

# FRAME by FRAME

by

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The vampire devil smashed the doors apart. Steve was scared but stood firm, watching as it dropped and sniffed the swirling dusty moonlit air... He tried to remember its perfectly delineated bristling fur and every tiny muscle twitch... He tried to write a note, but the letters squeezed from his hand. He tried to click but nothing happened.

The beast was alive, part of a complete world Steve could sense beyond, and as its eyes locked with his specular glints subtly shifted and the gnarled lips curled baring drooling sharp teeth, and-

Steve Davidson woke and found himself looking up at silhouetted polygons that only slowly resolved themselves: a cone-shaped lamp, a desk, and a molded-foam vampire head wearing dark glasses and a hat.

He sat up. He was on a sleeping bag in his office at the studio. Storyboards and reference photos covered the walls, books, memos and wildlife videos swamped the desk; his SGI workstation loomed from the mess like an iceberg in the night. Or day. It was hard to tell. Like most workspaces in Silver Egg Digital FX, Steve's office was shuttered against the Californian sunlight so he could see the colours on his screen better.

Too late, he remembered his dream beast; it slipped away as he reached for it, leaving only the impression of a perfect memory.

8.13 am. Damn. At around six he'd taken a short break to rest his eyes; he wasn't supposed to fall asleep. Not this week. Now there wasn't much time to get the latest iteration of his vampire animation out for dailies.

He sat down at the computer, pushing the gluey remains of a Pad Thai aside.

The animation character - deep torso, lanky long arms and knobbly knees - stood flat on the screen, waiting. When finally rendered with hundreds of megabytes of texture maps he would be big and hairy, but right now he was a stripped-down wireframe model and ready to roll. Alerted by a noise, he had to jump up,

bound down a slope over fallen statues and boulders as the camera moved to follow, and end up in a face-off with a live action human hero standing knee-deep in the river below. Cut.

Steve made the perspective window full screen, substituted a high polygon model and ran a preview. The beast looked up; head a little snappy. He looked round. Stiff. Then he just popped off the ground like a light frog and scampered inelegantly down the obstacle course, his legs alternately boneless and wooden.

It looked terrible. All 219 frames plus handles. There was little sense of real muscle and sinew articulating the joints, transporting a five hundred pound creature through a gravity field. There was no weight, no mass.

And of course there were no real muscles, just a hierarchically linked collection of polygons and NURBS patches, foot bone mouse-click connected to the shinbone in inverse kinematic chains, bouncing down a jumble of 3D-modelled virtual set objects with all the zing of a toy pulled over scattered play bricks by a two-year-old.

If only he could talk to the character. Look scary! OK, now growl and please use your legs more believably...

"You useless piece of trash!" said Steve.

It was going to be embarrassing to present, especially since Drissa Yilla was just rocking with his multi-vampire fight animations.

Why couldn't he?

The location was good, an Atlantean temple on a sunlit hillside. The complex live geometry had been measured by laser, rebuilt accurately in 3D and the two match-moved with no problems.

The creature looked believable enough. Sculpted by art director Todd Rankin, the digitised result was the basis of four computer models ranging from simple and speedy for blocking to a maxi-megabyte deal with hundreds of controls to manage all the variables needed to create a functioning character. Once Steve's animation was approved, the technical directors would colour and light and shade it, adding dust and other interactive elements to enhance the illusion that Old Vampy was integrated with the location plate.

But so far his animation had neither the solidity nor the spark that made it look alive and no amount of TD trickery would fix that. Somebody had to fix it, though, because *Vampire: Born of Atlantis!* was a movie largely about these beasts of love and blood; if the creature didn't work, neither would the story and SED/FX would fail in helping the director realise his artistic vision.

"Stupid vampire!" he yelled. "Act!"

He stood up in frustration. If you don't know what to do next, get coffee.

Windowless but fluorescing, the kitchen was an oasis in the dimmed corridors of the studio. As Steve stood blinking in the light, the hiss of the coffee machine became a stream he could almost see bubbling through a dappled glade-

"Hi, Steve, how's it going?"

