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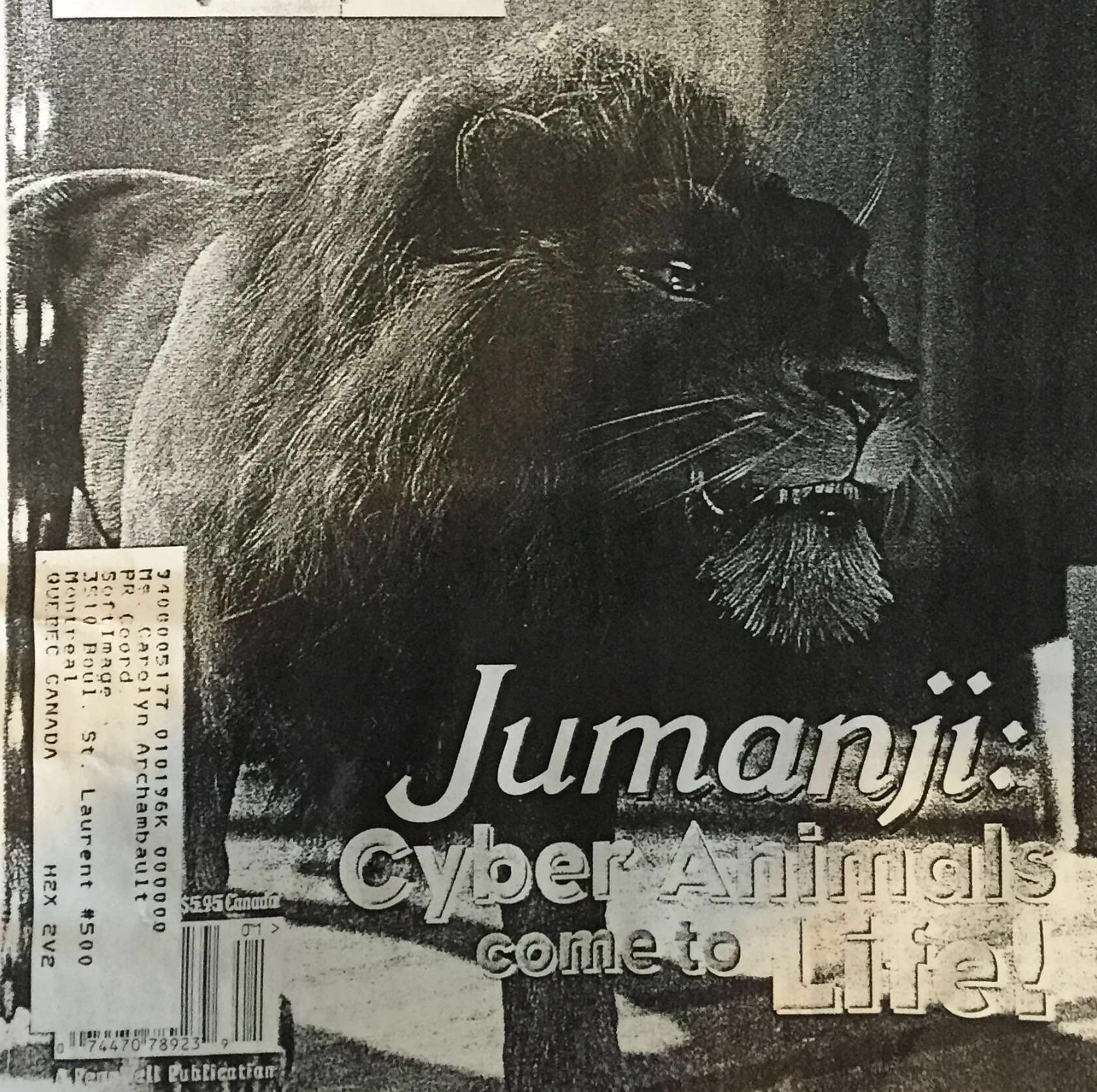
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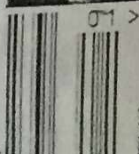
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Jumanji: Cyber Animals come to Life!

