paul Debevec of USC, incorporates a new CG lighting technique used for visualizing digital imagery.

WORKSTATION

HP xw6200 Workstation

The xw6200 provides an excellent price-performance ratio

By George Maestri

With its new line of workstations, Hewlett-Packard enters the world of PCI Express (PCIe), a serial bus technology with much higher speed than conventional PCI. Although it initially will benefit graphics performance, PCI Express can be used for any number of applications.

I reviewed the mid-range HP xw6200, a high-powered workstation for digital content creation. The 6200 can be configured with Linux or Windows XP Professional. The review system came configured with Windows and shipped with a very snazzy 21-inch HP L2035HP flat-panel monitor having excellent image and color quality.

Both attractive and well designed, the xw6200 packs a lot of features into a compact, black enclosure. The workstation is approximately 19 inches high, so it can be turned sideways and placed into a rack, if desired. The front of the case has large cooling fins, room for two external 5.25-inch drives, a power switch, audio, FireWire, and two USB ports. The back of the unit contains the requisite serial, parallel, and mouse ports, along with six USB, two more FireWire, audio, and Gigabit Ethernet connections. I like the overall layout of the case and its quality construction.

Flipping a small latch pops open the side of the case, revealing a well laid out interior with all the cables neatly routed. The card cage is tool-free for easy servicing. The workstation has room for only two internal hard disks, but the drive mounts are toolless and configured so the

drives pull straight out easily and without obstruction. Power is provided by a 440-watt power supply, which should handle most expansions fairly easily. Two whisper-quiet fans on the back of the case provide cooling and make this one of the quietest machines I've ever reviewed. This feature combined with its small size make the xw6200 suitable for desktop use. A majority of workstations on the market today have to be tucked under a desk because of size or noise considerations.

The motherboard came configured with dual 3.4GHz Xeon processors supporting Intel's new EM64 technology, which enables 64-bit applications to run on the machine. This trait will be very important as Linux and Windows move to 64-bit over the next few years. Memory consisted of 2GB of fast ECC RAM. The motherboard supports four standard PCI slots, one 16x PCI Express slot for graphics and another 4x PCIe slot. The motherboard also contains connections for two Serial ATA cables, as well as two standard IDE connectors for legacy drives.

A quick Sandra test put CPU performance at 14661 mips integer and 13178 Mflops. Integer performance seemed slightly slow, particularly considering the machine was running dual 3.4GHz processors. A slightly lower score is likely due to the fact that it was a pre-production machine that hadn't been fully optimized. Memory performance was clocked at 2901MB/sec-ond, which is quite fast.

The machine was configured with a DVD/CDRW drive and a 74GB Serial ATA hard drive. Spinning at 10,000 RPM, the drive provides outstanding performance for a single drive. A Sandra benchmark showed



The xw6200 is one of three new workstations from HP that take advantage of PCI Express technology.

a transfer speed of approximately 44GB/sec-ond, which is faster than some RAIDs. This drive should be great for video professionals.

HP offers a number of graphics options from ATI and Nvidia. The review machine was configured with an Nvidia Quadro FX 3400 graphics card, currently Nvidia's fastest PCI Express card. It is equipped with 256MB of memory and supports up to two monitors. Graphics performance was very good. Testing against Viewperf 7.1 revealed a 3ds max score of 25.68, a Pro/E score of 32.27, and a UGS score of 32.27. These figures, lower than Nvidia's published scores, are similar to those of other top-end cards.

Real-world applications are always the best way to test a machine, so I loaded it with several graphics applications, including Discreet's 3ds max and Adobe's Photoshop and After Effects. I ran a small project through the pipeline and encountered no discernable problems. The machine ran fast and strong. I also loaded a few games on the machine to test raw graphics performance, which proved to be excellent.

I like this machine a great deal. It's the first system in a long time that I don't want to send back. The combination of ergonomics, quiet operation, and advanced technology make it a cool and desirable machine. I'm certain the xw6200 will be successful in the content creation and graphics arena. ■■

George Maestri is president of Rubberbug, a Los Angeles-based animation studio specializing in character animation.

xw6200

stats

Price: Starting at \$1750 (\$6494 as configured)

Minimum System Requirements: Not applicable

Hewlett-Packard
www.hp.com
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LightWave [8]

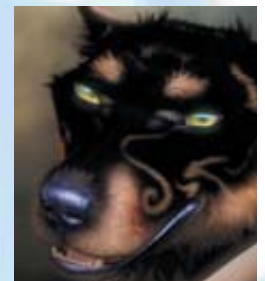
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Kaze, Ghost Warrior
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STOCK FOOTAGE

Artbeats Clip Collections

Artbeats delivers impressive royalty-free content

By David Singer

Many situations can require the use of stock film and video footage, and many sources from which to acquire it exist. Few companies, however, offer the wealth, breadth, and quality of selections provided by Artbeats.

Established in 1989, Artbeats quickly made a name for itself by providing affordable, high-quality, royalty-free still images; and in 1996, it added royalty-free video footage to its product line. Soon after, Artbeats released the first high-definition, royalty-free stock collection. Today, with well more than 200 royalty-free stock footage collections from which to choose, including 61 in high definition, Artbeats is a video producer's best friend. Whether you need NTSC or PAL, SD or HD, Artbeats should be on your shortlist of vendors.

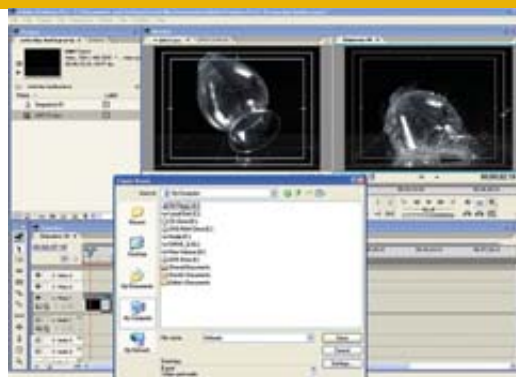
Artbeats offers royalty-free footage on a wide range of subject matter, from high-definition cityscape aerials to African animals to time-lapsed flowers. Its original source material is shot on 35mm film, 16mm film, or HD-CAM, or is computer-generated; and, its V-Line products contain footage from various sources, including DV, Digi-Beta, and Betacam SP. Each file goes through a preparation process to remove flaws and for color correction. The final clips are delivered on CD or DVD in QuickTime format (NTSC 720x486, PAL 720x576, and HD 1920x1080 pixels at 30 fps), accompanied by a full-color reference sheet with thumbnails, file numbers, and clip duration information.

