

The art of open source

Open source powers every part of the creative arts. **Jim Thacker** explores how Blender is conquering animation and movie effects.

Blender has been used to create animations for national television channels and commercials for Coca-Cola, Pizza Hut and BMW. It creates slick marketing images for brands ranging from Puma to Philippe Starck. It has even been used on Oscar-nominated movies. And best of all, it's open-source software.

Blender is a classic underdog story. Originally the in-house 3D toolset of a small Dutch animation firm, it has survived early financial hardships and even the collapse of its original distributor to win widespread popular acclaim. With over four million downloads each year, it is now by far the world's most widely used 3D software.

But more importantly for the purposes of this article, it's software that commands the respect of professional artists. Once dismissed as a tool for hobbyists, *Blender* is now praised by some of the world's largest animation studios. Even five years ago, the news that another new feature had been added to the application would routinely be greeted on industry forums with the response, 'Yes, but... it's *Blender*.' Today, the response is more likely to be: 'I wish my software did that.'

It may not be the market leader – commercial tools, particularly those developed by Autodesk, are still used for the majority of professional animation, visual effects and game development projects – in the West, at least. But it is capable of great work.

Over the next four pages, we'll meet

“Blender, a classic underdog story, is the world's most widely used 3D software.”

some of the companies using *Blender* for commercial projects, from illustrations for cereal boxes to the visual effects for *Red Dwarf*. We'll explore how the software powers an international network of animation studios on every continent except Antarctica. And we'll even try to answer the question: 'If *Blender* is so great, why doesn't it get used on more Hollywood movies?'

But before we do that, it's time for a brief history lesson...

» A complete 3D animation pipeline in a box, *Blender* is an ideal tool for CG commercials, like Character Mill's long-running series of ads for Bridgestone tyres.





› 2008's *Big Buck Bunny* was the Blender Institute's breakout short. The assets – also open-source – got reused in everything from kids' books to ads for Google's Nexus S phone.

Throughout its history, *Blender* has been inextricably linked to one man: Dutch programmer, producer and all-round maverick Ton Roosendaal. It was he who co-founded NeoGeo, the animation studio where, in 1995, *Blender* would begin life as the company's in-house 3D toolset.

Originally, *Blender* seemed destined to become a far more conventional product: Not a Number, the company that Roosendaal launched in 1998 to market the software publicly, originally planned to produce a free version of the tool for creating online content, and paid versions for everything else.

But things didn't quite work out that way. Even at the time, the 3D software market was saturated with established competitors, including early versions of Autodesk's now-ubiquitous *Maya* and *3ds Max*. Early sales of *Blender* were disappointing, and in 2002, Not a Number's investors decided to pull the plug.

Faced with the choice between seeing seven years of work go down the drain or going open-source, Roosendaal chose open source. A crowdfunding campaign quickly raised the €100,000 needed to buy back the code base, and on 13 October 2002, *Blender* was released under a GPL licence.

Now chairman of the fledgling Blender Foundation, Roosendaal began to accelerate the development of the software through a series of 'open movies' – crowdfunded animated shorts used as a platform from which to develop the new tools necessary for serious production work. The movies themselves are released under a Creative Commons licence, as are all of the CG assets used to create them.

By 2007, Roosendaal had established a permanent studio, the Blender Institute, to oversee the work. The next year, the Institute had its first real breakout hit, the comedy

short *Big Buck Bunny*. Its cast of animal characters proved irresistible to marketers, with images from the movie popping up in everything from pamphlets for the Boy Scouts of America to ads for Google phones.

Subsequent open movies would help tame *Blender*'s idiosyncratic user interface and develop a new suite of tools designed for live-action visual effects work. By 2014, the Institute was ready for its most ambitious project yet: a complete feature-length open movie, codenamed 'Project Gooseberry'.

Sadly, Gooseberry failed to reach its €3.5 million funding target, eventually being scaled back into the surreal animated short *Cosmos Laundromat – First Cycle*, released earlier this year. But it still became the most successful crowdfunded animation project in history, while the Institute's proposed list of partner companies demonstrated something else very important: that there was now a

»

More key tools for open-source animation

Even the Blender Institute doesn't just use *Blender* in its animations. Here are the other open-source tools used to create its 'open movies'. We'll be looking at some of them in more detail in future articles in this series.