"Mmm?" said Steve, turning. "Todd. I can't nail GT144\_3." Todd would understand; he'd done the FX storyboards, laying out key frames on paper, so he knew as well as anyone what the director wanted to see.

Todd scrutinised Steve's face. "Another all-nighter?"

"My vampire looks like a paper cutout," said Steve. And Todd had a real feel for mass and tonal values; what's more he'd managed to suggest a sinister, hooded look to the vampire's eyes that no one had been able to recapture in the computer model. In pencil! "Really," said Steve, "even your scratty little boards are better!"

"Well, thanks. What's the problem?"

"Hmm? Everything. Articulation, translation through space, its path... No sense of mass, of presence."

"Your wildlife refs don't help?"

"They only tell me a low-rez video of a wolf looks more real than anything I've ever done." It was true. How could a mangy animal with no training in 3D modelling make his own limited collection of TV-resolution pixels look alive?

"Have you acted the shot yourself?"

"C'mon Todd! No!"

Todd poured his coffee. "We shouldn't have let the performance classes go."

Steve had to smile at the thought: adults twirling around the local high school gym, trying to become more involved animators by imagining themselves as cats and elephants instead of simply prodding at their wireframes with digital sticks. "I never liked that. Acting like an octopus..."

"I'm serious," said Todd. "And when was the last time you went to a zoo, saw some big real animals up close?"

"Well, what about your life classes, while you're on the case?"

"Them too."

Steve laughed; Todd just wasn't living in the real world. "We're on a deadline. Lucy Hatter's not going to let us all sit around drawing naked girls, getting in touch with our inner animals!"

"Everybody needs to see live subjects. Sketch the muscle groups, know their weight." Todd smiled. "Feel their pain."

Steve shook his head. "What we need right now are more intelligent software tools." He checked his watch. "Sorry, but I got a shot to get out."

"Show me."

"Well, OK," said Steve, reluctantly. He got to his knees to mime the action. "Vampy's chomping a blonde priestess. Splash! he hears. Whuh!? he says. Human!! And he springs up... and..."

Steve just squatted there.

"How do you *feel* what happens next?"

"He jumps down. I won't do it, because I'll break my wrists."

"OK." Todd thought a moment. "I imagine him leaning out into space, heavy, swinging his arms forward like a swim racer diving into a pool. Purposeful. And not afraid of breaking his wrists."

Steve shut his eyes. Was that right? "I want him to be your worst nightmare, right in your face. We have to see him. Super-detailed."

"Really? Don't show the monster! they used to say."

Steve stood up. "That's because they couldn't do what we can."

"Well-" Todd was interrupted by a page echoing from a hundred phones: "*Heads of Departments meeting in the conference room.*"

"Gotta go," he said. "I'm going to raise this. The classes and field trips."

Steve nodded and followed him out, forgetting his own coffee.

The building was filling up. The technical directors would be at their workstations already, checking the overnight renders. More people were coming in through the daylight reception area, all looking enviably solid after a night in their own beds and a breakfast in their stomachs, trailing wispy ribbons of sunstuff behind them. Steve felt stretched and light-headed by comparison. Floating.

He blinked. Also in reception was a brooding vampire.

It was just an animatronic puppet, the augmented man-in-a-scary-suit used on set; at first it had given people quite a shock, but now they hardly saw it at all.

"Steve!"

It came from the dark video room; Steve saw two shapes silhouetted against flickering monitors.

"Helen?"

"Erika's about to run my comp!"

"Well, I - "

"C'mon, its OS1\_1 - the Opening Shot!"

"OK, OK." He wasn't going to fix his problem in the next five minutes anyway.

Erika fired up the clip. It opened as a digital 2D painting with a fade up to a new moon. 3D particle system clouds whipped in front and the virtual camera tilted down, through lightning-studded murk, to reveal a sea horizon and the red-tiled rooftops of distant Atlantean city suburbs, painted out of digitised large-format stills of Greek villages and animated by adding rippling flags, seagulls and waves breaking on the shore.