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JUMANJI'S AMAZING ANIMALS

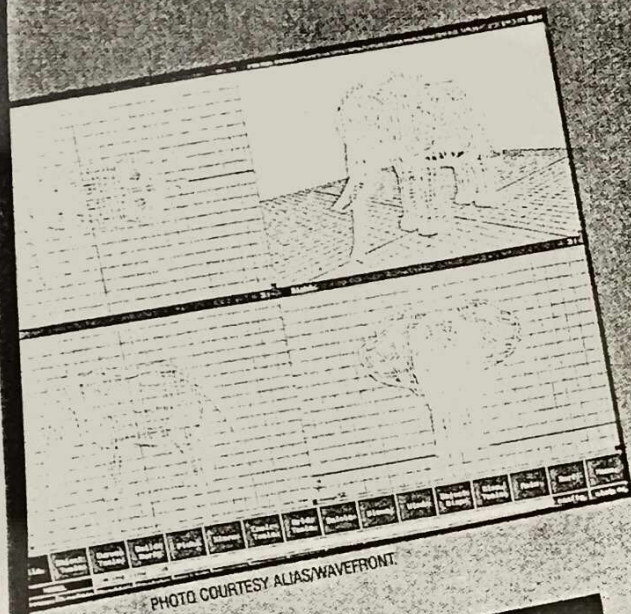


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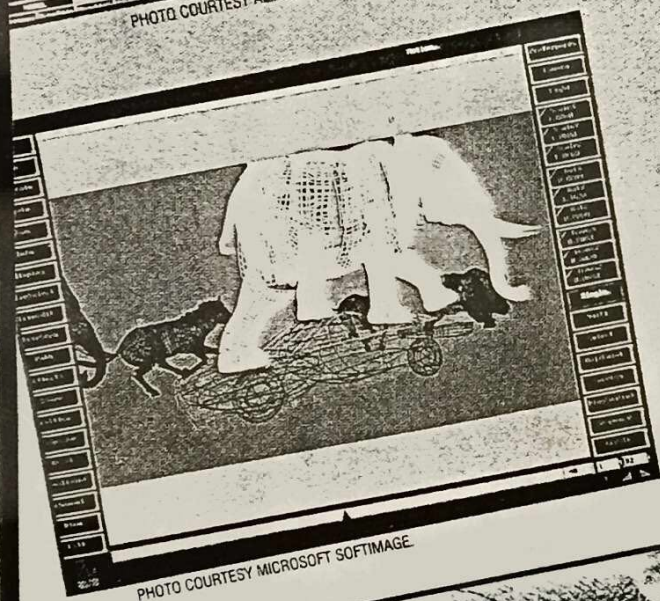


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The astounding realism of the eight species of CG animals in *Jumanji* would give even Darwin pause

Animator Daniel Jeannette moved this CG elephant step by step over the already crunched Chevy. The model was created by Paul Hunt. ILM used Alias/Wavefront's PowerAnimator for modeling, Microsoft's Softimage 3D for animation, Pixar's RenderMan for rendering, and Parallax's Mator painting program, along with many proprietary software programs all running on Silicon Graphics workstations, to create the animals and the effects in *Jumanji*. In addition, they used Alias/Wavefront's Dynamation for some particle effects.



COLUMBIA/TRISTAR. © SONY PICTURES ENTERTAINMENT. PHOTO COURTESY ILM.

BY BARBARA ROBERTSON

Games were always make-believe. Until now,* state the production notes for the movie *Jumanji*. The same could be said for most computer-generated (CG) animals—until *Jumanji*.

TriStar Pictures' *Jumanji* is an action-adventure film, based on a 1981 children's book by Chris Van Allsburg, in which a magical board game becomes a portal into a fantasy world. The fantasy world is filled with hundreds of 3D, animated animals you'll swear are alive. It's beautiful. It's also very dangerous—as game players Alan (Robin Williams), Sarah (Bonnie Hunt), and two orphaned children (Kirsten Dunst and Bradley Pierce)—quickly discover.

One roll of the dice, for example, sends a tribe of devilish monkeys rampaging through a kitchen and taking joyrides on police motorcycles. A pair of life-size rhinos charge through the walls of a house, sending books and bookcases flying. Right behind them are elephants, zebras, and a pelican that stampede through the town square. A snarling lion stalks the hallways. Hundreds of bats suddenly fly out of the fireplace.

Sound like fun? Well, it was for the visual-effects team at Industrial Light & Magic (San Rafael, CA) who created many of the *Jumanji* effects and most of the animals.