› Krita (krita.org)

The Institute's main tool for concept art and storyboarding, *Krita* had its own resurgence. Its successful recent Kickstarter funding campaign aims to make it "faster than *Photoshop*".

› Gimp (gimp.org)

Although it hasn't seen a major update for three years, *Gimp* is still a reliable workhorse for general image-editing tasks, such as creating the 2D texture maps used in animation or adjusting rendered stills.

› LibreOffice (libreoffice.org)

The ubiquitous office suite gets used on the Institute's movies for a range of tasks, with *LibreOffice Draw* often used to assemble storyboards for print or to distribute as PDFs.

› Flamenco (flamenco.io)

Developed for use on the Institute's latest short and still in beta, this render manager distributes animation jobs across the network of computers used to render them. Not sexy, but vital.

› Attract (cloud.blender.org)

Also developed for *Cosmos Laundromat*, shot-management tool *Attract* does another heavy-lifting job: tracking who is doing what on the production. Not out yet, but will become part of the Blender Cloud.



› An unused concept image for the Institute's short *Cosmos Laundromat*, created in *Krita* by David Revoy.

› Each *Blender* movie acts as a platform for adding new features to the software. 2015's surreal *Cosmos Laundromat* threw project-management tools into the mix as well.



› Most of the Blender Institute's movies have been animated shorts. 2012's *Tears of Steel* proved that the software could also tackle live-action visual effects.



» complete international network of studios using *Blender* on commercial productions.

One of those studios is London's Gecko Animation (www.geckoanimation.com), whose work ranges from visuals for Puma to visual effects for the *Red Dwarf* comedy series.

"I trained in *Maya* when I worked for other companies," says studio co-founder Jonathan Lax. "But over time, I became more and more interested in open source. Larger programs don't tend to help you if you're working on lots of different parts of a production, which a small team has to."

Whereas commercial software tends to be more tightly focused on specialist tasks, *Blender* provides a complete studio setup in a box, including tools for sculpting and animating 3D models, rendering the finished animation, and even integrating it into live-action footage or editing video.

"*Blender* is extremely versatile," says Lax. "Because the program does so much, and integrates it so well, you can work on many different areas of a production at once."

It doesn't hurt that *Blender* is free. But that isn't the main reason to use it, stresses

Lax. "When you're starting out, it's very handy to have software you don't need a licence for. But it's a misconception that there's no money in open-source development. I've paid more for *Blender* through donations to the Blender Foundation than I have for any piece of commercial software."

Beating commercial tools

One of the reasons for those donations is to ensure that bugs are fixed in a timely fashion – another key benefit of *Blender*, according to James Neale, founder of Sydney's Character Mill (<http://charactermill.com>), a five-person studio working on projects ranging from animated TV commercials to illustrations.

"*Blender* developers are generally users of their own tools, so it's easy for them to understand our requests for fixes," he says. "If I ever encounter a bug or need a workaround, I can reach out to the community and get a response within 15-20 minutes."

Like Lax, Neale used commercial software in the past, but says that when it came to customer support, the needs of larger studios crowded out those of smaller users.

"We've found the *Blender* community to be much more responsive to our needs than commercial software vendors," he says. "In 10 years of using proprietary 3D software, we never received usable support from either software vendor or reseller – except on problems with registering our licences."

Blender also plays increasingly nicely with the other tools that studios need for commercial graphics work. Most of the main render engines, used to convert raw 3D data into finished 2D images, now support the software – including, as of earlier this year, Pixar's Academy-Award-winning *RenderMan*.

In fact, support for *Blender* in some third-party tools is better than that for commercial software, since the fact that the source code is freely available makes it easier to do the necessary development work.

Neale uses the popular *Unity* game engine to create interactive applications, and points out that it can read *Blender*'s scene files directly, rather than requiring data to be exported in an intermediate file format. "You just save the .blend file into the *Unity* folder structure and use it as an asset," he says.

Open-source technology and Hollywood

Big Hollywood visual effects and animation companies often write their own proprietary 3D software. But that doesn't mean they don't use open-source technology.

Industrial Light & Magic led the way by open-sourcing OpenEXR (<http://openexr.com>) in 2003, its proprietary file format for HDR images, now familiar to most photographers.

Sony Pictures Imageworks followed suit with a whole set of open-source technologies (<http://opensource.imageworks.com>), including Alembic, now the industry's standard format in which to transfer complex 3D geometry between software packages.

