



UnrealCity

ILM Creates Artificial Cities for Artificial Intelligence

By Scott Lehane

Industrial Light + Magic has a long history of developing its own tools and techniques for creating special visual effects. From *Star Wars* through to *Terminator 2: Judgement Day*, *Jurassic Park* and *The Perfect Storm*, the company has always been at the forefront of visual effects work.

For *A.I. Artificial Intelligence*, the company created computer graphic robots called Mechas, a robotic teddy bear (complete with painstakingly accurate fur) and a futuristic CG vehicle called an Amphibicopter that flies through New York City, which, thanks to ILM, is half submerged underwater. But perhaps the most interesting aspect of ILM's work on *A.I.* was the new techniques developed to allow Steven Spielberg to storyboard, visualize and compose complicated bluescreen shots set in Rouge City.

But the film took a long time to come to fruition. It was 10 or 12 years ago when Stanley Kubrick first contacted ILM's Dennis Muren, ASC, who served as visual effects supervisor on the film, about how he might tackle some of the demanding visual effects for *A.I. Artificial Intelligence*.



A.I. Artificial Intelligence



According to Muren, whose credits include such effects work as all of the *Star Wars* movies, *Close Encounters*, *Jurassic Park* and *Terminator 2: Judgement Day*, "I had been talking on and off with Stanley for 10 or 12 years via telephone, and then I heard from him in 1993. He wanted me to come over. I flew there for Thanksgiving dinner. He talked a lot about *A.I.* at that time. He kept a lot hidden from me, but he told me about the robot child and New York being submerged under water. He was sort of drilling me on how I might do it. He had seen *Jurassic Park* and he thought by now maybe the technology was up to being able to make this movie. But he was still searching for ways to do it.

"I kept hearing from him about that for years after that," added Muren. "He had somebody shoot oil wells in the North Sea which was a suggestion I had made — that we might be able to use the oil wells as tracking points and put buildings over them. And we were ready to do it. But he just decided not to proceed on it at that point and went ahead and did *Eyes Wide Shut*."

At the same time, Kubrick had been talking to Stephen Spielberg about making *A.I.*

After Kubrick's death in 1999, with some 1,500 storyboards done and a 100 page synopsis of the film, Muren said that it would have been a "shame to have it sitting in a garage somewhere and never seen."

Hence Kubrick's family decided to offer Stephen Spielberg the opportunity to make the film.

"Stephen knew about as much about it as anybody," said Muren who admitted that, "I was surprised that it was still around."

The film, lensed by DP Janusz Kaminski, ASC, tells the story of a robot boy's development, as he becomes almost human.

But did Spielberg stay true to the original vision?

"The story is very similar, but it's still Stephen's movie. It has much more heart than Stanley would have given it. Stanley would have given it that incredible edge that he brought to his films," said Muren, "But it has definitely become a Stephen movie. It's not trying to be a Stanley Kubrick movie."



Dennis Muren, senior visual effects supervisor on *A.I. Artificial Intelligence*

For Muren, one of the most interesting aspects of the project was developing tools to enable the director to visualize, pre-vis and storyboard shots in Rouge City — a CG city that was filmed in front of a huge 160-by-60 foot bluescreen. The system made use of existing broadcast-oriented virtual set technologies, video game rendering engines for storyboarding as well as software written in-house.

The challenge for Spielberg working in front of such an enormous bluescreen would have been to try to compose in his mind's eye, with nothing to go by until the backgrounds were composited in later.

According to Muren, Spielberg is "a very spontaneous director and we like to give him the opportunity to change his mind. So we came up with an approach where we could actually see a composite on the bluescreen stage of what the background was going to look like in real time."

Where other directors might have had to resort to very fundamental camera moves in front of such a huge bluescreen, Spielberg was able to see the background composites live in real time on monitors around the set. This also gave the talent a frame of reference.