Middle-distance temples and other buildings were digital models built by SED/FX artists to a plan by Todd Rankin, 3D painted and bump-mapped for texture, lit to match and comped into the storm; lightning modelled the virtual structures while a foreground practical rainwater element shot against black started crashing out of the sky.

"OK, now look at this," said Helen.

The shot segued into a motion-control move that descended round a stage dragon statue splashing with rain, before wiping off a roof edge to reveal an actor standing in a location courtyard sixty feet below, and into a live crane down huge dripping Greek pillars amidst flashes of 70KW practical lightning.

Impressive - the 2D background, 3D models, animated elements and location shot were all visible in the frame together, tracked and matched seamlessly.

The scene ended on the priest, his arms raised in a ritual gesture he clearly thought inadequate against the coming vampire attack.

"What do you think?"

"Well, there's something not quite right about-" said Steve, but just then Lucy Hatter, SED/FX's producer on *Vampire, Atlantis!*, put her head round the door.

"Steve, your shot must be finished!"

"No, not yet..."

"Then quit acting as effects supervisor." She looked at him and shook her head. "You look just awful. We'll have to upgrade your flesh shader."

Steve sat at his desk. Helen's Atlantis composite was technically excellent, but there was a spark missing from the whole: you couldn't quite imagine being in the streets of the place.

Why?

He sat up. Because what you saw was all there was: an architect's model of an ideal city, missing a sense of life off the frame or in the buildings.

So remove the single architect. What planner ever designed, coloured, lit and wore out a city all by himself? None; it was the social result of people occupying space over time.

To do it in the computer properly, you would lay out only the basic city plan and some key buildings, then populate the scene with cyberlife norn agents. Give them an upper culture limit and details of the economy and building materials and iterate a hundred generations and what would you get? A natural-looking environment with buildings put up and torn down, houses lit and lived in by their inhabitants and streets constructed on least discomfort trails in a realistically random way: a digital town that had built and bump-mapped itself. You'd have a sense of things going on around the film frame. The virtual camera would be a window into a real place, like a real movie camera.

But if it got too elaborate, would the AI agents think they were alive, and if the computer crashed, would there be norn bodies lying about in the streets, dead butterflies no longer dreaming they were Chuang Tzu?

He shook his head.

Concentrate. Iterate.

Steve put Old Vampy through his act. Head up, look round, and down the boulders like a bunch of coconuts. Oof. The hero in the river would die laughing, not in terror.

He sent the shot off to Erika, telling her it was as ready as it was going to be, and sat back, frustrated. Bugs Bunny would be more believable.

Was that true, and if so, why?

Probably because our intellects could appreciate the character-driven wit of Bugs while his Toony outline did not alert the hunter-gatherer in us to his so-called rabbithood.

Vampy and all the other digital beasties, from mice to 200-foot lizards stomping Manhattan, were different: looking at least partially realistic, they presumably triggered food and danger alarms deep in our psyches, prompting closer inspection and so greater disappointment when the illusion broke down. Call that a man-

eating monster? our primal instincts might ask. Why, you should have seen the sabre-toothed tigers we had to deal with back in the old days!

He blinked. Must keep focus.

Perhaps old ways were better: using a physical vampire armature to translate manual movements in Harryhausen space to the x,y,z digital realm. A data glove and a VR headset would be an improvement on that, enabling him to step inside the virtual world himself, to walk around and make his changes directly to the CG model.

Or perhaps he should try Todd's character performance thing and really get into it, heart and soul, animating with his whole body instead of simply pushing his mouse about.

Steve closed his eyes and imagined what a vampire would really do on an ancient Mediterranean midday.

The town he conjured up was too Californian-Spanish, but never mind; as he drifted into a lucid daydream he became a solid vampire walking among the sunlit carved stones of young Atlantis, stalking prey with a clatter of unsheathed claws. He bared his teeth, unfurled his leathery wings, spread them wide, and...