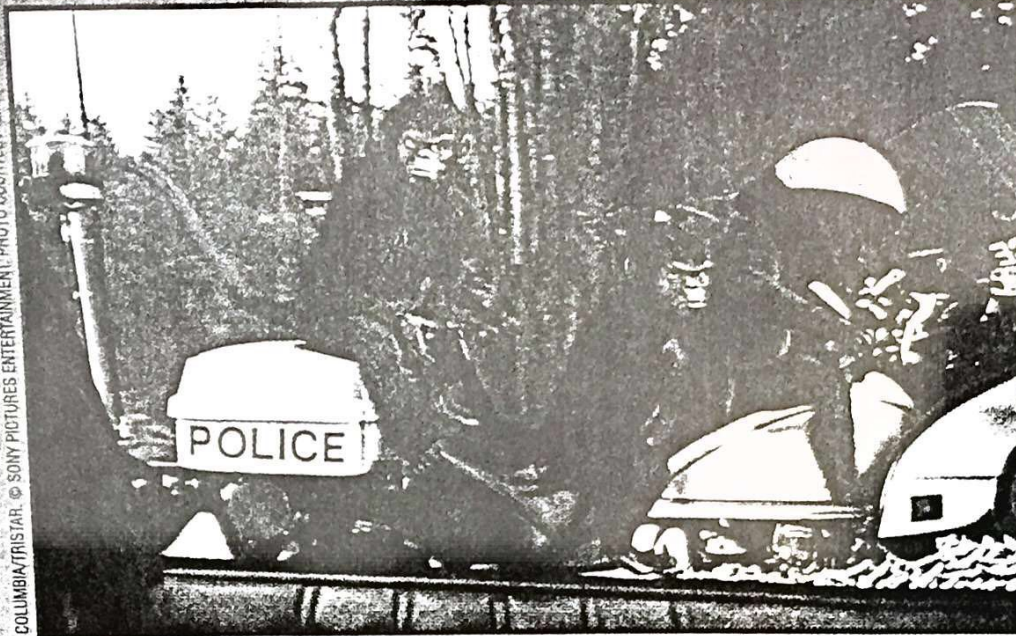
Remarkably, there are no live animals in *Jumanji*. The lion, pelican, and bats are CG, with animatronic "cousins." The monkeys and

mosquitos are all CG. The rhinos are CG, as are all the other stampeding animals (60 or so). The animals are stunning, making *Jumanji* a sure bet to be among the finalists for an Academy Award for visual effects. They aren't, however, exactly real.

Director Joe Johnston, himself an Oscar-winning alumnus of ILM (for visual-effects contributions to *Raiders of the Lost Ark*), decided early on that *Jumanji*'s animals, because they were fantasy animals, would be larger and more menacing than real jungle animals, with a character and intensity that would heighten their on-screen presence. The believable dinosaurs in *Juras-*

Ellen Poon was the CG supervisor for the stampede scene in which 60-some CG animals—rhinos, elephants, zebras, and a pelican—course through the small New Hampshire town's square.

Barbara Robertson is West Coast senior editor of CGW.



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The expressions ▲ on these monkeys' faces were animated in large part by Dave Andrews using Softimage 3D and custom software for facial animation.

Jurassic Park made ILM an obvious choice to create the CG versions.

ILM's visual-effects supervisor Stephen Price and visual-effects producer Mark Miller began working on *Jumanji* about nine months after *Jurassic Park* was released.

to meet. First challenge: even though the *Jumanji* animals would be exaggerations, they'd still have to pass a reality test the effects team hadn't yet faced. Unlike *Jurassic Park*'s dinosaurs, *Jumanji*'s animals could and would be compared by the audience to real, familiar animals.

"No one knows how *T. rex* moves," says Miller. "But everyone has seen nature films on TV of lions stalking the Serengeti; or they've been to the zoo." Moreover, while ILM had great success with the lizard-like skin on the dinosaurs, they couldn't point to an equal success with using CG for furry animals.

Thus, the first thing ILM had to consider was how to create the

hair, especially the long hair for the lion's mane. "We knew we had to model and control each hair individually to get a natural look," says Miller.

They also knew the second big challenge would be modeling, ani-

imating, and just dealing with dozens of creatures all at once. "We decided to divide and conquer," says Miller. Rather than burdening one CG supervisor with the entire problem, they organized the sequences into four groups, each led by a CG supervisor. Ellen Poon managed the stampede and the vortex scene at the end of the movie; Jim Mitchell took on the bats, mosquitos, and effects shots such as the quicksand in the attic; Doug Smythe handled the monkeys; and Carl Frederick got the hair, the lion, the pelican, and the vines. All told, a

core group of eight animators and 10 technical directors worked with the four CG supervisors who were all technical directors, too, and did some animating. In addition, they relied on three people using Viewpaint (ILM's proprietary 3D paint program), five rotoscopers, and a few 2D painters.

