

PIPE dreams

As movie tie-ins become an increasingly common sight within the games industry, much is being made of the potential of integrated production pipelines. A surprisingly controversial area for developers and technology firms, we investigate whether the re-use of film assets in games is the way of the future - or just a happy fantasy

BY JON JORDAN & BARBARA ROBERTSON

● No self-respecting Hollywood movie would be complete without its tie-in game. The current crop includes Disney Interactive's *The Chronicles of Narnia* and Ubisoft's *King Kong* (above). But the increasing tendency of such titles to share digital assets with the VFX team is prompting developers to rethink production workflow

Since the turn of the century, the marriage between Hollywood and the computer games industry has been sold as a match made in heaven. Film, with its megastars, its complex characterisation, and its audience for an interactive medium that can put its *Bond*, *Neo*, *Aragorn* or *Nemo*? No problem. Just switch on the *PlayStation* and let your movie experience continue. At least, that's the marketing spin employed in support of an ever-increasing range of film-to-game blockbusters, including *Harry Potter* and the *Coblet of Fire*. But veiled by this glibness, a dramatic shift is occurring on the production line. Previously regarded as the minor partner, both in terms of business acumen and visual quality, games studios have raised their ambitions. As a result of new hardware such as Xbox 360 and *PlayStation 3*, developers have been revising their pipelines to take advantage of assets created by their movie partners - a process led by an influx of talent from the VFX industry.

Publisher Electronic Arts has led the charge, recently announcing a three-game deal with Steven Spielberg. The director will work with EA's LA studio, providing his expertise with respect to concept, design, story and artistic visualisation. But it's not just household names. Michael Talarico, EA's CG Supervisor for the *Harry Potter and the Goblet of Fire* game, carried out similar duties on the two *Tomb Raider* films, while ILM special effects veteran Habib Zargarpour is now EA Canada's Senior Art Director working on its *Bond* series, amongst others.

The company is also capitalising on the kudos of existing movies with its remakes of classics such as *The Godfather* and *From Russia With Love*. "We're now seeing the likenesses of actors such as Pierce Brosnan and Sean Connery in games based on the *Bond* films," says Ian Shaw, Chief Technology Officer at Electronic Arts Europe. "Probably the best visuals I've seen are Marlon Brando in the next-generation *Godfather* game."