Erika knocked on his open door.

"Didn't hear the page? Wake up! Dailies!"

Everyone else was in the darkened conference room by the time Steve came in and sat on the floor.

"The production cannot miss their delivery date," studio president Mark Anderson was saying, again.

"We'll make the deadline," said Lucy. "You'll get a revised schedule today. Things are tight but not disastrous. We've wire-removed, rotoed and comped every greenscreen shot we can. Progress is good..." She checked her laptop. "All down the animation pipeline - even on GT144\_3, am I right?"

Steve nodded glumly as Drissa, Steve's immediate boss, spoke. "We think we're on top-"

"Think?" said Mark. "You're 'gonna make the deadline'."

"We'll do it," said Richard Bach, effects supervisor.

"OK, OK," said Mark, swivelling his chair. "Let's roll."

Erika started with some routine comps - actors emoting in front of what was now Atlantis, not the greenscreen they'd shot against in Holland. It looked OK on the monitor, but the real test would be the filmout screening, where you'd see if the digital matte-painted background looked like a believably distant, spacious

outdoor panorama or simply a stupid flat wall just behind the actors.

Character shots next. Steve leaned forward. The latest iteration of Drissa's major Three Vampires Fighting scene: three large pinkish creatures, slightly differentiated in size, shape and colour, duked it out in the amphitheatre by moonlight for the neck of the youngest virgin. Drissa was now fully using the complex model controls for fine-tuned animation to tweak little things the audience would not notice directly but might feel missing if they weren't there: subtle spine flexing, jiggling muscles, spreading toes... Beautifully interacting, the three angry vampires punched and bit and rolled on the ground as the camera followed, moving, up, down, left, BLAM! camera shake too.

Why couldn't he get that? Drissa's models were not rendered with hair yet, or properly lit, but were meatily impressive all the same.

It certainly looked good on the monitor; but as he watched the clip run through again Steve suddenly thought the vampires might prove a little too fast scaled up twenty feet tall on the movie screen. It could look like a scrap between agile domestic cats instead of the five-hundred pound lumbering bull vampires they were supposed to be, complete with inertia and a wide turning circle.

He made a note. Better if models have their own mass and tensions to work with in every limb and organ; imbued with a sense of their own capabilities.

"What d'you think, Steve?" asked Drissa.

"Need to see it on the big screen," he said. "Still a little way to go." But Brian Newhall, the director, now in Verona prepping *Undead Romeo and Juliet*, was sure to approve this by the end of the week.

Next up was Steve's own effort. He cringed as his lame creation skipped lightly down its boulders, but nobody made any sarcastic comments.

Debbie Stepanovic's shot came on for film-out approval. A terrified vampire, fleeing down a palace corridor from the rage of the mob, finds itself faced with a wall of fire. It looked good; the creature visibly seemed to think before deciding to vault the flames. But again there was something not quite right...

"So, Richard; go to film?" asked Lucy.

"Can I see it again?" asked Steve.

The vampire shied back, then jumped - and seemed to carry on rising! A lack of plausible mass once more. "It's like he's full of helium!" said Steve.

"It is not!" said Debbie.

"He's very heavy..." said Steve.

"It's strong, too," said someone.

Muscles powerful enough to accelerate a big torso that way would probably blow the joints apart first; couldn't they see? "He can't ping up like a grasshopper!" said Steve.

"I know that!" said Debbie. "And he doesn't!"

Drissa Yilla sighed. "I get what Steve means, and it'll be floatier on the big screen. Good eye."

After the meeting ended in triumph with Helen's Opening comp, Debbie walked away briskly, avoiding Steve.

"I got approval," said Todd, stepping in front of him. "Despite you! Life drawing after this show wraps. Dance classes!"

"Great, Todd; gotta run."

"And a big animal park trip too- Hey, wait!"