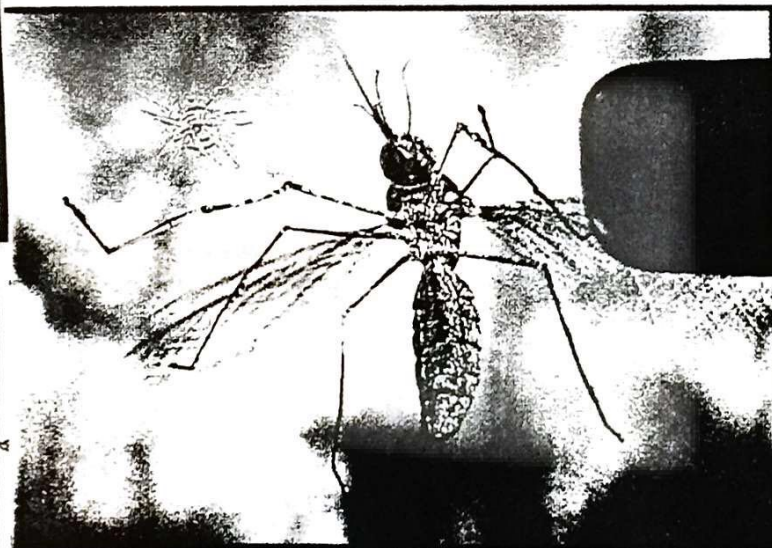
Knowing that creating the lion would be the hardest project, the team decided to save it for last. They started with the hair software in June 1994, and began modeling the stampede in August.

First, the models

Working sometimes from Cyber-scans but often doing freehand sculpting in the computer. Geoff Campbell, CG model supervisor, created the bodies for the rhino and monkey, the zebra head, and the 30 monkey faces and 10 lion faces used for facial animation.

ILM modelers use Alias Wavefront PowerAnimator software, having found that its control points provide the right digital tools for creating fine detail. Detail, for example, like believable skin folds and wrinkles.

It takes, on average, about seven



COLUMBIA/TRISTAR © SONY PICTURES ENTERTAINMENT PHOTO COURTESY ILM

To give the ▲ mosquitos wings that blurred realistically when they beat, CG supervisor and modeler Jim Mitchell gave each insect a set of four to five wings rather than two.

"We started talking to Joe in April 1994," says Miller. "At the first meeting, he said he wanted the monkey and lion to be CG to get the performance he wanted." It was not a simple request. Creating these animals would give ILM two new challenges

weeks to complete each model. While the modelers sculpt, envelopers work on the skin (the body's "envelope"), refining, particularly, surfaces for bending joints. At the same time, painters add realism with bump maps and textures.

When Poon began working on the stampede and vortex scenes in *Jumanji* in November 1994, the live-action plates had just started coming in, the stampede animals had been built, the textures were being painted, and the enveloping was started.



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COLUMBIA TRISTAR © SONY PICTURES ENTERTAINMENT PHOTO COURTESY ILM

The stampede begins with two life-size rhinos charging down a hallway, bumping into each other as they move past the camera. It's an implausible situation—two life-size rhinos in the hallway of a house—but the skills of the modelers, animators, painters, and envelopers make the animals absolutely believable.

"We tried our best to make the animals look organic, like living, breathing animals. If they seem too clean, it's because they haven't been to a mud pool," Poon laughs.

The rhinos crash through the library walls—a combination of practical and CG effects—then lead a stampede through the house and into the town square. The stampeding animals—rhinos, elephants, zebras, with a pelican flying overhead—stretch back into infinity.

Knowing it would be impossible to choreograph 60 animals and put them into one scene in Microsoft's Softimage 3D, Dale MacBeth came up with a method that used "run cycles," working with "pawns" rather than the real models, to create non-intersecting paths for the stampeding animals. Once the paths were set, "real" animals were substituted for the pawns. Then, Poon's team used proprietary software to add subtle movements, such as the zebras leaning into the curves, and secondary enveloping, such as bellies jiggling.