When bringing the clips into a 720x480 non-linear editor (NLE), you'll need to allow the NLE to scale the clip or you'll have to crop it. If you choose to crop the clip, make sure to do so while maintaining the lower field first. Because most NLEs support QuickTime importation, format shouldn't be a problem. Just in case, every Artbeats collection ships with a converter that will translate the QuickTime file to a Targa sequence; or, you can use QuickTime Pro. The CD sleeves and reference sheets are three-hole punched to make organizing in binders a breeze.

Visitors to Artbeats' Web site are able to browse the Artbeats collections by category, volume name, or keyword search. Using the keyword search field, you also can specify category or format. There's a lot of footage to go through, so be prepared to spend some time on the Web site. Alternatively, after registering for a free account on the Artbeats site, you can request a free demo DVD with which you can browse content off-line.

Importing the clips into your project is straightforward. If you were to run into any challenges or issues, however, help is only a click away. Artbeats offers e-mail technical support via a Web-based support form and provides an online FAQ page, which answers some of the more basic questions.

During the evaluation period, I spent a significant amount of time working with a number of Artbeats collections, including *New York City Aerials HD Vol. 1*, *Seascapes 2 HD*, *Forest Rays*, and *Ultra Motion*. I experienced no problems importing the clips into Sony



Working with Artbeats footage, such as unique *Ultra Motion* clips (above), proved easy and problem-free.

Vegas 5, Pinnacle Liquid Edition 5.5, and Adobe Premiere Pro 1.0. Whereas all of the clips reviewed—from slow pans through beautiful forest environments to breathtaking Statue of Liberty aerials—were of the highest quality, Artbeats' *Ultra Motion* collection was the most impressive.

In its *Ultra Motion* offering, Artbeats has successfully captured the essence of motion. Using special high-speed cameras, Artbeats was able to capture every nuance of fleeting moments that the human eye would normally miss, such as the flapping wings of a hummingbird, water droplets landing on flower petals, glass shattering, milk spilling, and the like.

With the wide array of topics covered by the Artbeats royalty-free stock library, you're sure to find something for just about any video project. The variety combined with high quality and reasonable pricing makes Artbeats an attractive option. In fact, Artbeats is so confident in the quality of its product that the company offers a 30-day money-back guarantee on royalty-free stock collections (not individual clip sales). That confidence is well placed. Each clip that I used was absolutely stunning in its beauty and quality. Anyone in need of high-quality, affordable, and unique royalty-free stock footage should strongly consider Artbeats. ■■

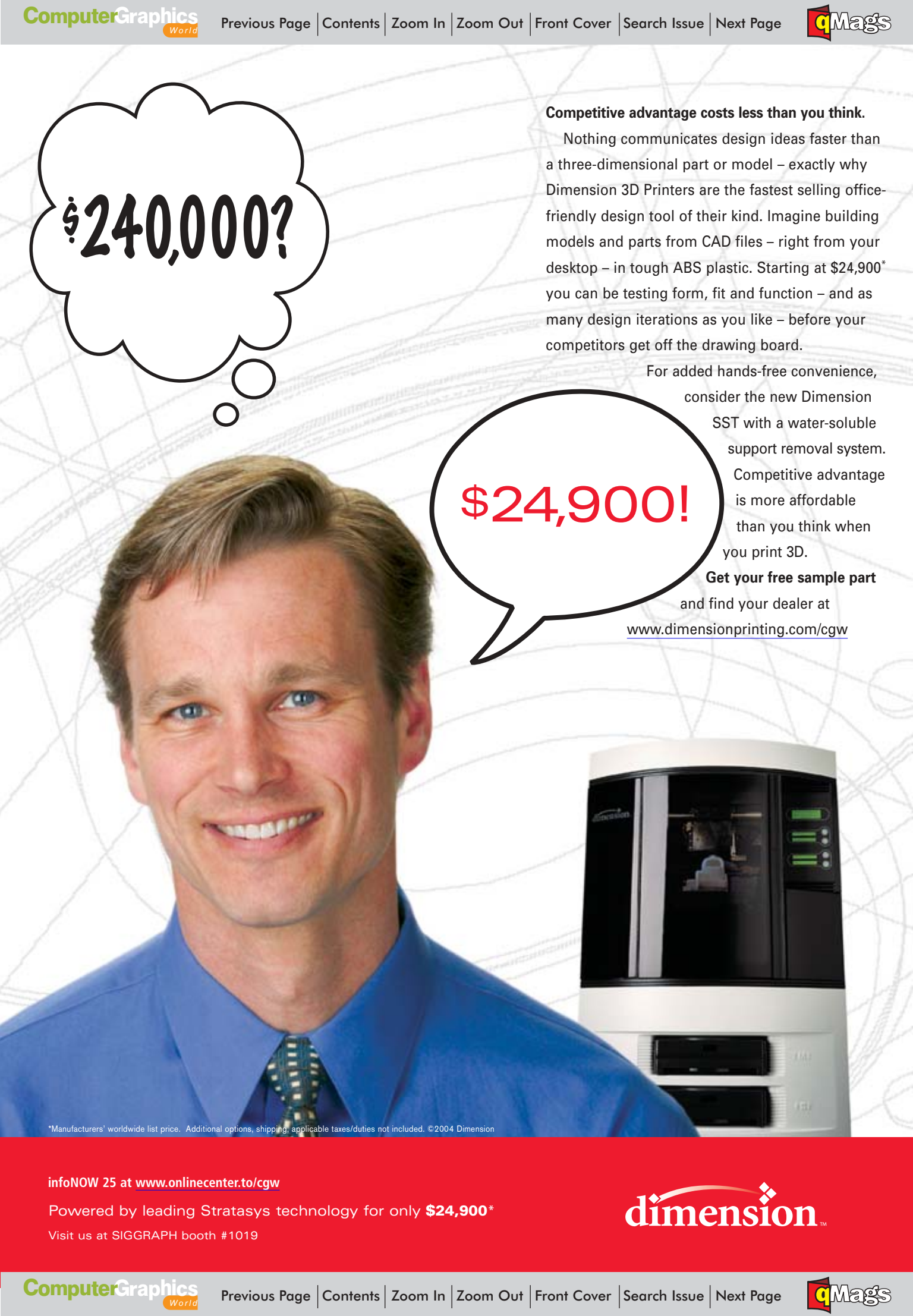
David Singer (*singercreativeservices@charter.net*) is a founding partner of *Singer Creative Services* offering photographic, video, and other services.