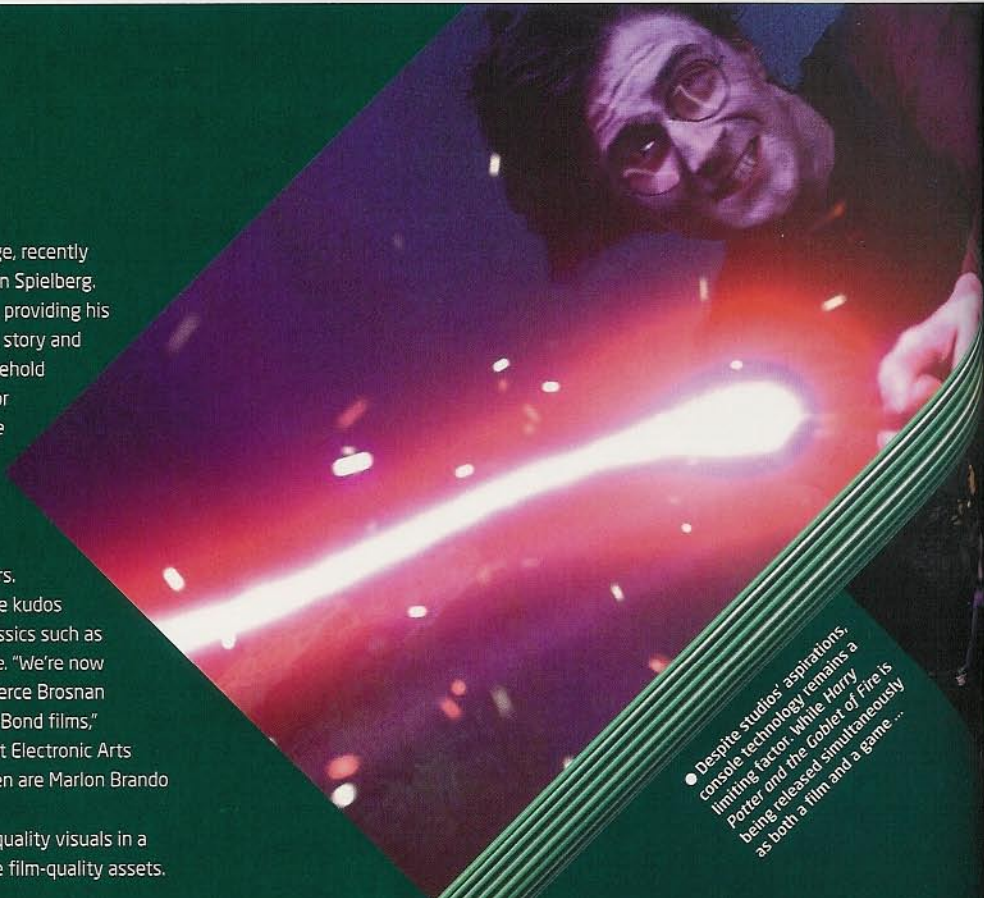
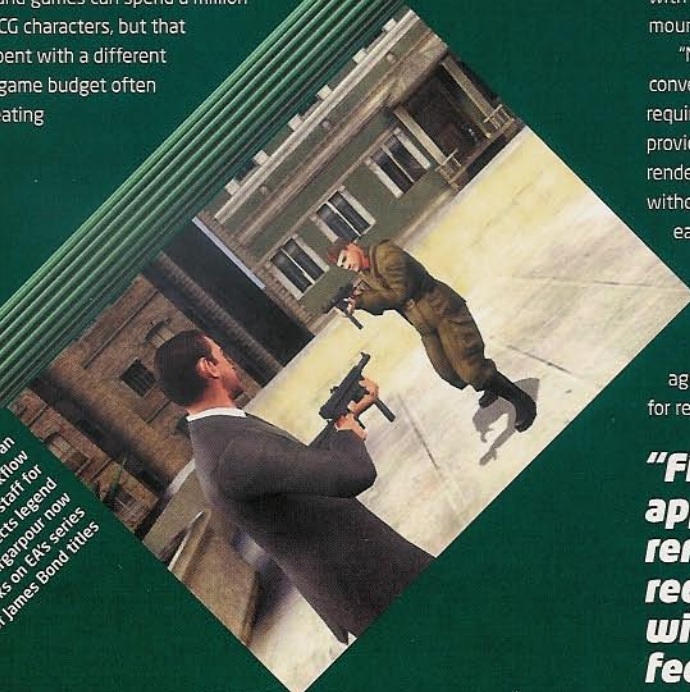
Of course, before you can create film-quality visuals in a tie-in game, you need to be able to handle film-quality assets.

"Current consoles are still a step below using film-resolution models. The next generation of games hardware will change all of that."

IAN SHAW, CTO, ELECTRONIC ARTS EUROPE

"Technically, the current generation of consoles is still a step below using film models in terms of resolution, but next-gen consoles will change that," Shaw claims. "There's also a commercial question. Both films and games can spend a million pounds on CG characters, but that money is spent with a different focus. The game budget often goes on creating

• The first step to an integrated workflow is hiring VFX staff for games. Effects legend Habib Zargarpour now works on EA's series of James Bond titles



• Despite studios' aspirations, console technology remains a limiting factor, while *Harry Potter and the Goblet of Fire* is being released simultaneously as both a film and a game...

interactivity and optimising the characters for console hardware. But when we start spending many millions of pounds, I'm sure that this will generate the motivation to overcome these hurdles."

PULLING THE STRINGS

Key to this process are technologies once restricted to the movie effects toolbox, such as complex shaders, HDR lighting, multiple layers of textures, and million-plus-polygon models. These are beginning to filter down to real-time graphics, massively reducing the differences in the way that films and games are made. It's common for VFX studios to share assets with external game teams, but it's now not just the usual mountains of concept material, miniatures and maquettes.

"Models, textures and shaders have been usefully converged for some time now, though a fair bit of work is required," says David Kirk, Chief Scientist at PlayStation 3 chip provider Nvidia. "Film assets that are appropriate for offline rendering can be simplified and recast for real-time rendering without losing the look and feel of the film. And it's much easier to modify and simplify film assets than to start completely from scratch."