"OK, count me in on all of it!" said Steve over his shoulder.

He caught up with Debbie at reception, picking up her mail. "You could have raised that before," she said.

"Sorry." Steve narrowed his eyes against the midday sunlight blazing outside the plate glass windows. "I called it soon as I saw it."

"Yeah; 'Good eye.'" Debbie glanced at him. "If a little bloodshot."

"But if you can crack this gravity thing," he said, rubbing his eyes, "you'll look fantastic!"

Debbie smiled, hooking a thumb at the heavy animatronic vampire in the corner. "Why don't I just drop him on you? See if you can crack this gravity thing?" She walked off, leaving Steve to look at Vampy, who just stood there, all surface and no innards.

Demoted to a texture and colour reference once principal photography ended, the puppet was still an impressively disgusting object with big yellow teeth and clumps of scraggly hair. He had an undeniable presence simply by being weighty and three-dimensional.

Steve peered inside the opened back. It was hard to imagine a man in there, less wearing a costume than installed in a machine. Rubber, plastics and nylon covered a bulbous muscle suit, the kevlar carbon fibre head had a forty-servo underskull with facial articulation run off portable control boards, and the thing even had AC and R/T for the performer, according to the specs. Claustrophobic, for sure.

The filmed puppet looked good sometimes, especially when backlit and in deep shadow. But when it moved in a brightly-lit

scene it was simply too stiff and stuffed to look real, for all the dexterity of the gymnast inside. A real creature, even standing still, has so much more going on than can be mechanically modelled: pumping blood-filled veins, breathing chest, subtly adjusting balance and weight, ears rotating to catch a passing whisper, eyes glinting, fur changing position in the shifting breeze, skin twitching as fleas bite. A real animal is integrated with its ecology and not a solipsistic individual divorced from life.

Steve touched the wiry hair. No fleas on this skin; it was latex, airbrush-painted with veins and pores. But computer-generated Vampy was as much a solitary object too, not part of any world. He should be, and could be.

How about a fully-developed norn with intelligence and memory and complex neural networks made up of virtual biochemistry, dendrites, nodes and decision lobes, evolved in a dynamic ecology of other virtual creatures and plants and made aware of its own movement cycles and personal goals? You could then just leave the vampires to get on with it and they would be fully part of their environment.

Except that for a movie they would have to be persuaded to act instead of simply being manipulated - suppose they preferred hiding in darkness to performing? Steve smiled as he stroked the puppet fur. The problem would be worse.

"Goat hair, yak hair... individually sewn," said Richard Bach behind him. "The puppeteers were great guys. And yet-"

"It looked shit?" said Steve.

Richard glanced at him. "Animatronics isn't that easy..."

"Neither's CG. But I know we can get closer to a perfect holistic simulation... A complete ecology."

"Is that what we want?"

"Of course..."

"Isn't that more for system designers? Like, of power stations? We really want an effective *impression*..."

"Sounds like second-best," said Steve.

"A perfect simulation is positively undesirable, even if achievable. Which I doubt. We're looking for an emotional response, not engineering acclaim."

"That's a lack of ambition," said Steve. "You know, I can dream the perfect realistic shot."

"What?"

"It's achievable, and I know I can get it!"

"But dreaming means nothing!"

"Maybe. Except my dreams seem so real and 3D. Solid creatures with their own minds, and a whole world for them to live in."

"That's true of everyone's dreams," said Richard.

"I dreamed a perfect shot again last night: Vampy Smashes Down Door..."

"CD49\_5? You've done that, Steve, the neg's shipped. Great animation. Great TD work."

"It was OK, but it wasn't great!" said Steve. "Whereas in my dream, it's perfect down to the last scraggle! How come I can build a model, animate it, light and render it in real time, stick it in a complete gothic world and scare the crap out of myself all when I'm asleep? It must be possible to use that latent ability to create the software tools we need..."