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Minimum System Requirements: CD-ROM or DVD-ROM drives

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Maya 6

Version 6 is flush with customer-requested features

By Dariush Derakhshani

A longtime professional user of Alias's Maya, I couldn't wait to get my hands on Version 6. Soon after I began using the upgrade, it was evident that Alias packed 6.0 with a wealth of user-requested features.

The Hair system (Maya Unlimited only) is a nice addition to Alias's animation package. Drawing on the company's strength in dynamics, the hair module can be used to create curves for rendering hair or essentially any other use you'd have for a curve, including surfaces. The upgrade's dynamic curves respond to regular dynamic fields and have a fairly adequate dynamic system of their own, similar to that of Paint Effects. It offers the user new options in making dynamic surfaces, as well as the option to make hair, of course. Animators previously had to resort to soft-body dynamics, which always left something to be desired, namely controlling the length of the curve or surface.

Effects artists will like the ability to add deformers to particle objects, helping control unruly particles. Given its performance improvements to cloth dynamics and fur, including the ability to add fur to polygons and render through Mental Ray, Version 6 is a strong upgrade for effects work all around. Effects houses or boutiques should strongly consider making the leap from Version 5 for these improvements alone.

It's not as if the other faces of Maya have been left out of the upgrades—far from it. One upgrade of particular interest is the

ability to read and write Photoshop PSD files and layer sets directly. Texture artists will love being able to write UVsnapshots directly to a Photoshop layer, and assign different layer sets within a single PSD file to different shader attributes. Now many shader attributes may be contained in one easy-to-manage map file. It is an enormous work flow leap for texture artists as well as generalists.

The Hypershade window has been streamlined to load faster than before. I still prefer the Multilister for quick shader work, considering it still loads in roughly one-third the time of the Hypershade.

Alias also improved Maya's rendering pipeline. Mental Ray is more tightly integrated in Version 6, which is nice to see. For example, you can now create Mental Ray shaders easily through the Hypershade, and you can render Maya Fur in Mental Ray.

The new Soft Modification Tool, a deformer that works like a cluster, allows for a soft selection around the deformer. You can adjust the deformer at any time and animate it as you would any cluster, which I immediately found helpful. Yet, it has its quirks: The soft modification handle sometimes disappears when you're trying to add several soft selections to a surface or curve. But it's still highly useful for animators.

Maya 6 enables the addition of lattice deformers to animation curves in the Graph Editor. Alias paid extensive atten-



Maya 6's revamped hair module enables users to create dynamically controlled curves that can be used to render hair.

tion to Trax Editor, previously considered by some as Maya's weaker link. You can mute tracks and create clips out of expressions or constraints in Trax Editor and work more easily with soundtracks.

Maya 6's work flow is made more efficient through the addition of node renaming and a faster Outliner, and faster subdivision surface performance. Speed gains are achieved with proxy and poly smooth functions, reworked file referencing, and custom node colors in the Hypergraph. Maya's online documentation was retooled for better, more intuitive performance in Version 6, in swift response to customer feedback—a tribute to Alias's commitment to users.

Alias also upgraded the Split Polygon tool. It now completes its function with a click of the right mouse button, which keeps the tool active; before, you had to press enter, and exit the tool each time. Alias reworked its command-line rendering for greater flexibility, adding render flags and easy command line interfaces for Mental Ray, Maya Hardware, and Maya Vector rendering.

All in all, I see a few major changes and plenty of smaller improvements and enhancements. Maya 6 is a worthwhile upgrade for its improvements to dynamics and effects work, and its rendering and texture-mapping enhancements. I look forward to seeing how Alias will continue to push Maya's limits and abilities. ■■

Dariush Derakhshani (dd@koosh3d.com) is an effects animator in Southern California and author of several books.

Maya 6

stats

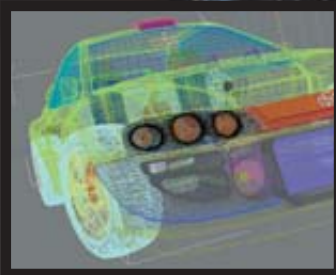
Price: \$6999 for Maya Unlimited 6 and \$1999 for Maya Complete 6 (single-user versions)

Minimum System Requirements: Microsoft Windows XP Professional or 2000 Professional, SGI IRIX 6.5.15, RedHat Linux 9.0 or Enterprise Linux WS 3.0, or Apple Mac OS X 10.2.4 or higher (Maya Complete only); Microsoft Internet Explorer or Netscape; an Intel Pentium II or higher, AMD Athlon processor, or Macintosh G4 or G5; 512MB of RAM; a CD-ROM drive; a hardware-accelerated OpenGL graphics card; a three-button mouse; and 450MB of hard disk space.

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SOFTWARE

PLUG-IN

Quite a Character

Win Di-O-Matic has unveiled Character Pack, a suite of character animation plug-ins for use with Discreet's 3ds max. Targeted at 3D animators, the new software bundle integrates several of the company's award-win-



ning plug-ins: Facial Studio, Voice-O-Matic, Morph Toolkit, Morph-O-Matic, Cluster-O-Matic, and Hercules. Priced at \$1999, Di-O-Matic's Character Pack ships with a training CD and a one-year VIP membership card, which provides users free access to plug-in upgrades, beta tests, and additional 3D tools.

Di-O-Matic; www.diomatic.com

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ASSET MANAGEMENT

Alienbrain SDK

Win Avid has unveiled a new software development kit (SDK), called Windows Integration Framework, for its Alienbrain Studio 7 digital asset management solution. Windows Integration Framework enables content creators to infuse virtually any Windows-based software application—including Criterion RenderWare, Discreet 3ds max, Alias Maya, SoftimageXSI, and Kaydara MotionBuilder—with Alienbrain Studio 7 functionality, such as

file access and version control. The new SDK is designed to streamline work flow and reduce the risk of losing or overwriting data. The Windows Integration Framework is available free with Alienbrain Studio 7.

