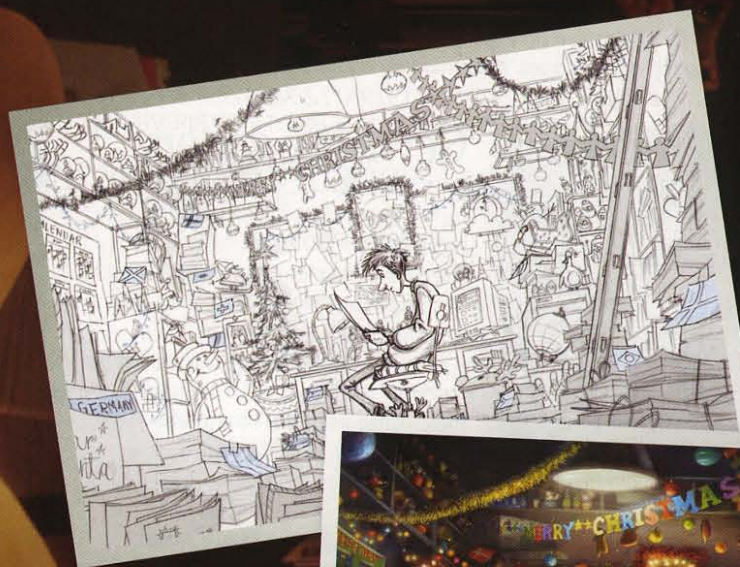# An Aardman Christmas

## The secret methods of Santa's worldwide gift delivery are answered in Aardman's latest CG adventure

**Words** Renee Dunlop

"Ten years ago it was about what was possible to do. Now it's about using technology in concert with what you can achieve creatively" – Doug Ikeler

### Till Nowak

**Job title** Digital set designer

**Company** During *Arthur Christmas*: Aardman. Otherwise: independent freelancer

**Location** Hamburg, Germany

**Expertise** 12 years of professional design work since 1999. Graduated as media designer in 2005 at the University of Applied Sciences in Mainz, Germany

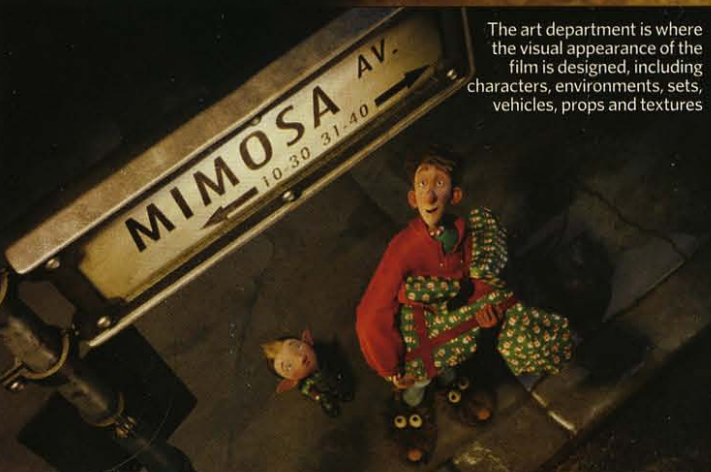**Software used** 3ds Max, Photoshop, After Effects

### Evgeni Tomov

**Job title** Production designer

**Company** Independent

**Location** Los Angeles, CA

**Expertise** Evgeni Tomov is an esteemed production designer, conceptual artist and illustrator specialising in feature animated films, animated TV series and shorts

**Software used** Adobe Photoshop

### Doug Ikeler

**Job title** Visual effects supervisor

**Company** Sony Pictures Animation/Sony Imageworks

**Location** Los Angeles, CA

**Expertise** A veteran visual effects professional who has been working in feature film production for 20 years

**Software used** Katana (SPI-developed lighting package), Arnold (SPI-developed Global Illumination render engine), Maya, Houdini

As long as you don't need to move your light positions, the typical use of an AOV is to dial your lights in a comp

The art department is where the visual appearance of the film is designed, including characters, environments, sets, vehicles, props and textures

Mission Control was built to accommodate around 15,000 elves at their computers, and Till Novak designed all the interior detail and impressive high-tech displays

## Mission Control motion graphics

Motion graphics applied to computer screens provided additional detail and realism to the Mission Control set