"But dreams don't work that way," said Richard. "They're really impressionistic. Like matte paintings - impressions with strategic distractions, and our brain fills in the gaps." He smiled. "Though I did hear of a guy in Mill Valley who dreamed the solution to an image scanning problem."

"That's what I mean!"

"Yeah, but... Look. When I first worked on a live movie set with all the lights and action, I got really into it. I got so involved that every night I dreamt a series of fantastically creative camera moves soaring through elaborate crane shots. Probably everyone does that; strawberry pickers dream fields of perfect strawberries. Doesn't mean they can grow one when they wake up."

Steve was unconvinced. "If I can create a working world and animate the inhabitants perfectly in a dream, then I can in the computer. I only have to connect to the right places, and we'll have digital creatures that are as concretely real as anything they can point a camera at on the live set."

Richard laughed.

"Have you been on a live set, Steve?" he said. "I mean, really been? For months?"

"For a few effects shots. Plates."

"Well, there's hardly anything real they point the camera at; even for landscapes they pick their angles to exclude unwanted junk like power lines. Pretty much everything is an in-camera special effect, from make-up to gels. You know that. By itself the camera just stares, indiscriminately; you have to manipulate things - light and shade, action and composition - to direct the audience's attention. Styrofoam painted to look like stone, and take twelve of a stumbling actor: how real is that?"

And just out of frame in every second of film ever shot is a whole ghostly army of crew and equipment, from director to doughnut table, and a bubble halo of camera light follows made-up people through contrived spaces, and as soon as the the big eye and lights move on the characters evaporate, leaving the husk of actors, and the dulled sets are struck; at the end of production the crew scatters and all that remains is miles of film negative that only has coherent narrative meaning when a projector light is shone though an edited positive print onto a white screen with a sentient audience watching.

"Steve?"

"Sorry?"

Richard looked closely at him. "Shouldn't you get some rest?"

Steve drove with the roof down, warm air whipping his hair; home first to pick up a change of clothes, and on to the pool.

He had hardly been outdoors in the daytime for the last few days and looked around with curiosity, though it was hard on his eyes. The sun beat down on shimmering roads with a white intensity. The air was too hot, the hills too dry, the palm trees aloof, and the ocean distant, harsh and glittering. The houses seemed to be film sets in a Spanish-style siesta, closed and dozing with no one inside.

The world was thinly alien, subtly changed in his absence. He used to feel like this after staying up all night at college; out of place, a sole survivor of the past in a false new day taken over by possessed people.

Other cars slid by, paintwork gleaming, their occupants anonymous in humming air-conditioned comfort behind their tinted windshields, norn avatars on their way to a city-use convention.

He jerked awake. Nearly ran a stop sign.

The open-air pool was invitingly Hockney-blue. Steve concentrated on his body in space as he bent his knees, leaned forward and pushed out, swinging his arms up and forward and curving into a smooth arc that ended in a satisfying plunge into cool water.

He opened his eyes, stretched out and let his momentum carry him, enjoying the water frothing round his tired mind. Perhaps Todd Rankin should see him now, getting in touch with his inner dolphin. He smiled, bubbles dribbling past his teeth.

He swam the first length underwater. It felt good to get his whole body into something physical for a change, to power through 3D space instead of sitting around half the night growing fat on candy bars and sodas.

He turned at the deep end and pushed off like a torpedo, then transformed seamlessly into - what; an albatross soaring far over the tiles below?

Why not?

Because things can be too seamless; the audience has seen tigers morph into gas stations, they're smart and know it's fluid, anything goes. Digital objects have a too loose grasp of their identity over time.

Got to hold that uniqueness.

At the surface he took a deep breath before rhythmically pulling in a slow front crawl, concentrating on his own solidity, his muscles working under his skin as he swam, his joints rotating and sliding. Each arm was a chain, the hierarchy of an inverse kinematics model with rotational constraints, his hand an animated effector pulling the entire skeleton through the x,y,z space of computer water. Maybe vampires would swim like him, if any survived the drowning of Atlantis.