Magnus Högdahl, Chief Technology Officer at Swedish developer Starbreeze Studios, who worked on the game based on *The Chronicles of Riddick*, broadly agrees: "Film models can now be used to trace normal maps for real-time use, as our high-resolution models already consist

"Film assets that are appropriate for offline rendering can often be recast for real-time rendering without losing the look and feel of the original film."

DAVID KIRK, CHIEF SCIENTIST, NVIDIA

IN FOCUS The scale of the problem

Why convergence comes at a price: ten challenges movie-quality assets present to existing videogame-development pipelines

...being designed for current consoles such as PlayStation 2, the game cannot handle assets from its film partner. Only next-generation counterparts will permit such integration, says Ian Straw of developer Electronic Arts

"Film models can now be used to trace normal maps for real-time use. But I don't think reusing shaders will be feasible, even on Xbox 360."

MAGNUS HÖGDAHL, CTO, STARBREEZE STUDIOS

of millions of triangles," he says. "Equally, basic diffuse textures and specular maps would be easy to use, since they can be scaled to the game's texture budget."

The problems, he explains, come with trying to reuse the more sophisticated material properties that really give a film its special look. "Because these are often encoded in textures, they're harder to use directly and would require us to use similar lighting models," he says. "As far as reusing shaders goes, I don't think it will be feasible, even on Xbox 360 or PlayStation 3. The best you could hope for would be to use offline rendering shaders as inspiration when trying to come up with a suitable cheat or approximation in real time."

TYRANNY OF NOW

It's this difference between real-time and offline graphics that remains the major point for debate. Dan Prochazka, Product Manager for Animation Software at Autodesk, contends that it remains a fundamental barrier. "While I think the two industries are now closer in many ways, the priorities for high-quality film shots are different to the priorities for high-quality games," he argues.

"Visual effect shots count time per frame in minutes, while games developers count time in frames per second - that's 1,000 times faster than what's required for film." He also points out that, for films, visual accuracy and quality are the highest priority. "If it takes another minute or two to render a frame,

1 MODEL SIZES
While offline models can be scanned from mannequins at the equivalent of millions of polygons, the restriction of real-time processing means games models max out at just 50,000 polygons.

2 LIGHTING
High-quality techniques such as raytracing and subsurface scattering are so computationally intensive that the only way game artists can use them is to bake them into static textures.

3 TEXTURE SIZES
With offline rendering image quality is all that matters. This means artists can create gigabytes of complex materials. For games artists, even textures consisting of tens of megabytes end up being compressed.

4 OFFLINE SHADERS
Shaders for offline packages like RenderMan are very different from real-time shaders which have to be written specifically for the hardware they will run on. While the technology is improving, it's still restrictive.

5 ANIMATION RIGS
Taking full advantage of the resolution available with offline rendering, film animation rigs are so complex that, as yet, there are no ways to reduce their inherent subtleties to real-time formats.

6 DATA TYPES
Movie-quality NURBS-based models still don't work well within game engines, especially in terms of dealing with seams and automatic level of detail.

7 VOLUME OF DATA
The sheer scale of assets handled by visual effects studios means they require some of the biggest computer clusters in the world in order to move all of the data around. Your game console, this ain't.

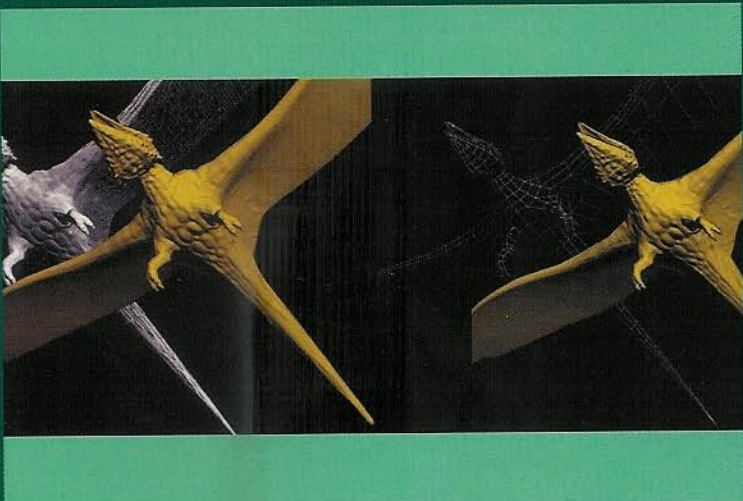
8 DATA DENSITY
With each second of movie effects weighting in at over a gigabyte of assets, the volume of data also necessitates industrial-sized database and referencing systems - something game studios have little experience of.