Avid; www.avid.com

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MOTION TRACKING

RealViz by Subscription

Win • Mac • Linux RealViz has introduced Absolu, a new monthly subscription scheme designed to provide access to the company's MatchMover Professional 3.0 motion-tracking software, including all upgrades. With RealViz Absolu, postproduction houses, individual users, and video professionals who require occasional matchmoving functionality gain the use of MatchMover Professional in exchange for a monthly subscription fee. The monthly fee begins at \$300 for companies, schools and universities, and freelance artists; professors, teachers, research scientists, and students incur a monthly fee as low as \$60.

RealViz; www.realviz.com

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Image from the Artbeats Cloud Chambers collection.

professionals, the new titles include *Cloud Chambers*, *Majestic Scenics*, *Southwest Scenics*, and *Extreme Sports*. Standard-definition offerings are available in D1 NTSC 720x486 or D1 PAL 720x576 resolutions, whereas high-definition footage is offered in HD 1920x1080 resolution.

Artbeats; www.artbeats.com

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events

AUGUST

8–12

SIGGRAPH 2004, held in Los Angeles. Visit www.siggraph.org.

15–27

2004 Oregon3D Film Camp, held in Portland, OR. Contact Oregon3D at 866-626-9100, www.oregon3d.com/filmcamp.html.

SEPTEMBER

9–13

IBC2004 Conference held in Amsterdam. Contact International Broadcasting Convention (IBC), www.ibc.org.

OCTOBER

23–30

2004 Savannah Film Festival in Savannah, GA. Contact Savannah College of Art and Design, 912-525-5051, www.scad.edu/filmfest.

25–27

CTIA Wireless I.T. & Entertainment 2004 in San Francisco. Contact the Cellular Telecommunications & Internet Association (CTIA), www.ctia.org.

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Board Technology
from July 13 presentation

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products

Filmmaker's Bundle

Reelhouse, producer of royalty-free footage and video effects, has amended its product line with a new bundle: *Film Makers FX Suite*. Targeted at DVD and video editors, *Film Makers FX Suite* includes more than 815 film effects offered in NTSC and PAL formats. Built from



16mm and 35mm sources, the new offering combines five of the company's popular titles—*Filmbacks FX*, *Film Leader FX Library 1* and *Library 2*, *16mm Film FX*, and *Ultimate Countdowns*—on eight DVDs at a cost of \$999.

Reelhouse; www.reel-house.com
infoNOW 155

HARDWARE

TABLET PC

Touch-Screen Tablet

Sand Dune Ventures has developed the Sahara Touch-it Tablet PC to meet professionals' mobile computing needs. Well suited to the entertainment sector, the slate Tablet PC features a 12.1-inch Resistive Touch Screen with 1024x768 resolution, a Trans-meta 1GHz CPU, 256MB of



DRAM, and a 30GB hard disk drive. Running Microsoft Windows XP Home or Professional Editions or CE.net, the Sahara Touch-it Tablet PC accepts input via a pressure-

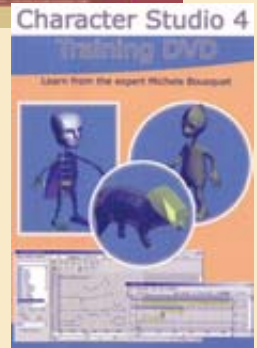
BOOK CORNER

TRAINING TREASURES

Many Worlds Productions has released a new book and DVD from Michele Bousquet. *Character Studio 4 Training DVD* provides more than six hours of training on DVD at full-screen, 1024x468 resolution. The DVD teaches viewers how to use the Discreet Character Studio 4 plug-in.

After covering the basics, *Character Studio 4 Training DVD* tackles advanced footstep animation, free-form animation, and the use of motion capture. *Model, Rig, Animate! with 3ds max 6*, Bousquet's new book, offers easy-to-follow instructions for modeling and animating low-polygon characters with 3ds max 6. Among the tools and techniques discussed are: box modeling with editable poly; how to model heads, faces, and hair; creating and editing bones; animating facial expressions; and more. The text and DVD are priced at \$49.95 and \$9.95, respectively.

Many Worlds Productions; www.click3ds.com
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INTERACTIVE STORIES

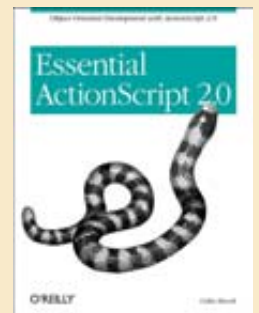
AK Peters, Ltd. has introduced *Interactive Storytelling: Techniques for 21st Century Fiction* by Andrew Glassner, a writer, director, and consultant in story structure, interactive fiction, and computer graphics. Composed of more than 500 pages, *Interactive Storytelling* imparts the fundamentals of classical story and game structure, and explains the challenges in bringing the two together into an interactive story form that involves the audience as active participants. Glassner's latest text is available now at a cost of \$35 in the US.

AK Peters, Ltd.; www.akpeters.com
infoNOW 149

ESSENTIAL FOR ACTIONSCRIPT

O'Reilly has begun shipping *Essential ActionScript 2.0*, a new book by Colin Mook on object-oriented development with ActionScript 2.0, introduced in Macromedia Flash 2004 and Flash MX Professional 2004. In the roughly 500-page text, Mook delves into ActionScript 2.0 syntax, as well as object-oriented design and programming. The book discusses how ActionScript 2.0 differs from Version 1.0, how to upgrade legacy code to Version 2.0, how to take advantage of ActionScript 2.0, and how to leverage your object-oriented programming knowledge in Flash, for delivering multimedia over the Web. *Essential ActionScript 2.0* is priced at \$39.95 in the US.

O'Reilly & Associates; www.oreilly.com
infoNOW 150



sensitive touch screen. Available now, the new system also supports handwriting recognition.