At the end of the pool Steve turned onto his back and floated, gazing at the sky.

Was computer water wet? Perhaps you could drown advanced CGI animals in a virtual bath instead of deleting them from the database the old way.

He sculled gently, enjoying the sense of lightly drifting between air and water, his heartbeat pumping in his ears. He closed his eyes, imagining his body becoming disincorporated, his thoughts sliding freely out into the amniotic fluid of the oceans from which life had slubbed to make our blood salty still.

Get in touch with your inner brine.

It was hard to see how the universe made the journey from heavy elements created in the guts of exploding first-generation stars, via millions of earthly species of life, to him floating idly in a chlorinated swimming pool in an electronic civilization whose entertainment came from the simulation of crashing ships and the rage of fictional creatures.

What about making models of real animals instead, for people living in cities far from nature? For everyone?

That's a project, data-capturing the biosphere; the next stage of the counter-entropic evolution of the universe from energy to matter to life to intelligence and next: information.

Especially as real animals are now compromised; domestic cows and dogs and chickens have been artificial in essence for ten thousand years, and as for wildlife, big game animals are barely tolerated in the margins and are no longer powerful, independent species with their own territories; in fact, their time is done. Humanity is supremely dominant and we no longer really need actual animals for food and clothing and medical testing or to measure ourselves against; they take up living space and carry diseases and eat the crops, so it's lucky technical development has got so far just when we need it to digitise disappearing species and preserve their encoded forms for the educational nature videos of the endless future; and Steve slipped shells down his archived multi-generational memory files, digging into ancient psychic levels to grasp the primal motion of the perfect archaic creature, and as he drifted on the cusp of consciousness he experienced flashes of darkness, shadows moving in deep history far below him: the structure of creatures not extant, among them large saurians that had come once and gone forever, and the bewildering potential shapes of animals that might have been and should have been but never had evolved in this iteration of the multiverse.

The aquatic vampire, for instance.

He felt a shiver down his spine and stood up with a splash, coughing and spluttering.

He raised his mouse hand into the air, letting the wetness element run through his fingers. Tiny points of sunlight danced in each drop. He thought of all the billion billion points of light in the dataspace of every nanosecond in all the empty water across the world. The visible universe was an awesome energy processing machine, that was for sure. But one day we'll crack it.

He clambered out of the pool, dripping sparkling stars which no one saw.

Back in the darkness of his office that evening, after the screening of the latest filmed-out shots, Steve felt depressed. They were never going to get it, none of them.

The shots all looked bad. Dead matte paintings, flat and lifeless as cement. And, blown up full size on the big screen, none of the creatures looked right any more, but massless tissue paper vampires all too light, ludicrously light, peeling off the screen frame by frame and fluttering like butterflies up around the ceiling.

I don't want to produce seamless cheating fields of light pixels, I want solid creatures that have identity over time. Make

them round and real! Make them heavy and massive and able to punch!

First, make the deadline.

He sat forward. He breathed deep.

The windows on his monitor were real windows.

His hand closed over his mouse and it was an extension of his arm.

He cleared his mind of the cluttering CGI jargon of metaballs, hierarchies, patches, B-spline deformation, jitter, null constrained camera and Skeleton|Move Joint|Pick Joint By Mouse.

He would be in the scene as he had been in the pool, feeling the muscles of Old Vampy, feeling his grievances and ancient longing, wanting the warm blood of the man in the river. He is no hero but an enemy, murderer of my kin: he took wooden stakes and hammered them into their chests, he cut off their heads with a bronze spade and burned the bodies in the flame.

I want to tear into that human flesh and drink his blood to the last drop and toss his remains into the heaving sea. I'm a massive curving flesh torpedo on jackhammer legs with big teeth and deliberate vengeance in my heart and I'm bearing down like the angel of death on that feeble mortal vessel and I'll crush him utterly in payment for the humiliations he has heaped on me and my kind...

Steve sat back.