The S-1's helm is staffed with elves sitting at their computers, Star Trek style, each in charge of their part in navigating the ship. They track weather patterns, scan the city radar defences – designs that were handled through motion graphics. There was one wall that acted as a data bank, identifying everything from the ship location to Santa's health status. According to Doug Ikeler, "In one set you have probably 100 screens that have to have stuff moving on them – a whole other creative and technical hurdle because we had to get that stuff designed, executed and approved before it got into the shot prior to lighting." The task was handled by a small team of Inferno artists as well as a portion of Aardman's art department. "We were doing slap comps to get them into the shots so the director can see them in context of the shot. You have this whole secondary layer of rendering going on just so you can fill computer screens... for the movie. Very tedious and laborious work."

**A** ardman Animations' latest CG feature, *Arthur Christmas*, is a four-year production to answer the question of one night: how does Santa deliver all those gifts on Christmas Eve? The answer is a dedicated staff of CG artists, a host of elves, and a massive FedEx-style delivery system contained in a city-sized sleigh called the 'S-1'. But after learning that one child was inadvertently dropped from the list, Arthur – the youngest in the Santa lineage – sets off on an adventure to deliver that child's gift too.

The scope of the movie is huge, travelling around the world in one night while visiting many locations. Several cities, towns and exotic environments – a total of around 20 environments, not counting smaller interiors – were among the numerous CG sets required to tell the story. The movie relies heavily on inspiration from the natural world – oh, and from immersing the artists in Christmas decorations hanging about the Aardman studio. For four years, even during summer, the decor was festive, gracing everything from computer screens to a Christmas tree in the office.

The established Aardman style can be seen in the character design and the heavily textured and tactile world, akin to an Aardman stop-motion set. But beyond that, this is a new look for Aardman. The stylisation of the film lies within the shape of the geometry that was modelled, yet the whole premise of the movie was to make it look like it really could be done. How was this accomplished? According to VFX supervisor Doug Ikeler, it was lots of "detail, detail, detail!"

### Film design
The North Pole operation is comprised of Mission Control, the S-1 sleigh and its docking bay, plus smaller spaces such as the Clauses' living space, bedrooms and dining room. Production designer Evgeni Tomov provided concept designs, headed the art department and "worked with every department except animation and camera... I'm responsible for everything visual, the look, the design, the style, feel of the movie, and the colour palette."

Digital set designer Till Nowak handled much of the concept modelling.

The art department usually consists of traditional artists who paint and draw, either on paper or digitally. However, for Arthur Christmas, Nowak convinced director Sarah Smith to work out the concepts directly in 3ds Max. "I handed over my designs the same way the 2D artists did, as model sheets," Nowak explains. The set of pages acted as a style guide, which precisely described the design from all angles.

The topology of Nowak's meshes passed through months of design tweaking and rethinking so they weren't optimised for the technical production pipeline. However, since the next step was to send them to the modelling department at Imageworks, they recreated the two-dimensional instructions in Maya, remodelling from scratch.
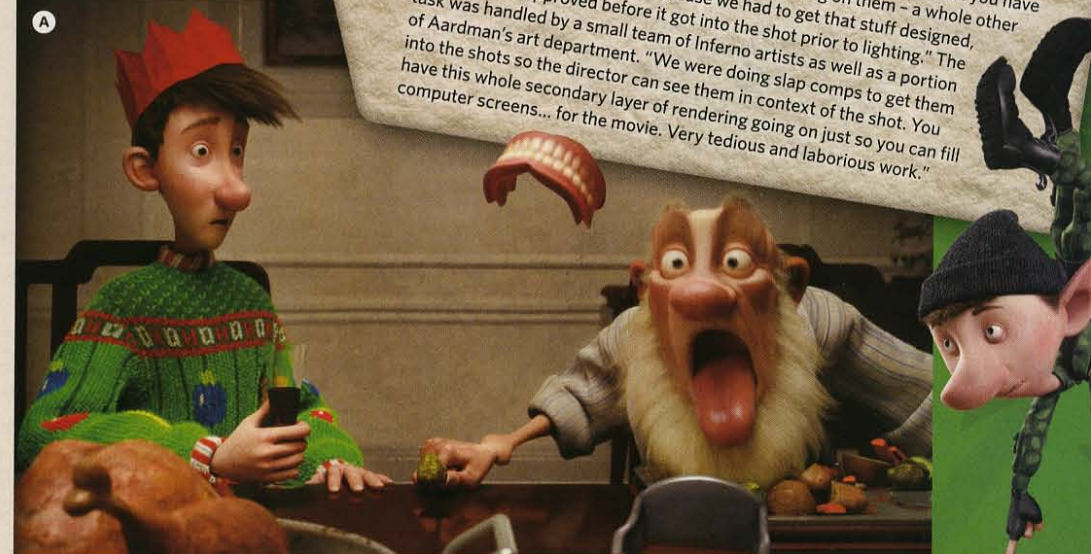
### The S-1 sleigh design
The S-1 ship was approached in a similar manner – particularly the interior dispatch deck where the giant FedEx-type delivery operation was filled with presents travelling by conveyer belts. Each gift is directed through the maze of belts, eventually dropping into chutes that load into the backpacks of elves who go into the city to deliver the gifts to their destinations.