Disney has also got in on the act with Ptex (<http://ptex.us>), which controls the way in which the 2D texture maps that determine the local colour of a 3D model are mapped onto its surface, while DreamWorks has released OpenVDB (<http://openvdb.org>), used for volumetric effects like clouds. You can see it in action in the still from *How to Train Your Dragon 2* (above).

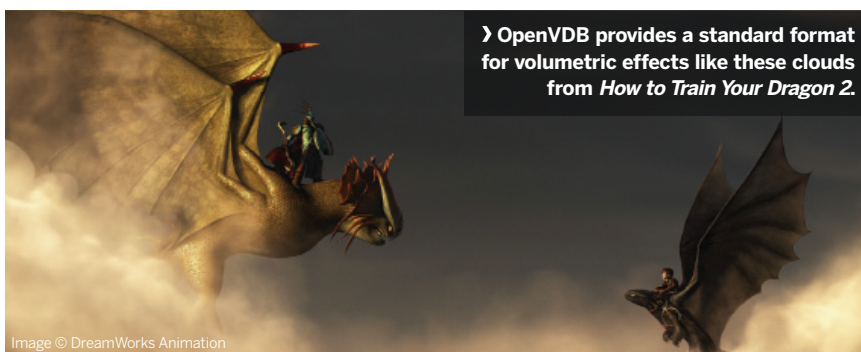


Image © DreamWorks Animation

› OpenVDB provides a standard format for volumetric effects like these clouds from *How to Train Your Dragon 2*.

The big studios open-source their technologies to ensure that there are standard formats in which data can be exchanged when companies have to collaborate on a movie, as is often the case in visual effects – but the benefits are felt by everyone, since they quickly become incorporated into off-the-shelf software.

Blender itself uses several of these code libraries: the most recent release, *Blender 2.76*,

incorporates OpenSubdiv, Pixar's technology for "high-performance subdivision surface evaluation". (Among other things, it enables animators to preview the movements of their characters more accurately in real time.)

The work seems to have found favour at Pixar, which even switched OpenSubdiv from a Microsoft Public Licence to an *Apache* Licence so *Blender* could make use of its technology.

"That wouldn't work with *3ds Max* or *Maya* scene files."

So if *Blender* is so good, why aren't more studios using it? Of the five Oscar nominees for 2015's Best Animated Feature, only one – independent Irish animation *Song of the Sea* – is known to have used *Blender*, whereas *Autodesk* can claim that its software played a 'significant role' in the remaining four.

There's a caveat hidden in that phrase "is known to have used", which we'll come back to later. But in general, the studios using *Blender* as their primary production tool are smaller than those using commercial or proprietary software – typically 20 people or fewer, in contrast to the hundreds of artists who work on big Hollywood movies.

One reason for this, says James Neale, is the lack of suitable staff. Many of the artists that Character Mill hires are only familiar with commercial software, and have to be taught how to use *Blender*.

"The main limitation is finding competent people who use *Blender* regularly," he says. "Each time we take on someone new, there's a training period, and if it's a tight deadline, we need someone who can hit the ground running. Sometimes there are jobs we can't take on because we can't staff them."

Overcoming prejudice

The Blender Network, the social network for *Blender* pros that the Blender Foundation launched in 2012, now makes it far easier to recruit artists internationally, but Neale says the software needs to be taught more widely in schools and universities. "There are so many *Maya* artists out there because all the schools teach it," he says. "And because there's a pool of artists, the big studios continue to use it. It's chicken and egg."

While the Blender Foundation is now addressing this issue with its Blender 101

› **Gecko Animation's photorealistic visual effects for 'Words Can Hurt', an NSPCC commercial to highlight emotional abuse, were created entirely in *Blender*.**

initiative, which aims to develop a version of *Blender* configured for teaching 3D to high-school students, another stumbling block may be harder to overcome: the lingering belief that use of 'free' tools is unprofessional. "There's always a stigma attached to using open-source software," says Jonathan Lax. "I

requiring support, and of feeling a bit ashamed of using free software," he says.

That reluctance to speak publicly makes it harder to get a true picture of how widely *Blender* is being used in production. One thing we were often told while researching this article is that many artists at large games

and visual effects studios do use the software, they just don't tend to talk about it.

However, that may finally be changing.