9 TOOLSETS
While 3D texturing packages such as BodyPaint 3D are slowly creeping into the hands of games artists, high-end procedural animation packages such as Houdini/MoSes remain conspicuous by their absence.

10 PRODUCTION SCALE
With team sizes in the hundreds and budgets of over \$50million, the scale of effects work outstrips even that of triple-A games, which typically have budgets of under \$20million.

For all of their visual power, games still struggle to match film-quality imagery due to sheer volume of data required. Compare this still from Ubisoft's King Kong to the movie itself, pictured at the end of the article





● Typical of the problem game developers face when reusing movie assets, the image above shows a 400,000-polygon film-resolution model (left). Its game-ready companion on the right has just 2,000

well, so be it. For games developers, however, the priority is to perform at a certain framerate."

One knock-on effect is the density of assets. "In visual effects, textures can be anything up to a gigabyte, while game developers are either limited to much smaller texture map sizes or, increasingly, are relying on real-time shaders," Prochazka says. In addition, film models are usually created using curved surfaces such as NURBS, while game artists remain committed to real-time-friendly polygons.

"There's an assumption that convergence between games and films will happen and that it's a good thing. I'm not sure either is true," Prochazka says. "Companies will place the highest priority on making the offerings they deliver the best possible [for the market they work in]."

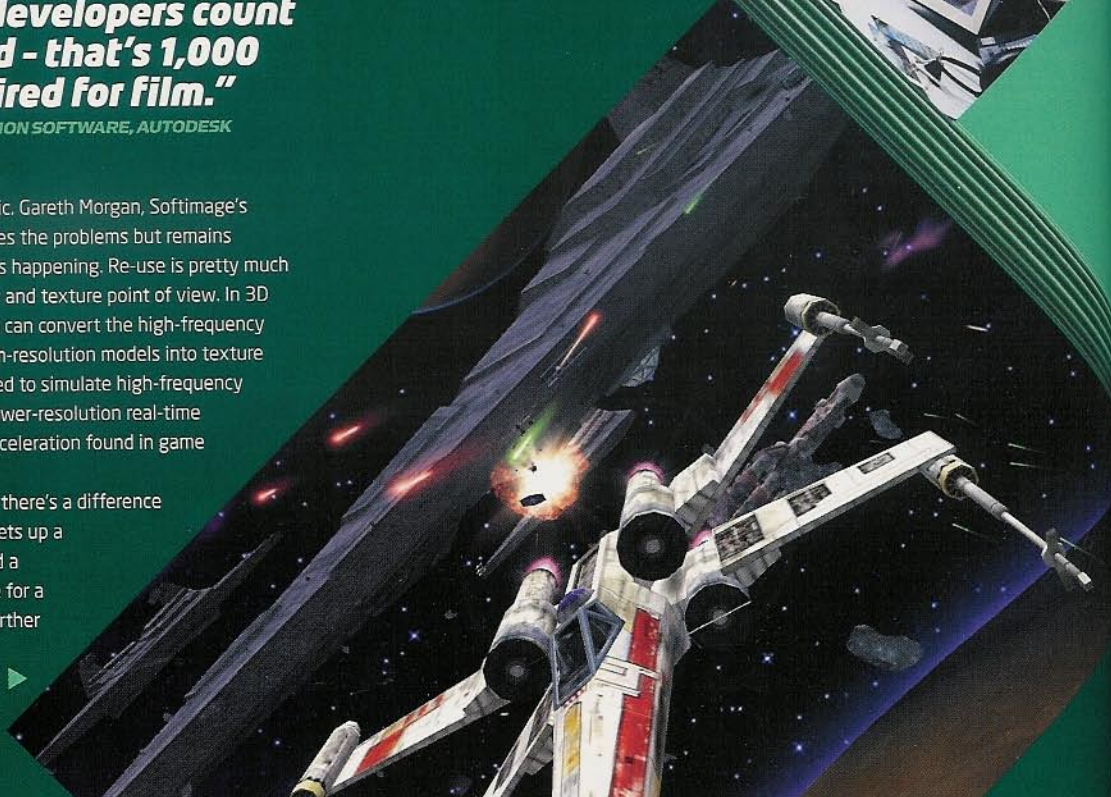
"Visual effect shots count time per frame in minutes, while game developers count time in frames per second - that's 1,000 times faster than is required for film."