The basic shape of the super-fast, high-tech sleigh S-1 was created by Tomov then passed to Nowak for concept modelling. "For the S-1 dispatch deck we studied some existing structures in FedEx dispatch facilities which were used as a

**A** Working closely with Doug Ikeler, "the original artistic design vision is respected and carried through the CG process and what makes it to the screen" – Evgeni Tomov

**B** There are eight primary characters, ten or so secondary ones and tens of thousands of elves that had to be created and animated

## From pencil to pixels

### Drawing and modelling concept art works together hand in hand, but each has its own challenge

Arthur Christmas sets and camera views were often composed in 2D by Olivier Adam or Evgeni Tomov, but those perspectives can turn out to look quite different in a 3D model. As explained by Till Nowak, "A drawn shot composition often has a stronger graphical impact and a more defined artistic appearance than a camera shot found through searching... within the 3D scene. But at the same time it creates challenges, because the 3D set doesn't necessarily match the drawing." Often this will mean placing the camera beyond a set wall, or that dimensions have to be distorted to get a specific look from a specific angle. In the real world these solutions wouldn't be physically possible. While tricks can be applied to the CG world, there are still limitations. Tomov embraced the challenges: "These things were exciting for me to learn when working with such skilled drawing artists and I think it often leads to stronger images than a physically correct 3D approach."

Digital set designer Till Nowak's main task was to design all the science-fiction sets of the North Pole base, as well as the gigantic modern sleigh, S-1

> ❝ The underbelly of S-1 included thousands of hatches for the elves to descend and deliver the presents ❞

starting point for Till's design," said Tomov. But "we had to make the set few times bigger than the reference material we had found." The end result is a set that almost appears to be infinite.

The underbelly of S-1 included thousands of hatches for the elves to descend and deliver the presents. According to Nowak, the "tricky task was how to place these in regular lines, but avoid intersections with the many structural parts of the snowflake-architecture of the underbelly." Nowak decided to solve the dilemma using particle flow. "Each hatch was a particle sitting on the vertex of a plane while a black and white map of the tiles and hull elements erased particles on the intersections. This way I could create a map of underbelly with

automatically distributed hatches."

Another massive set was the S-1 docking bay under the North Pole. The hangar is much bigger than the ship and Nowak had to find ways to create a sense of gigantic scale in his concept renders. While there are many different ways to achieve scale, Nowak used "a light fog and reduced saturation and contrast for faraway objects. The relations between objects are also very important, so in the docking bay there are tiny trucks, tiny windows and thin structures and cables on the wall that tell us that the room has to be huge."

### Mission Control

The S-1 Mission Control was like NORAD for Santa, a huge underground bunker the size of a football stadium made out of reflective

transparent ice cut into the shape of a Christmas tree. Roughly 15,000 elves sit manning – or perhaps we should say 'elfing' – their computers as they run the Christmas Eve operations. The set was extremely heavy because of the scale. "You could put a camera on one side of the room and if there was an elf that was opposite it would be too small to sit in a pixel, it was that big," said Ikeler. "The inside of that ship is literally a spider web of thousands of criss-crossing conveyer belts taking the presents to the right places – on top of a Houdini simulation that figures out where the presents should fall."