Sand Dune Ventures; www.tabletkiosk.com
infoNOW 156

VIDEO

Kona Card

AJA Video Systems' Io FireWire Interface for video editing on Apple Power Mac G5 and G4



The logo for 'this MORNING', featuring the word 'this' in a script font and 'MORNING' in a bold, sans-serif font, with a bright sun graphic above the text.

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Tim Johnson,
Emmy Award Winning
Broadcast Graphic Artist
KUTV, Salt Lake City, Utah

For system specifications and more information about Emmy award winning LightWave 3D[®] and VT[3]TM, visit www.newtek.com/cgw or call 1-800-862-7837
infoNOW 28 at www.onlinecenter.to/cgw

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products



systems has been qualified by Apple for use with the company's Final Cut Pro HD editing software. Using a single FireWire interface, it connects 10-bit uncompressed video and 24-bit multi-channel audio to the Power Mac.

AJA Video Systems; www.aja.com

infoNOW 157

Portable NLE

Provider of digital video editing and compositing systems, 1 Beyond introduced a 64-bit laptop configured for non-linear editing (NLE) and graphics applications. The 1 Beyond Power Pro

6434-X is designed to run 32-bit applications now, and provides a seamless migration path to 64-bit applications in the future. The NLE laptop integrates an AMD Mobile Athlon 64 processor 3400+ with AMD PowerNow! technology, a 1600MHz system bus with HyperTransport technology, a DDR memory controller, Microsoft Windows XP Professional, and a 15-inch SXGA TFT LCD with 1400x1050 resolution and 32-bit color. Also available with Avid Xpress Pro or Sony Vegas, the Power Pro 6434-X with all the options and Adobe Premiere Pro is priced at \$5395.

1 Beyond; www.1Beyond.com

infoNOW 158

WORKSTATION

Portable NLE

Alienware has introduced its latest worksta-

tion for mobile professionals, the MJ-12m. With the MJ-12m, Alienware combines desktop performance with the convenience and mobility of a notebook computer. The new Alienware system is designed to meet the computing needs of virtually any digital content creator working in graphics, visual arts, animation, and the like, especially those people on the go. The MJ-12m laptop, which comes equipped with an Nvidia Quadro FX Go 1000 graphics card, is currently shipping at a starting price of \$2869 in the US.

Alienbrain; www.alienbrain.com

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For more information, and to find the latest plug-ins, visit our website: <http://www.turbosquid.com/DCP>

To contact us about the Discreet Certified 3ds max Plug-in program or any of the outstanding technologies that are part of this effort, please send an email to: DCPInfo@turbosquid.com



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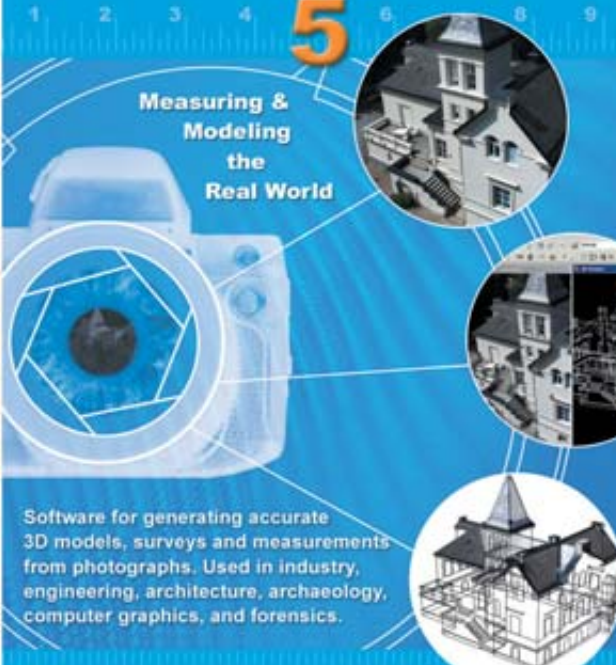
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FireGL™ professional graphics accelerators are available worldwide from workstation OEMs, system integrators and ATI channel partners.



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Robert Ahdoot, President of Ciara Technologies

Ciara Technologies is a world-class provider in the business to designs, develops, manufactures, markets, services, and supports a variety of computer systems. Computer systems include desktop and mobile computer, graphic workstations, rack-mounted and tower servers, networked storage and the newly acclaimed VXRACK™ Cluster Technology, VXSTOR™ ISCSI storage system and the revolutionary Ciara N-PC™.

The company's state of the art servers, supercomputer clusters and ISCSI storage solution are primarily based on the Intel IA32 or IA64 architecture and utilize Microsoft Enterprise Operating Systems as well as Linux Operating Systems, today's fastest growing segment of the server market. We are proud to be recognized by Intel as an "Intel Premier Provider".

Ciara Technologies provides also end-to-end manufacturing solutions, delivering world-class quality and support to medium and large OEMs primarily in the communications, computing, defense and industrial markets. Ciara is at the forefront of the computing industry due to its commitment to leading or bleeding-edge technology, cost-effective manufacturing and unparalleled customer service.

Incorporated in 1984, Ciara has achieved its 20th year in business in the Information Technology field. Ciara products are UL, CE, CSA, DOC, EPA certified and built under the ISO 9001 standards and regulations. The growth of Ciara enabled us in February 2003, to move to an ultra-modern plant of 576,000 sq ft, with the capability of producing more than 500,000 units per year. We are now the largest Canadian manufacturer of Intel based computers.

VXRACK™ HPC Cluster Solutions from **Ciara Technologies** provide the highest value, production quality solutions for the High Performance Computing (HPC) cluster marketplace. **Ciara Technologies** is mainly dedicated to providing high performance computing systems for production environments. Having set the standards for fast SMP processing computing systems, **Ciara Technologies** offers the highest level of technical expertise and experience to successfully implement scalable cluster-based computing systems.

Ciara Technologies began the VXRACK™ HPC Cluster project with the goal of delivering the highest performance and value in the emerging Linux cluster-based solutions space. Combining skilled engineers, valuable intellectual property, extensive experience with customer requirements, and a strategic OEM relationship for the basic cluster component, **Ciara Technologies** provides differentiated value through our systems integration and world-class service and support.

In addition, **Ciara Technologies** focuses on several key areas to advance HPC cluster computing. Ciara's understanding of critical technologies related to system software development, high-bandwidth/low latency networking and I/O implementations, and application porting and optimization are all important components of self-funded projects with our customers.