Muren reported that "we probably spent four months getting the whole package to work and all of the pieces to fit together and then writing our own stuff to make it bullet proof because it can't fail on the set with all the talent there."

ILM's on-set visualization supervisor for *A.I.* Seth Rosenthal, who was in charge of developing the system, reported that it relied on Rademac's camera tracking system (which was developed at the BBC for broadcast applications) and a rendering package from Brainstorm SP, as well as in-house software.

Continued on Page 2



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Unreal City

Page 2



Jude Law and Haley Joel Osment in A.I. Artificial Intelligence.

setting up during production."

"The whole goal of the exercise was to expose aesthetic choices or opportunities to Stephen Spielberg. So it was a director's tool not a postproduction tool. We weren't particularly concerned about using that data later for motion control or for match moving in CG," said Rosenthal.

But he added that "while the system really was not a postproduction process or tool, it was a way to push postproduction decision making back into production where it belongs."

Rosenthal reported that ILM is very interested in using the technique again on other films and perhaps expanding on the idea. "We see it as the first of a whole family of analogous tools or techniques. In this case, it was used primarily as a composition tool so that the director could frame the action against various specific parts of the skyline or against particular parts of buildings. And he was able to direct very specific performances and camera moves. But it seems that there may be a related tool in there that would be more of a DP's tool to make decisions about how CG lighting in the post effect is going to match the lighting that he is

Muren added that, "it was sort of a big breakthrough for us and it was helpful for Spielberg since he didn't have to rely so much on his mind's eye to be able to come up with what it was going to look like, or try to figure it out later. He could actually see what the background was going to look like, there on the set. And the actors could look at it also. We had large screen monitors around so everybody was able to see it."

But even before Spielberg confronted the massive bluescreen, he had a pretty good idea what his set was going to look like thanks to a novel approach to storyboarding. The same artist that put together the rough composites for the virtual set, also generated a version of the Rouge City world for the 3-D virtual reality video game "Unreal Tournament."

"It's a just a regular shoot-em-up game, but the nice thing about it is it gives you the engine to make your own mapping so you can make your own world," explained Muren. "The resolution on this stuff is great. It looks gamey, but the idea that the resolution doesn't hold up and it doesn't refresh fast enough, that's not true anymore. It's really great what you can do just on a laptop. We had it working on a Powebook and on a Compac laptop. It takes it out of your mind's eye and puts it down there where you can actually look at it, which is really the way that artist should be able to work."

ILM also added the ability to pick camera lenses to the "Unreal Tournament" engine "We had all the lenses that we were used to. And we were able to record the moves so Stephen actually sat there on the set before we were shooting and fiddled around with his Powerbook on his lap."

"In your head you start understanding, 'oh yeah, two miles over there I see that building and a quarter of a mile over here I see that building and it's a lot taller than I thought it was going to be. He became familiar with the relationship between everything, so that a week later, when [he was] on the real set, he already was comfortable. He had already done his walkthrough and now he was walking onto his real bluescreen set," said Muren adding that Spielberg "very quickly picked up on how to move the camera around based on all the 'Unreal Tournament' keyboard strokes... it's obvious he played the game a lot. He just got right into it."

ILM was also called upon to create a futuristic New York city submerged under 100 feet of water as well as CG vehicles called Amphibicopters (kind of a cross between helicopters and submarines), which take the audience on a aerial/underwater tour of Manhattan and Coney Island.

To create a convincing New York, ILM built scale models in a water tank combined with CG buildings.

"Background plates were done with large models that we had built. This was a huge model... probably about an inch to a foot or so, so some of the buildings are four or five feet high," said Muren. "We did it that way because we could just get a lot more interactive control because it's all real. We have some great model makers who just know how to make this stuff look like it's been underwater for 200 years, which is pretty important to the story."

ILM also composited in debris in the underwater scenes to make the water look realistic.

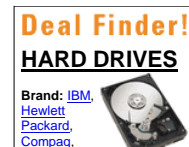
Part of the challenge for Muren was trying to match the unique style of cinematography that Kaminski used on the film.