Mission Control was designed in a similar fashion as the S-1 ship, based on concept sketches created by Tomov before passing over to Nowak's concept modelling. Some problems with the drawings were discovered, triggering some changes "specifically in scale because we discovered that some things did not look quite the same as the drawing once they were built in 3D," explained Tomov. "This is exactly why we were using this, in my

opinion, necessary stage in the design process." For example, Mission Control was enlarged and sloping angles of the Christmas tree-shaped structure were adjusted to make it work for the desired camera angles. "We had a mock-up artist, a 3D modeller as part of the art department because I knew the importance of testing the designs in 3D. It was an unusual concept, but it proved valuable and saved time and money."
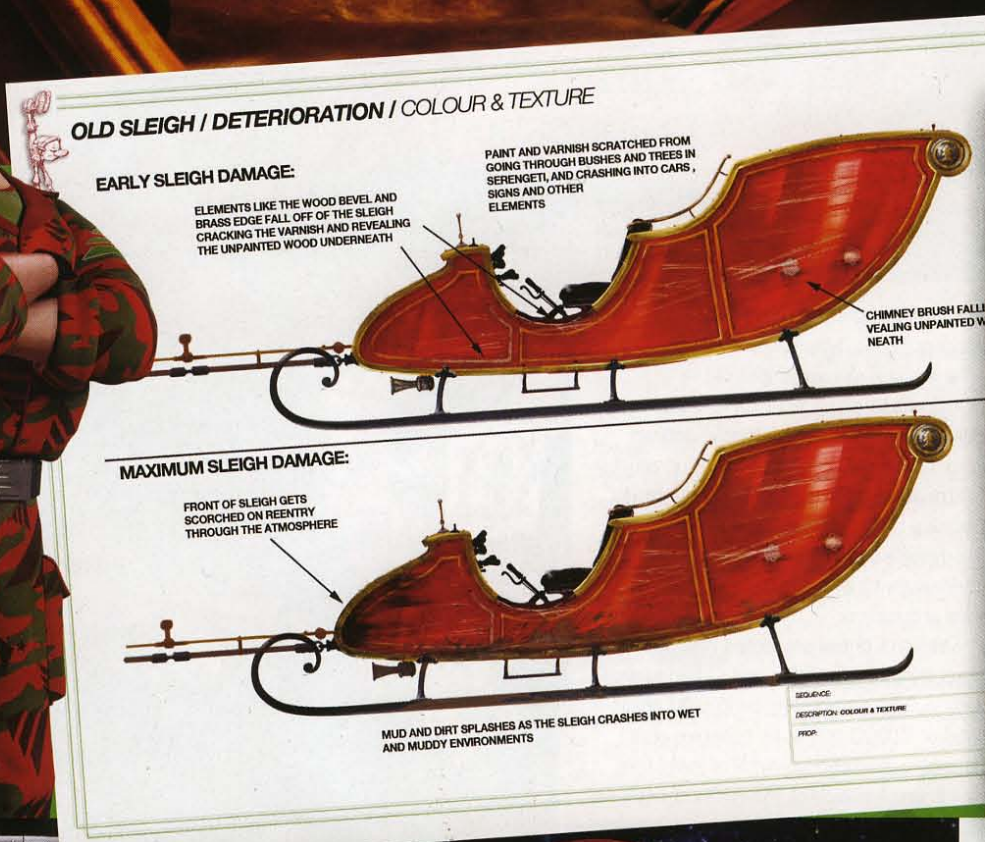
Mission Control presented Nowak with a staggering number of assets. "I had to deal with 15,000 elves sitting on 15,000 chairs in front of 15,000 computer consoles on a huge structure of thousands of ice blocks – all in one frame." For Nowak's concept design renders he used "instances of V-Ray proxies to handle the extreme amount of polygons. I could make a design change on any detail of one of the consoles, resave the V-Ray proxy and render it a minute later in a frame showing the change on thousands of consoles at the same time. It was surprisingly stable, even though scene files were often larger than 500MB."