Ciara Technologies has a strategic technology agreement with Intel Corporation. Ciara focuses on its strengths in engineering and systems integration, and its world-class service and customer support organization. Intel provides leading-edge technology and unequaled value and quality for delivering of large-scale systems.

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D2 Software, Inc., a subsidiary of Digital Domain, Inc., the Academy Award® winning effects house, has one simple mandate: To provide the high-end visual effects community with the most powerful and production proven software solutions on the market.

Our Debut Product: NUKE™

In keeping with that mandate, D2 Software released NUKE, Digital Domain's flagship compositing application, as its initial product offering. NUKE (originally short for "New Compositor") has been used by Digital Domain for over ten years on almost 40 feature films and hundreds of commercials. It offers several key feature advantages over competing products in the high-end segment:

- A full 3D compositing workspace
- 64 channel scripting
- Fast, floating-point quality rendering
- Open FX™ (OFX) plugin support
- Spline-based warper/morpher tools
- Paint tools (coming soon)

Since its release, high-profile effects houses throughout the world have adopted NUKE as their compositing and effects solution.



nuke™ NUKE 4.2 interface displaying (clockwise from top left) flowgraph, 2D viewer, 3D viewer, animation editor, 3D camera parameters.

What's Next

Given the success of NUKE in the marketplace, D2 Software has plans to release other powerful, production proven products in the near future. Like NUKE, each will draw on D2 Software's unique relationship with Digital Domain, a visionary in high-end production software with a broad portfolio of marketable products.

D2 Software's long-term goal is to offer a complete suite of interoperable, high-end production tools designed to provide facilities with end-to-end solutions for even the most difficult jobs. These products will not only address content creation, but also infrastructure and pipeline needs.

With an eye on providing maximum value and flexibility to our customers, all of D2 Software's products will include:

- Multiple operating system support
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To further enhance the flexibility of its products, D2 Software will continue to work with complementary vendors to ensure that our customers can create complete hardware and software solutions to suit their unique needs.

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Cyberware was incorporated in 1982 and holds several key patents in the field of digitizing technology. Starting out as one of the forerunners in the field of 3D digitizing and scanning, Cyberware continues to lead the industry by producing software and hardware solutions that other companies have yet to imagine.

Cyberware's unique digitizing technology has been successfully used in many fields including:

- Art • Animation • Medicine
- Virtual Reality • Clothing • Ergonomics
- Anthropology • Industrial Design

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DIGITAL MICHELANGELO PROJECT

Cyberware designed and built the scanner that was used to create the first authoritative 3D computer archive of Michelangelo's most famous sculptures, including the David.

BURN MASKS

Cyberware's 3030RGB/PS system is being used to create masks for burn victims to treat hypertrophic scars.

UNIFORMS FOR THE US MILITARY

Cyberware's WBX Scanner and DigiSize software are being used to rapidly scan and issue uniforms for new recruits.

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eyeon



"Digital Fusion is awesome. It is an irreplaceable part of our post-production pipeline and we could not get through a single day or a single shot without it!"

Tim Miller, Creative Director - Blur

eyeon Software has been developing compositing solutions for almost a decade. Blossoming from their post-production facility roots, eyeon's continuing development is based on the original philosophy that drove the proprietary tools that are now leading commercial solutions.

eyeon's client roster includes leading institutions such as Digital Dimension, Blur, Giant Killer Robots, Charlex, Spontaneous Combustion, Frantic Films and many, many more.

eyeon's primary compositing solution, Digital Fusion, has matured to include features based on the commentary, concerns and needs of eyeon's new and existing clients. Because the products are developed to address the needs of production specific to the compositing process, eyeon is a consistent leader in pragmatic innovation surrounded by speed and power.

Digital Fusion : At A Glance

Digital Fusion is a 2D compositing application renowned for its role in feature film and broadcast effects production, as well as alternate applications such as stereoscopic rides and NASA image processing. The individuals who take advantage of DF on a daily basis are as diverse as the program itself. eyeon continually accomplishes its goal of making a hardcore compositing application that can work the way you want it to, do the things you want it to, better and faster than any existing alternative.

eyeon's dedication to fast and efficient compositing tools is the primary reason for the success of Digital Fusion. This understanding translates directly into the overall dynamics of DF. eyeon makes every effort to understand the need of desktop compositing artists and the need for multiple workflow paradigms and program customization to suit both the user and the project. Digital Fusion is limitless in every respect; from tool selection to overall performance, DF can handle anything you throw at it.

DFX+ : At A Glance

DFX+ is based on the same image engine and architecture as Digital Fusion but designed specifically for Digital Video compositing, handling all appropriate color processing for SD and HD video production. The DFX+ tool set is modular to allow the artist or facility the option of adding only the functionality they need. Each of DFX+'s seven additional modules are designed to answer a specific production demand.

DFX+ offers similar functionality to DF, including the flexible flow, superior character generation, PSD import into separate layers for animation, and more. Without sacrificing quality, purchase the core architecture of DF but pay only for what you need.

www.eyeononline.com



Screen Shots Courtesy Rainmaker Vancouver

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NewTek

The Vision

NewTek, founded in 1985, set out with a mission to make it possible for anyone to realize the dream of creating broadcast television and film. The NewTek team, a group of frustrated filmmakers, has a passion for creating the highest quality production tools that make it possible and affordable for anyone to put their dreams on the screen.



The Tools

LightWave 3D®, winner of the 2003 Emmy Engineering Award, combines a state-of-the-art photo-real renderer with intuitive and powerful modeling and animation tools, and is often used as a complete 3D production solution. LightWave® also includes a powerful scripting language, API and advanced integration with other popular production tools. These and other features make LightWave 3D® one of the most complete professional toolsets in the industry and, coupled with its affordable price, have catapulted it into use worldwide for broadcast graphics, games, print, web, as well as visual effects for film and television.