In one memorable shot in the stampede sequence, a CG elephant walks up and over a car, crunching the car underfoot. For this sequence, the "run cycles" were abandoned in favor of hand anima-

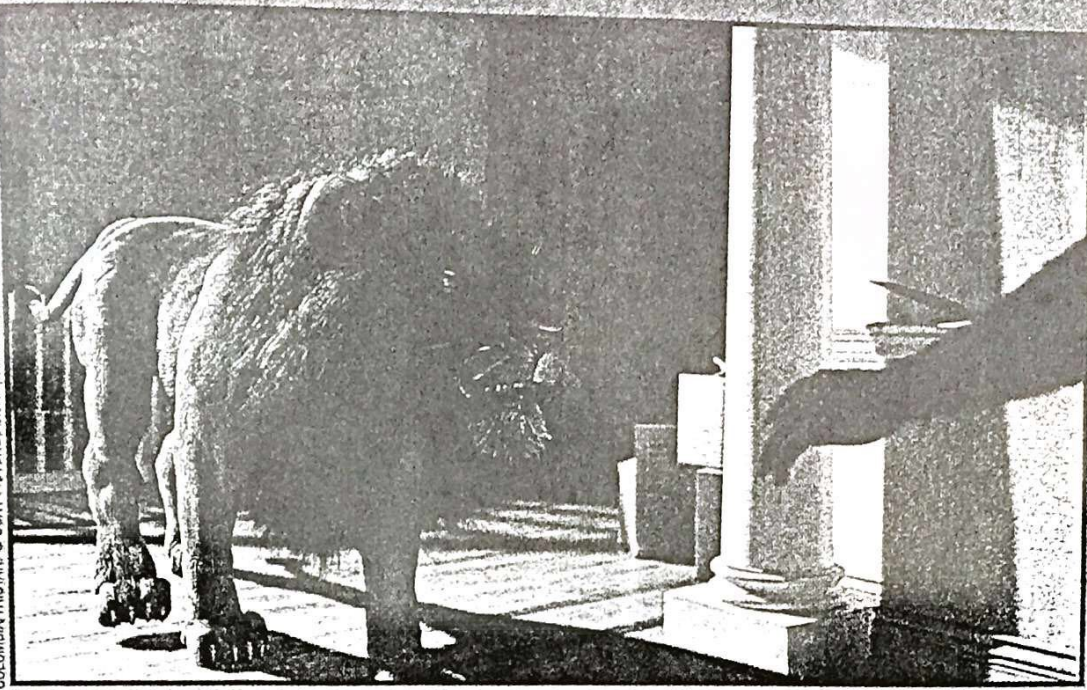
tion. Although ILM could have modeled the car as well as the elephant, it was decided to crunch a real Chevy Caprice with "practical" effects. This meant that while the animator was marching the elephant over the car, he had to worry about matching the timing of the animal's steps to the physical effect.

In other scenes, ILM replaced practical effects with CG effects. The scenes of the rhinos charging into the library are one example. Another is when a rhino rips off a car door during the stampede. For these effects, ILM painted out practical effects—the library doors and the car door—and replaced them with CG models to heighten the drama. With CG animation, the rhinos could toss the doors in the air in ways that would have been very difficult to create with cable rigs.

Selling the Shots

The combination of practical and visual effects helps sell the shots, as do the little things, as Poon calls them, which the team put in to help make the shots interesting—the debris, the dust, the zebras kicking up leaves, the reflections on the car of the stampeding animals. "Animating the rhinos was a snap compared to the dust and de-

The realism of the monkeys' fur may be the big CG news; however, choreographing and animating eight monkeys in a kitchen was no small task either. CG supervisor Doug Smythe's group worked on the monkeys' look and performances for about a year. In these scenes, the monkeys are 3D characters, but the environment they're in and many of their props are real.



Have you ever seen a CG lion's mane that looks as realistic as this one? CG supervisor Carl Frederick credits lead programmer Jeff Yost along with David Benson, John Horn, and Florian Kainz for developing the short- and long-hair software used on the monkeys and the lion. The lion's body was modeled by Paul Hunt, with Carolyn Rendu and Rebecca Petrucci-Heskes doing mane modeling and painting, and Geoff Campbell sculpting the 10 lion faces.

bris," she says, which had to be painted into the live-action background plates.

This attention to detail helps add realism to the scenes. But what finally pulls it together is the lighting. Always, the effects teams have to match their lighting to the live-action plates. With indoor scenes, the lights are relatively easy to pinpoint. Outdoors, it's another story. To more accurately match the lighting of the overcast day during which the live-action footage of the stampede was shot, ILM had people carry little maquettes of the stampede animals through the streets while the camera was still set up.

The stampede sequence is amazing. But, then, so is the vortex sequence at the end of the movie. In this scene, all the CG animals from earlier scenes get sucked into the attic by a great force that blows out the windows and walls. The animals are kicking and struggling to get back outside as a giant vortex envelopes the entire room, pulls the animals in, and creates a twisting effect that causes them to be whipped around inside.