"Our lighting tool is set up to iterate based on the individual, pushing it in the way they need to get to the next render" – Doug Ikeler

C "Having now used our raytracing renderer I would not want to go back to raycasting, but I did have to learn a lot on the way" – Doug Ikeler

D Mission Control was designed in 3ds Max, then replicated with the right level of detail and accuracy in Maya by Sony Imageworks' modellers

"To work with a raytracer in production is a big deal, especially with the data sets we are leaning on" – Doug Ikeler

Adding requirements of raytracing, bouncing rays off of all the required surfaces produces a beautiful render, but you need to manage it well

IN SANTA WE BELIEVE

While *Arthur Christmas* skips effects like explosions, volumetrics were used for footprints in snow, maintaining a history of footprints as more and more characters move about

**E** After the concept drawings were approved, the design went directly to the 3D mockup, key cameras were tested and the scale was evaluated

**F** "The old way is you design everything and deliver it to the CG department... and if something doesn't work, you have to redesign and rebuild the problematic areas" – Evgeni Tomov

> 66 By using AOVs, it allowed for increased creativity and rapid experimentation during compositing 99

weekend, come back on Monday and start building your comp with all those AOVs that were generated."

In Arthur Christmas, some lighter files included perhaps 40 AOVs in a single scene. "It's a really smart way of rendering – incredibly smart, because you are paying once for the expense of the render. Many of the things you would have dialled in the render, like turn this light up or make that material a little more matte, once you are in AOV land all those things are still diallable, except they are diallable in a comp and

happen very quickly." By using AOVs, it allowed for increased creativity and rapid experimentation during compositing. "This opens you up to a lot of creative choices – after you pay for this big render!

"The director gave me a lot of leeway or trust in the look of the film, so creatively I've put myself out there. This is very much the way I would make a film look," said Ikeler, "but at the end of the day, my job is mostly about creative supervision, figuring out what to do with what we have to get to the look that we are all after."

"We deliberately embraced a level of imperfection in the design of the characters; the real-life people are not perfect either" – Evgeni Tomov

## OLD SLEIGH / DETERIORATION / COLOUR & TEXTURE

PAGE: 12

**EARLY SLEIGH DAMAGE:**

ELEMENTS LIKE THE WOOD BEVEL AND BRASS EDGE FALL OFF OF THE SLEIGH CRACKING THE VARNISH AND REVEALING THE UNPAINTED WOOD UNDERNEATH

PAINT AND VARNISH SCRATCHED FROM GOING THROUGH BUSHES AND TREES IN SERENGETI, AND CRASHING INTO CARS, SIGNS AND OTHER ELEMENTS

CHIMNEY BRUSH FALL... VEALING UNPAINTED W NEATH

**MAXIMUM SLEIGH DAMAGE:**

FRONT OF SLEIGH GETS SCORCHED ON REENTRY THROUGH THE ATMOSPHERE

SEQUENCE

DESCRIPTION: COLOUR & TEXTURE

PROP:

MUD AND DIRT SPLASHES AS THE SLEIGH CRASHES INTO WET AND MUDDY ENVIRONMENTS

### +AOVs

The heavy geometry meant single-frame render times reached 20 or 30 hours. "We wanted the detail that was necessary to sell the scale of the operation," explained Ikeler. "To get that scale, you just had to deal with slow render times, not to mention problems like memory limits." To handle this, Ikeler applied the use of AOVs (Arbitrary Output Variables).

AOVs work by splitting the information from one massive render into checkpoints that limit the viewed information to, for example, the specular information, or from each light, or on each character. Each of these AOVs is defined based on collections of objects or surfaces, lights, or types of rays such as diffused or specular. "You render a single frame," said Ikeler, "get it working the way you need it to look, then go to the comp to tweak it. Once you get the buy-off on that single frame, you send the scene to the render farm for the

## The Serengeti's own style

The Serengeti set was designed to stand apart from the rest of the film in modelling and colour theory

A plot twist sends two characters in the wrong direction. The sequence had to look and feel very different from England, the desired destination, and cue the viewer that something was amiss. That is when the characters discover they have mistakenly travelled to the Serengeti.

The colour palette was quite different from the rest of the film, and had to reflect an African landscape at night with a hot, almost sunset-hued "blood moon" lighting creating a suitable colour palette for the suspense sequence that takes place there. It was very organic, and believable without being hyper-realistic. "The set required a lot of matte paintings and elements such as trees, grass and rocks," explained production designer Evgeni Tomov. "It feels like a live-action film because of the colour palette, the lighting and the camera style. The cameras are quite specific, typical for live action rather than for animation. We have a lot of handheld cinéma-vérité-type cameras."

EYE
NORTH POLE