VT[3] Post™ provides real-time layering and effects for video and graphics in virtually any input standard or file format and operates internally in uncompressed D1 component video. NewTek's VT[3]™ suites include integrated timeline and storyboard editing, paint, 3D modeling and animation, titling, keying, live-switching and much, much more. For live production, nothing matches VT[3] Live™ for live-switching for studios, events and public venues. Up to 24 inputs, a complete suite of virtual equipment



in software, including monitors, decks, switchers, waveform/vectorscopes, audio mixer and more – VT[3] provides a comprehensive real-time toolset for all professional video production needs from network broadcast to web streaming.

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The Artists

Zoic Studios used LightWave® and NewTek's VT[3]™ broadcast production suite for their Emmy and VES Award-winning work on Firefly and Battlestar Galactica. Regional Emmy-winner Tim Johnson of KUTV-2 in Salt Lake City finds NewTek's VT[3]™ unbeatable for fast performance and tight integration with LightWave® and with other popular production tools. Tim refers to VT[3]™ as "one screaming finish machine. We've got more expensive systems we can only off-line on, and with VT[3]™'s uncompromised uncompressed output, we can online edit at pristine quality, with incredible speed and ease – just what we need in our fast-paced broadcast environment." Rich Helvey, lead animator for NBC's Access Hollywood, makes a similar assessment: "NewTek's VT[3] allows us to complete projects under ridiculously short deadlines by letting us do in minutes work which would otherwise take hours." Many more major studios, production houses, and independent artists with a story to tell share NewTek's vision.

For more information on the complete NewTek product line and to meet some of the great artists using NewTek tools, visit NewTek at SIGGRAPH 2004, Booth #1147 or on the web at: www.newtek.com.

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Harry Potter and the Prisoner of Azkaban.

ILM Uses SOFTIMAGE®XSI® to Triumph Over Dementors in Harry Potter and the Prisoner of Azkaban



Harry Potter and the Prisoner of Azkaban © 2004 Warner Bros. All Rights Reserved. All photos courtesy of Industrial Light & Magic.

Given the success of the first two installments of the Harry Potter series, it might seem surprising that the producers decided to change their proven formula for the third film. But that is exactly what they did on several levels of production. First, Chris Columbus stepped aside as director, making way for Alfonso Cuarón, and then, in order to create new and even more spectacular effects, Industrial Light + Magic changed their production pipeline. Given the huge success of Harry Potter and the Prisoner of Azkaban, it is clear that both moves paid off.

The superiority of the third installment in the Harry Potter series owes a great deal to the initially dark and brooding, yet ultimately amusing and uplifting 3-D character animations created by the wizards at ILM using SOFTIMAGEXSI.

According to Paul Kavanagh, Lead Animator on Harry Potter and the Prisoner of Azkaban: "This was really the first show at ILM that went completely with SOFTIMAGEXSI. All the other recent projects have built their models in SOFTIMAGE3D and imported them into XSI for the animation tools, but this time we decided to build a pipeline entirely around XSI. It was a bit of risk, but it turned out to be an entirely pleasurable experience."

With their new XSI-based pipeline, the ILM team were ready to take on all the creative challenges that Cuarón sent their way. One of the first such challenges took the form of a giant spider.

"When Ron Weasley (Rupert Grint) encounters a boggart, it takes the form of an immense black widow spider. He is terrified, but, with the help of a Ridikulus charm, he puts the beast on roller skates," says Kavanagh.

The success of the sequence depended on making the spider appear real enough to scare both Weasley and the audience and then ensuring it maintained its seeming reality while scrambling around on roller skates.

Kavanagh, who worked closely with Creative Supervisor Greg Maguire and fellow Lead Animator Steve Rawlins on the spider, explains how they managed it: "I built the rig for that sequence entirely in SOFTIMAGEXSI using a black widow from our model department. The Animation Mixer in XSI was particularly helpful. It was fantastic for timing and offsetting animations, as well as for easy experimentation with sliding and scaling animations. We were always able to get a whole new animation very quickly.

Turnaround was very fast, because the mixer is so easy to use."

The creative team also worked on the truly horrible dementors, the soul-sucking, eye-less creatures who guard the Azkaban prison and make for, arguably, the most compelling and frightening scenes in the film.

With some scenes having as many as 75 dementors, the team took an unconventional approach in their animation. Rather than using a crowd or particle system for the dementors, Maguire used XSI to develop a tool that allowed the team to hero-animate each dementor individually while at the same time keeping scene files relatively small.

Kavanagh explains: "We really wanted to have that control over the dementors, because they were such a key part of the story. Greg's XSI tool allowed us to work freely and smoothly. We just concentrated on the performance, without having to worry about speed issues. SOFTIMAGEXSI gave us full control over just about everything. The tool truly saved our lives on this project, and Greg did it all in XSI."

"...this time we decided to build a pipeline entirely around XSI. It was a bit of risk, but it turned out to be an entirely pleasurable experience."

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Founder, Karim Rashid



The firm's 10 designers use Solid Works 3D software. Until recently, designers relied on outside sources and an internal workshop to create foam models – a process that was time consuming, lacked precision, and ultimately hindered their ability to communicate designs.

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"With a good model, we can remove any ambiguity for clients and expedite the decision making process," Rashid said.

Recently the firm completed a new line of kettles and barware for Copco Kettle company that will be sold worldwide through Moma stores, Conran's and Target. The collection includes 18 new products all designed using Dimension. *"We were even able to get the threads on the corkscrew models we designed to work using Dimension,"* Rashid said.



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Corporate Overview



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backdrop

Interview by Editor-in-Chief
Phil LoPiccolo

Mobile Gaming Goes 3D

Given new handset technologies, mobile gaming may soon approach and even transcend the console experience.



Dave Campbell is product marketing manager for animation at Discreet, sponsors of the first International 3D Mobile Gaming Contest (see "Mobile Gaming Prepares for Takeoff," pg. 44).

Q *What is the state of the art of mobile gaming graphics?*

A Currently, 2D sprite-based graphics—reminiscent of the 16-bit and 32-bit games of the late 1980s and early 1990s—are primarily being used in mobile games. But by the end of this year, phone manufacturers will be introducing handsets with 3D graphics that will change the look and feel of mobile gaming.

Q *How will 3D graphics change mobile games?*

A It will make mobile games technologically current. All home consoles are 3D-based, and have been for years. The first time I saw a game on my cell phone, it was a 2D sprite game. My first thought was, "Why do I want to play this when I have an Xbox at home?" It's all about perception. And incorporating 3D content will blow this perception out of the water.