Would it work? The 3D environment was just a shadow of the blistering universe of his dreams; the computer was not yet subtle, it did not understand the anguish and exultation of vampires.

He previewed.

Well. A little better. The vampire's paws were not sticking to the ground so much. The head looked more goal-oriented. The torso still didn't flow well; it looked floaty, a balloon changing vector unconvincingly. It should be more like a dolphin following a motion path with little deviation, a skier on a mogul field whose body stays smooth while the legs pump.

It was a small improvement, that was all.

Perhaps going swimming had helped. He would try life classes. Dancing. Field trips.

He sat back and closed his eyes, imagining himself bobbing gently in the pool, mind floating away to chase down wisps of gossamer dream that contained the codes he needed to put together a living, breathing vampire with teeth. One day he could just buy one and a whale and a velociraptor and a cow from some digital farmer who'd raised pups to earn their living in special effects movies and schools and people's homes. Animals would be better

off that way, anyway, pure, their forms saved forever in dataspace, living reincarnated in a wonderfully sunny Tipler environment of teeming abundance and no death, no longer suffering the persecution, manginess, pollution, starvation, marginalisation and gawping of tourists that they had to endure in the current world of flesh and concrete and barbed wire.

What would that all look like?

Someone kept paging him about pizzas in the conference room and then a cappuccino and his car but he ignored them, concentrating on floating up like a bubble from the abyss to a bright surface and beyond to where all his screens shone, six, seven, eight enormous monitor screens surrounding him in a buzzing video room, a rising VR data-capture probe in an environment of soaring blueness where the radiosity was intense but the software was real-time ray-tracing and shading an infinity of purposeful models that constantly erupted from the tree of life: rhinos, kangaroos, giraffes; polar bears and penguins together at last, and chunky polygony crocs lying log-like in a lake, all parading their formal perfection as high order cyberlife agents in a world that sang.

"And look at the elephant," he whispered, writing a note. Big slow-flapping ears and a lumbering gait, full of solidity and the sense of life and flowing blood. If Todd were here...

"Yes, Steve?" said Todd.

Steve dropped his notebook and held his mouse hand up and shouted and the creatures' heads all moved... Telepathy almost. If only he could take it all back with him to show Debbie and Richard and Drissa and Lucy and Helen!

Was that frogs croaking? "Look!" said Steve. "We're reincarnating the frogs!"

"What?" said Lucy.

"Must be a resolution of a bazillion pixels a cubic inch out there and it's super-holographic!" said Steve, his eyes boiled bright and glistening, and he threw his arms wide and some of the darkness between the screens fell away as he opened the door.

"Steve!" shouted Richard. "Come back!" But he was already pushing deep into z-space; Richard started to climb down after him.

"No one follows!" shouted Ed the driver, walkie in hand. "That's an order!"

"But..." said Helen, watching through the window. Steve was distant now, carved in sunlight in the midst of the environment, running towards a water-filled moat.

Ed was calling in park rangers. Urgent, calm.

"Come back, you idiot!" yelled Debbie.

Fantastic highlights and refractions in the water; Steve splashed in the shallows, exulting in the sparkles.

A big lion on top of the hill turned his head to watch. Steve looked up at the shifting geometry silhouetted against the sky. "Hey!" he yelled in joy.

"Steve!" shouted Drissa.

The big cat shape got ponderously to its feet, leaned out into space and jumped massively down onto the boulder below, and down, boulder to boulder, in measured, weighty leaps, fur sharply delineated, Steve grinning all the while as he knew he could do it too.

An armed ranger jeep kicked up dust elements in the distance as it raced towards the stopped safari minibus.

"Steve!" shouted Todd.

The lion came to a halt at the water's edge and stood, heavy tail swishing slowly and menacingly, eyes locked with Steve's.

There were beautifully subtle contact shadows under its feet. Steve forced himself to look, to remember every bristling hair, every muscle twitch. He splashed forward.

The lion roared, baring sharp teeth.

Steve laughed and reached out a hand, as happy as he would ever be.

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