According to Poon, the hardest part technically was in distorting the animals so they would look like

they were melting until they vaporized and disappeared in the primordial soup. "We had to develop software that would decrease the resolution, do the distortion, then bring the resolution back up," Poon explains. The custom software reduced computation time for each animal from five hours to 14 minutes.

While Poon's team was working on their sequences, Jim Mitchell was leading a group working on bats, mosquitos, and other weird visual effects, Doug Smythe was supervising the monkey scenes, and Carl Frederick's team was creating hair, the pelican, lions, and vines.

For the bats, Mitchell's team had to match an animatronic. "When we started, the bats were fairly detailed," Mitchell says, "but we could go to lower resolution because of the motion blur."

To manage the animation of the flocking sequence for the 100-some bats, technical director Pete Dalton created three wing-flapping cycles. He distributed the bats along predetermined paths, animated the paths, then added the flapping cycle for each bat.

The mosquitos were even more fun. "We had free rein," Mitchell says. "There was no animatronic,

and they didn't have to be anatomically correct." They weren't. These mosquitos were monsters—6 to 8 inches long. "They fly in formation like starfighters, breaking off, terrorizing the kids."

Mitchell's group also worked on a scene where Jumanji has turned the attic floor into

quicksand that tries to suck Robin Williams within it. To be able to pull textures around Williams, the animators converted the plane of the live-action floor into a 3D surface, then mapped the floor texture onto that surface.

Monkey Business

With Mitchell's group mired in quicksand when it wasn't flying mosquito bombers and bat flocks, and with Poon's group working with herds of stampeding and whirling animals, Smythe's group could concentrate solely on its own monkey business.

The monkeys in *Jumanji* were created by Smythe, two other technical directors, three animators, and a Viewpainter. The group worked on them for about a year, spending the first couple months on look development and the rest on the monkeys' performances. "My personal take on the monkeys' personality is that they're intelligent enough to wreak havoc, but not totally aware of how their actions affect others," says Smythe. "They seem surprised at the result."

Wreaking havoc is exactly what the monkeys do in the kitchen, where a combination of practical

and visual effects has them turning the gas stove into a fireball, riling through drawers, throwing plates, hanging from chandeliers—in general, creating total mayhem.

In a second scene, we find the impish monkeys on police motorcycles. To create the monkeys' facial expressions, the animators used custom software which gives animators timeline control, the ability to mix and match pieces of facial models, and preview the animation in real time. "An animator can choose which percentage to use of different features to create expressions," says Smythe.

Hair's the Thing

Perhaps one of the biggest reasons the monkeys look real, though, is the fur, a project taken on by Carl Frederick and a software team led by programmer Jeff Yost. Their solution: two different approaches for short and long hair. Short hair is created in the renderer, long hair is modeled.

For short hair, used for the monkeys, the pelican, and the lion's body, a critter creator orients little arrows (vectors) to set the direction the hair grows, then specifies parameters to further describe the hair. For long hair, animators define the position and shape of individual mane hairs using custom software that plugs into Softimage. Once the chains are modeled, they're run through a program of hair data parameters to set textures that define such things as length, color, turbulence, and tangling.

Rather than using RenderMan shaders, the team created their own shaders specifically for the hair primitives—which, in turn, created a new set of challenges, rendering one animal using two different programs. But these weren't the only challenges. They had to match the lion to two ani-

matronics, and they had to give the lion facial expressions. Knowing the lion would be difficult, they left it for last. So, by the time they started working on the lion shots, they'd had a year to perfect the hair software. It shows.

"We're getting to the point where it could have been used in any shot," Frederick says.


Miller agrees: "The camera could have gotten closer." *Jumanji*, Miller believes, gives ILM a "new quiver of arrows," by showing people what they can do in the natural world.


Adds Mitchell: "We want to develop as a character and creature animation facility and *Jumanji* has helped us get better at it." In addition to developing the hair software, the group fine-tuned a lot of other custom tools—the 3D paint

system (Viewpaint), the enveloping software, and the facial animation software in particular.

"It's unbelievable," adds Mitchell. "You start animating creatures, you put a smile on a monkey, and the next thing you know, you've given it a personality."

This comes none too soon for Poon, who wants to do more emotional work. She believes that the time will come when directors acknowledge the role of virtual characters as actors rather than thinking of them as post-production effects. That could change the role of animators dramatically.

"We're creating integral parts of the movies," Poon says. "Sometimes the best parts. It's time they asked us, 'What were you thinking when you were creating those creatures?'" 



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