DAN PROCHAZKA, PRODUCT MANAGER FOR ANIMATION SOFTWARE, AUTODESK

Others are more optimistic. Gareth Morgan, Softimage's Senior Product Manager, notes the problems but remains positive: "Real convergence is happening. Re-use is pretty much a done deal from a geometry and texture point of view. In 3D applications such as *XSI*, you can convert the high-frequency geometric detail found in film-resolution models into texture maps. These can then be used to simulate high-frequency details in conjunction with lower-resolution real-time models and the rendering acceleration found in game graphics hardware."

Although he agrees that there's a difference between the way an artist sets up a multi-pass offline render and a 60 frames-per-second scene for a game, he thinks there are further tangible benefits available in trying to unify these

● Right: the technology needed to keep the Zero pipeline operational. Below: artists at work with the system inside the new Letterman complex



CASE STUDY The Zeno production pipeline

Industrial Light & Magic and LucasArts share more than a building - they also share a pipeline. Could this be a blueprint for future film/game convergence?

With each new generation of consoles, a new generation of pundits predicts that games will soon look as impressive as movies. But while graphics have improved hugely, photorealism is still only a promise; game cinematics are still not yet truly cinematic.

Even so, most action and sci-fi feature films are spawning matching games that sometimes use CG assets from the films. And games development companies are actively recruiting visual effects wizards. These artists are applying film techniques to games and producing dazzling visuals. 'Cinematic', as gamers are now seeing, has as much to do with lights and camera work as with photorealistic rendering.

"Gamers are starting to embrace the sorts of techniques we've always used at ILM, especially when it comes to camera moves," says Cliff Plumer, Chief Technology Officer at Industrial Light & Magic. "Even introducing camera shake makes a huge difference. Things we take for granted in visual effects are changing videogames."

He should know: this October, Lucasfilm's game division, LucasArts, and its visual effects division, Industrial Light & Magic, moved into the new, state-of-the-art Letterman Digital Arts Center in San Francisco. The relocation brought together the two divisions into one facility for the first time. Now, approximately 700 artists have access to the same tools on one hybrid pipeline, dubbed *Zeno*. Around 450 of the artists work for ILM; the rest work for LucasArts. The merger has influenced the development of new kinds of tools.

"The move allows us to work together and optimise both," says Jim Ward,

Senior Vice President of Lucasfilm and President of LucasArts. "Once the next-generation games come out, people will be asking, 'How did they do that?'"

ILM's R&D department first began developing a new visual effects pipeline in 1998-99, spurred by the need to manage large scenes to create the pod race in *Star Wars: Episode I*. When George Lucas decided to consolidate and move the visual effects and games divisions of his empire to San Francisco, the studio decided to revamp ILM's pipeline in time for the move.

Thus, for the past 18 months, ILM's R&D department has been collaborating with LucasArts engineers. LucasArts' game engine, *Zed*, was folded into ILM's

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CLIFF PLUMER, CHIEF TECHNOLOGY OFFICER, INDUSTRIAL LIGHT & MAGIC

pipeline, *Zeno*. ILM replaced all its legacy tools with new *Zeno* modules, and created live links to commercial software. Both studios can access any module on the pipeline, and 3D artists can copy and paste between applications.

"We can extract [ILM's] technology in *Zeno* and incorporate it into our runtime editor," says Ward. "And we're working with them to forge new ground."

The first focus for LucasArts has been layout, animation, nonlinear editing, and lighting. "The list will continue to grow as they work on their next titles," says Cliff Plumer. "Physics and particles will be added early next year."

The layout tools live within a new previsualisation module that evolved from LucasArts' game engine. Because

the system is integrated within *Zeno*, it's tied into the whole production pipeline, including the asset-management system.