This year, Pixar announced that *Blender* is one of the small number of off-the-shelf 3D applications that it officially supports for use within the studio, and namechecked the software in its press release for the latest version of *RenderMan*.

And as Roosendaal points out, the fact that large studios were traditionally more willing to talk about commercial 3D tools doesn't mean that they use them as their primary means of production. "People have some kind of romantic fantasy that big

"The Blender community is much more responsive than commercial vendors."

base everything on the strength of the output [but] larger clients have expressed concerns when I say what software I'm using."

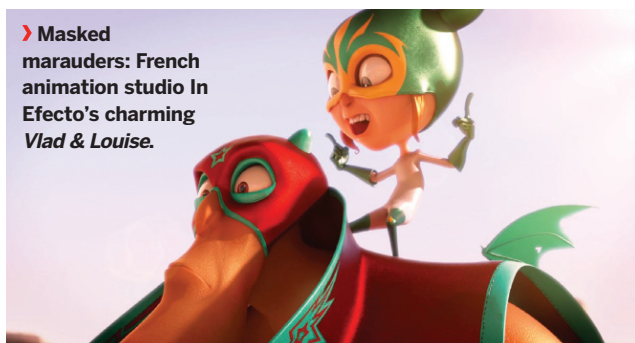
According to Ton Roosendaal, this problem is compounded by the fact that many artists in Asia and South America – where the largest studios using open-source tools in production are currently located – have switched to *Blender* from cracked copies of commercial software. "They switch from being an illegal user to being a legal user, but they don't change the habit of not

Five great Blender animations from around the world

Babioles

(<http://bit.ly/babioles>)

Broadcast on France's Canal+, this animated series features a trio of cute toys and the terrible things that happen to them. Director Mathieu Auvray has put nearly 30 episodes on YouTube.



› **Masked marauders: French animation studio In Efecto's charming *Vlad & Louise*.**

Vlad & Louise

(<http://bit.ly/vladlouise>)

Another animated series, *Vlad & Louise* stars an eight-year-old girl who finds a winning ticket in a cereal box to become a Mexican lucha libre wrestler. French studio, In Efecto plans to

produce 52 13-minute episodes, but for now you'll have to content yourself with the charming trailer.

Adit & Sopo Jarwo

(<http://bit.ly/aditsopojarwo>)

Probably the world's largest studio to use *Blender* as its main production tool (it

employs over 300 people), Indonesia's MD Animation produces a huge range of animated series, including the award-winning *Adit & Sopo Jarwo*. Clips are on YouTube.

Song of the Sea

(<http://bit.ly/songoftheseamovie>)

This Irish animation got rave reviews on its release – not to mention an Oscar nomination for Best Animated Feature. Much of the animation is 2D, but some of the vehicles and effects use *Blender*.

Sabogal

(<http://3da2animation.com/sabogal>)

It wasn't the first feature film to be produced primarily in *Blender* (that was Argentina's *Plumíferos*), but gritty thriller *Sabogal* is arguably the best.

» studios use desktop software to make films, and suddenly they might start using *Blender*," he says. "But that's not true. They hardly use [commercial] software either. They have their own in-house tools."

"Studios like Pixar are awesome, but they are the tip of the pyramid," he adds. "Below that, there are millions of people doing stuff with 3D, and those people need tools, too."

Where next for Blender?

The coming year looks likely to be another significant one for *Blender*. Rather than continuing the recent cycle of smaller three-monthly updates, the Blender Foundation proposes taking a year out to focus on major development projects aimed at readying the software to tackle even larger productions.

It is, admits Roosendaal, a huge challenge for a non-profit organisation that currently supports fewer than 10 full-time developers, particularly given the increasing complexity of the work. "Many of these improvements are just not possible in a normal volunteer-driven open-source project," he says. "You

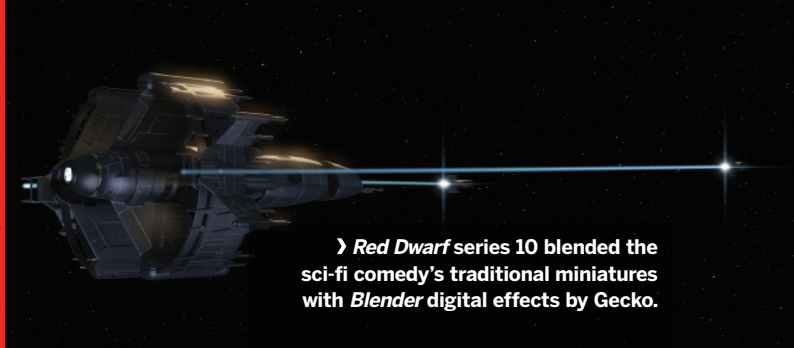
have to get the professionals on board. And the only way to do that is to reach out to studios

and make them stakeholders in taking care of parts of the future development of *Blender*."