"We put a lot of effort into getting a strong aesthetic on the film. Janusz Kaminski came up with a really great look for the movie and we incorporated that into all of our effects work which was pretty difficult because it's not a standard way of shooting. It's very contemporary," said Muren. "And then carrying that through in the precise computer graphic world was difficult because computers do everything perfect and if you don't tell it exactly how screwed up you want it to be, it won't do it. And a lot of this kind of screws around with the image to make it much more compelling. It was really hard analyzing it and trying to figure out what we needed to do to get to the computer image to look the same way."



Haley Joel Osment (left) and Jude Law in Warner Bros. Pictures and DreamWorks Pictures A.I. Artificial Intelligence.

Continued on Page 3





Unreal City

Page 3



"What's going on, I think, is that some DPs now are reacting to the digital future that they see coming where the images are so clean and they are making these movies really gritty. There are flares in them and there's diffusion on them and there's grain showing up," said Muren. "The stuff looks really great, but it's really hard to composite into it. We've been seeing this trend happening for the last year or so. And so a lot of work was put into getting just the right lens flare from a certain type of filter that he was putting in front of the camera, that under certain conditions gave things a certain look."

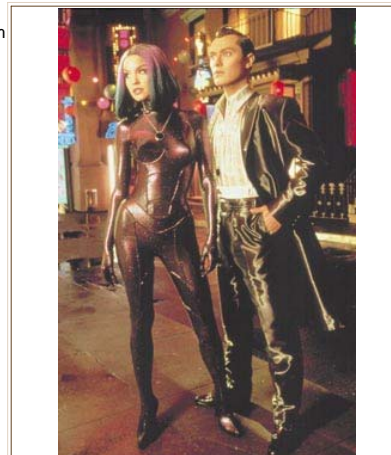
ILM also created a number of robot characters called Mechas for the film.

Muren explained that "there was no other way to do it except in CG. What we had in the design was just so neat that it couldn't be built for real. There was a whole set of problems to solve making the robots that look real."

In one challenging scene, the audience sees the Nanny – a robot with the back of her head taken off. Muren reported that it was a time consuming rendering job to get it to work.

"You see her face, which is of course a real face acting the way only a human can act, but when she turns sideways the back of her head is all gone and there's all the mechanical apparatus in there. It's got a lot of transparency to it — lots of self illuminated lights on the inside," said Muren. "We wanted it to look real so we used real people then cut away the parts of their bodies and replaced them with CG interiors."

To create a futuristic robot Teddy Bear for some shots, ILM relied on a combination of Stan Winston robots and CG creations. But the Bear raised the whole problem of creating CG fur, one of the most challenging tasks for digital artists.



Ashley Scott (left) and Jude Law in A.I. Artificial Intelligence.

"When it actually had to walk and run and do that heavy performance stuff we did a CG bear" explained Muren. "We spent a lot of time trying to get the fur because the fur is very complicated and heavy. It had a lot of sheen to it and various colors on the fur, so there would be one level deep into and then it would curl and go to another amount of sheen and colors. There were many levels on it. In our fur experiments, the rendering times were like 18 hours to be able to get it. And then we managed to optimize it down to something more realistic and I think we got it in the four-hour range. But wherever we could, we cheated and did it with photomaps and stuff like that, when it was in the long shots so we weren't dealing with the renderings. There's no fast way to do fur. It's still grueling to render."

Muren explained that ILM is an SGI-based house, and that all of the company's compositing and in-house software is designed for SGI's Irix platform. For the fur rendering work, the company used Maya as the basic foundation, but he was hesitant to talk about software because for ILM, known for writing its own code or customizing existing packages, "so much of what we do is way beyond the package."

In summation he said, "the whole show had so many different types of things in it, that it was really complicated for us. As soon as you solved one set of problems, you had another for another sequence."

[Back to page 1](#)



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