"Artists have access to the database from the previz tool," says Plumer, "and it's drag and drop. They can drop whatever they need into a 3D scene."

At *Zeno*'s core is a new, ILM-proprietary file format that allows *Zeno* to manage all the data on the pipeline. "*Zeno* is a fundamental toolset," Plumer says. "It's a timeline, scene graph and curve editor in one."

Maya, used for modelling, rigging and animation, is integrated into *Zeno*; the user interface is patterned after the *Maya* interface. Gamers can work on an asset in *Maya*, and publish it to *Zed*.

If they edit it in the game engine, it automatically updates in *Zeno*.

Non-destructive override capabilities are built into the pipeline, making it possible for artists to work on individual pieces of a project without having to worry about the book-keeping; *Zeno* keeps track of parts, versions and relationships. A new lighting tool called *Lux*, which is render-agnostic, handles pass dependencies.

One of the last pieces to be finished is a new motion-capture stage that becomes operational in November, combining performance capture with real-time compositing. In addition to optical capture,

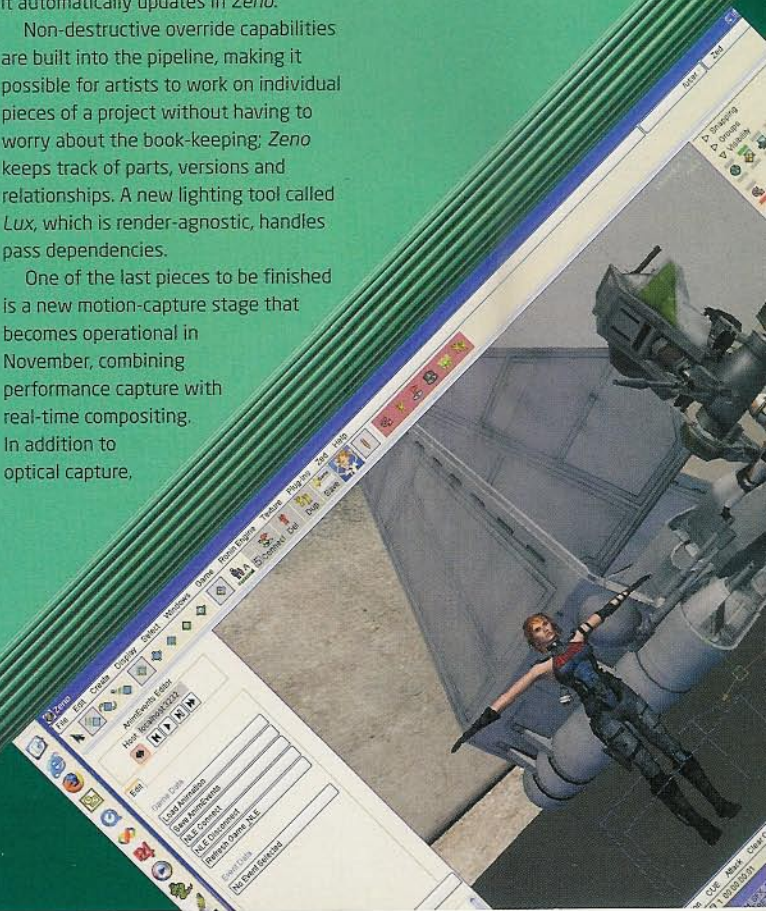
the studio has developed image-based motion-capture tools. "LucasArts has already booked motion-capture shoots for the stage," says Plumer.

It's too early yet to see the effect of mixing games developers and VFX artists on one pipeline, but it's easy to imagine what might happen. Sharing assets is one likely possibility - a few *Star Wars* assets moved to LucasArts before *Zeno*. But Ward believes that the real opportunities lie elsewhere.

"We think the opportunities will move away from 'here's a movie, let's make a game,'" he says. "We have interactive games, but there's not a lot of depth to the stories. We're working on technology to bring more reality to the characters."

Right now, though, the biggest excitement for Lucasfilm is not the new technology, but the working culture it fosters. "There are so many common areas on the campus that we're starting to see the two artist cultures meeting each other," says Plumer. "There's a lot of conversation and communication between artist types who have worked for the same company for years, but have never met."