Ultimately, Roosendaal's goal is still to make a feature-length open movie, both as an ultimate proof of *Blender*'s capabilities and a means of further fostering that professional user community.

"If we can get a decent budget – say \$12-15 million – to make a good-quality animated feature film, we can adopt some *Krita* or *Gimp* developers [as well as hiring] more *Blender* developers," he says. "Once you have a feature film plus a 100% open-source pipeline, you get something very interesting indeed. You could even set up a facility to train technical artists who could go on to work in other studios."

It's a lot to ask. But, on the evidence of what *Blender* has achieved over the past 20 years, you wouldn't want to bet against it. **LXF**



» *Red Dwarf* series 10 blended the sci-fi comedy's traditional miniatures with *Blender* digital effects by Gecko.

Useful resources

» www.blender.org

The official *Blender* website hosts software downloads and news of new features

» www.blendernation.com

Daily news from the *Blender* community, plus a smattering of free video tutorials

» www.blenderartists.org

Hang out or ask for advice from other artists in one of the best-known *Blender* forums

» www.blendswap.com

Free assets of all shapes and sizes for *Blender* users: from models to tech resources.

» <https://cgcookiemarkets.com>

A newer online marketplace than Blend Swap, aimed at sharing commercial assets

» www.blendernetwork.org

The Blender Foundation's official directory and social network for *Blender* professionals.

From Blender to Pixar



For Colin Levy, open-source software led to a job at one of the biggest animation studios in the world. Having started experimenting with *Blender* while he was still in high school, by

2006 he was helping out at CG industry conference SIGGRAPH, where he met the Blender Foundation's Ton Roosendaal.

"I didn't interact much with Ton at the time," says Levy. "But I guess he kept me on his radar, because three years later, I got an email from him, asking if I'd be interested in working on his next project."

That project was *Sintel*, the third of the Foundation's 'open movies' – short films made entirely using open-source software, then released under a Creative Commons licence. Partly a showcase for the software and partly a way to develop new tools, *Sintel* was also the Foundation's most ambitious production to date – and, with a budget of €400,000, then the second most expensive animated film in Dutch history.

"It came completely out of the blue," says Levy, who was midway through his studies at Savannah College of Art and Design at the time. "I was lucky: it could have been a foolish decision to hire me."

The story of a young woman who adopts a baby dragon, *Sintel* isn't a typical comedy short. The 15-minute animation explores

what Levy describes as "some pretty deep themes – motherhood and loss and death, friendship and letting go".

It's also very beautiful. Although clearly the work of a small team (just 14 people at peak), some of the shots in *Sintel* wouldn't look out of place in a Hollywood production.

Pixar evidently thought the young director had promise: Levy was accepted for an internship at the studio. "It was actually the third time I'd applied," he says. "The previous time, as a sophomore in college, I had the worst interview of my life. By the last round, I'd grown a lot, both as a person and artistically. But the main difference was that I had *Sintel* on my reel, and it definitely wasn't just a student short."

It wasn't the fact that Levy had directed *Sintel* that interested Pixar. He'd also done the layout work on the film: choreographing the action of the 3D characters within virtual sets,

and composing shots to tell the story cinematically. It was those skills that got him the internship – and ultimately, a full-time job.

For the past five years, Levy has worked as a layout artist for the studio on movies like *Monsters University*, eventually becoming director of photography on *LAVA*, the animated short that Pixar released alongside *Inside Out*.

He also continues to use *Blender* in his own work. On his current side project – an as-yet-untitled live-action sci-fi short – all the visual effects are being created using it. "I still really enjoy working in *Blender*," he says. "It's a fabulous tool for short film projects with a dozen or so artists."

"I feel so indebted to Ton, and to the Foundation, and to *Sintel*," Levy concludes. "I don't think I'd be at Pixar today if *Blender* didn't exist."

» *Sintel*, the third *Blender* open movie, provided young director Colin Levy's calling card to Pixar.