Q *Can small-screen mobile games be entertaining by today's standards?*

A Yes. Good gameplay is scalable. Moreover, the "fun factor" will be judged by a different set of criteria. You can play a console game for hours on your big screen at home. But because mobile games are generally easier to get into and out of, they can be played in short bursts of time, such as on your train ride to work.

Q *How can games take advantage of mobile technologies?*

A Technologies such as Bluetooth, which enable limited-distance wireless connections with other devices, are creating interesting opportunities for gaming, such as allowing head-to-head play between people who are near one another. Also, most handsets are connected to some form of service provider and, therefore, to many other mobile devices. So, we might start seeing client/server games akin to the massively multiplayer games for PCs.

Q *Why hold a mobile gaming contest?*

A Discreet, Nokia, Orange, Intel, IBM, Infusio, Criterion, Fathammer, Nvidia, Kaolink, Ideaworks3D, and Turbo Squid are co-sponsoring the first International 3D Mobile Gaming Contest to encourage independent mobile gaming artists and traditional game developers alike to produce creative concepts for mobile games. More than 100 projects were submitted from 35 foreign countries, including India, Russia, China, Australia, Argentina, and Hungary. The top 14 finalists have been chosen, and the public will be able to download and play the finalists' games and vote for their favorite game at www.discreet.com. The winning mobile game will be announced this fall, and the winner will receive a publishing and distribution contract.

Q *What's coming in terms of new technology?*

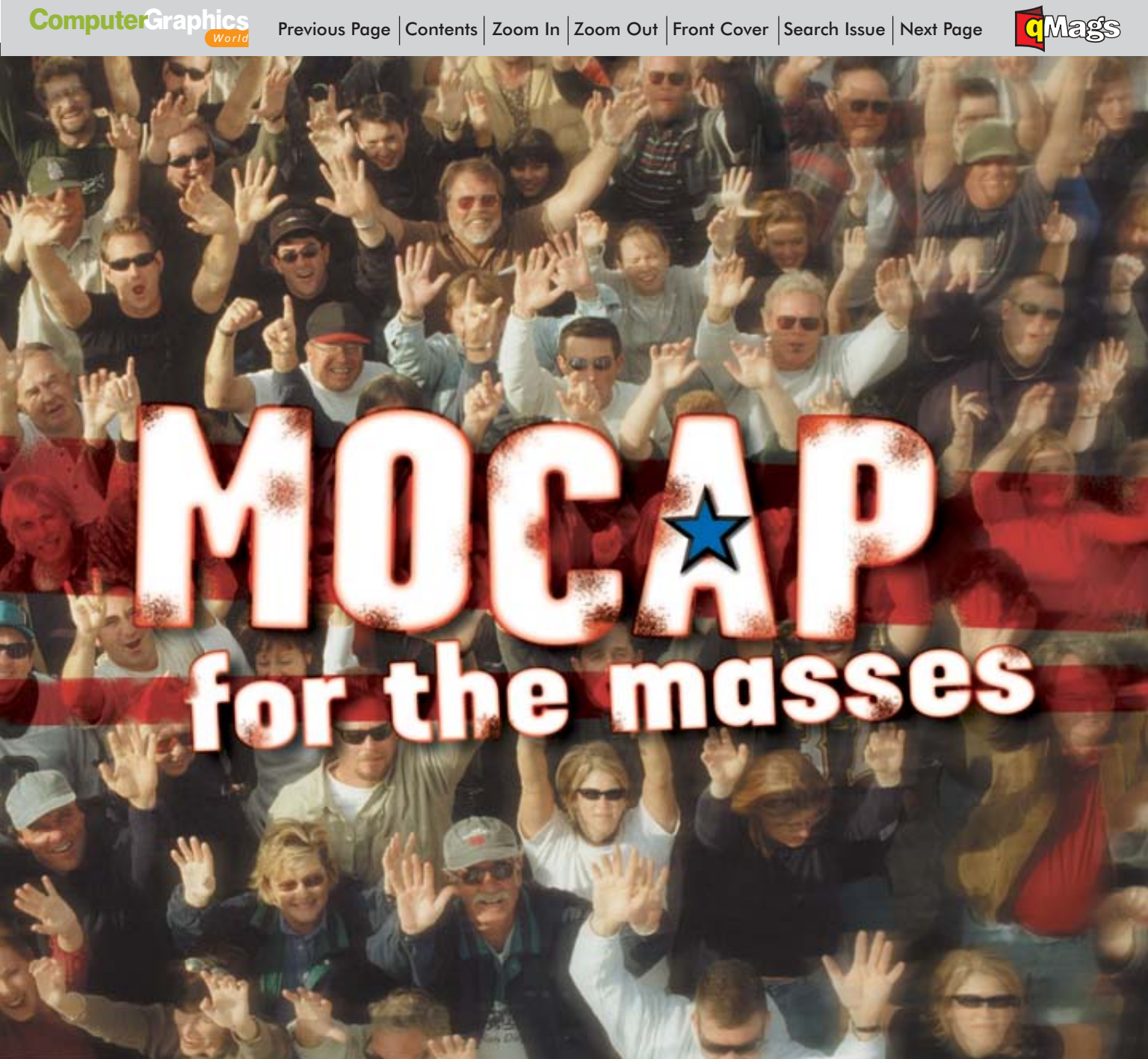
A Mobile phone technology is progressing at an incredible pace. We are seeing bigger screens, faster processors, better GPU processing, and faster connections. The evolution is similar to what occurred with computer and video-game consoles, only it is occurring at a much faster rate.

Q *What's your vision of the ultimate mobile game?*

A It will take advantage of the fact that millions of people can choose to be connected and play, if they wish. And it will be something that never causes them to think, "Wouldn't this be better on my PlayStation or Xbox?"

Q *Are there other uses for mobile gaming technology?*

A Games will drive the market, but many other applications will follow. New mobile devices have powerful processors and great graphics, and they are connected to one another through service providers. The framework reminds me of the early days of the Internet, when it was almost impossible to predict the uses that would evolve for it. Only time will tell which applications, besides games, are best suited for mobile devices. The only guarantee is that at least a few of them will break out and redefine the way that we think and live. #



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