Below: the interface of *Zeno*, ILM/LucasArts' new production pipeline. The system allows artists on games such as the *Star Wars* titles (left) to share assets with their VFX colleagues





● One final obstacle to pipeline convergence is timing. Although Starbreeze Studios received a scan of actor Vin Diesel's head, the CG assets for the movie version of *The Chronicles of Riddick* were not finished until the game was close to beta testing

approaches. One area of value in this respect is animation. "There's a long way to go before we can reuse character animation, especially articulated character rigs and their skins. But, equally, there are lots of good reasons for it to happen," he says. "The extensive use of digital characters is clearly a common area between visual effects and games, and with many franchises publishing across both media, being able to reuse the digital character assets would be a significant benefit."

SCHEDULING DIFFICULTIES

In fact, the biggest obstacles to film/game convergence may not be technical, but logistical. "To get proper synergies between projects, CG assets would need to be created well before filming has begun, while the game project would have to start at least a year before film production," says Starbreeze Studios' Magnus Högdahl. With *The Chronicles of Riddick* game, the film's finished CG assets weren't complete until the game was close to its beta testing phase. "We did get a 3D reference

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GARETH MORGAN, SENIOR PRODUCT MANAGER, SOFTIMAGE

scan of Vin Diesel's head - but all the modelling happened in-house," Högdahl adds.

The result is that, by the time most films have been greenlit to go into production, and the licensing negotiations are completed, games developers are already struggling to meet a 15-month deadline. It certainly doesn't give them much scope to also start wrestling with reworking half-finished movie visual effects assets.

But despite the difficulties, Nvidia's David Kirk still thinks that joint development teams are the future - or one part of the future, at least. "It's possible to envision a joint team producing a game and a film together from the same assets, although I think one would have to lead, and the other follow," he says. "Forcing the two to progress at the same time and

pace seems likely only to degrade the quality of one or the other."

So will true hybrid production pipelines, such as that linking LucasArts and ILM (see Case Study, previous page), really become the norm? Only time will tell. For now, the union between games and visual effects remains more a marriage of convenience than the 'happily ever after' scenario dreamed up by the PR agencies. But while the relationship may not always be easy, there are, it seems, no immediate grounds for divorce. ●

The *King Kong* and *Chronicles of Narnia* games are scheduled for release in November. Both movie and game versions of *King Kong* will feature in issue 73 of *3D World*

TALKING POINT | Where next for convergence?



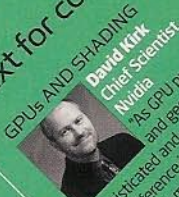
Ian Shaw
Chief Technology Officer,
Electronic Arts Europe

"It's all about model resolution and shader quality. PlayStation 2-generation games are limited to 5,000 polygons with two texture passes. As we shift to next-gen consoles, we're finding polygon counts can go above 10,000. And instead of texture passes, we're using 10 layers of real-time shaders. That's a huge step forward usually, and most of that benefit comes from shifting from texture generation to real-time shading."



Magnus Högdahl
Chief Technology Officer,
Starbreeze Studios

"In real-time graphics, we always have to make trade-offs between quality, quantity and framerate. With offline rendering, you don't have to trade quality or quantity for speed, since you can just throw more computing power at the problem, or wait longer for the rendering to eventually finish. Content creation will be the only limiting factor for both real-time and offline graphics, but we're far away from that today."



David Kirk
Chief Scientist,
Nvidia

"As GPU programmable shading and geometry get more sophisticated and powerful, there is increasingly less difference in the performance and quality of the two media. Eventually, film assets will form the core assets for games. Fortunately, for companies such as Nvidia, this is a moving target. Although real-time rendering will inevitably be simpler than film rendering for quite some time, both will get better and better."



Dan Prochaska
Product Manager for Animation
Software, Autodesk

"I don't see the next-generation platforms changing the fundamental difference between films and games. While they're more powerful, to prevent the spawning of assets, what makes a beautiful film will remain different enough from what makes a captivating game, for their art assets not to be interchangeable."



● The way of the future? Can next-gen consoles like the Xbox 360 lead to true film/game convergence, or will a 'fundamental difference in priorities' continue to divide the two worlds? Only time will tell...