

How 'Kubo and the Two Strings' Merged Stop-Motion Animation and 3D Printing (Plus a 400-Pound Puppet)

Several modeling techniques were used to marvelous effect in the directorial debut of Travis Knight, the head of Portland, Ore.-based Laika studios.



John Leonhardt/Laika Studios/Focus Features

Stop-motion animation is a time-honored art: Humans have been molding figures out of clay and filming them one frame at a time since the dawn of cinema. But last summer, while visiting Laika studios outside Portland, Ore., I

encountered a stop-motion puppet so advanced — not to mention so huge — that simply lifting one of its boney fingers was nearly as complex as a lunar launch.

At 400 pounds, standing 16 feet high, with an arm span of 23 feet, the enormous skeletal monster in *Kubo and the Two Strings* is believed to be the largest, most complicated stop-motion puppet ever built. As I wandered through Laika's soundstages, where *Kubo* painstakingly was shot over a period of two years before its release in August, I kept running into all sorts of scary monsters — like that 11-foot-tall one-eyed creature that still keeps me up at night. Most stop-motion sets are universes in miniature, with tiny towns built on workshop tabletops — and that's also taking place on these stages. But mostly I felt like a mouse in a world of giants.

"There were all kinds of red flags to making this movie," says 43-year-old Travis Knight — son of Nike founder Phil Knight — who took time off from his day job as president and CEO of Laika to shoot *Kubo*, which has been nominated for a Golden Globe award, as his directorial debut. "It was the most demanding experience of my life. It was like shooting a stop-motion David Lean movie."



Courtesy of Laika Studios/Focus Features

The boat used for this stop-motion scene was 12 feet long, 14 feet high, 4½ feet wide and covered with 250,000 3D-printed, laser-cut leaves.



Steve Wong Jr./Laika Studios/Focus Features

Monkey (voiced by Theron) had more than 30 million possible facial expressions.

The film tells the story of a young boy, Kubo (voiced by *Game of Thrones*' Art Parkinson), who wanders through a magical ancient Japanese kingdom searching for clues about his dead father's life as a famous samurai warrior. Along the way, he picks up a couple of sidekicks, a talking monkey (Charlize Theron) and an equally verbose beetle (Matthew McConaughey), and gets into scraps with the evil twin Sisters (Rooney Mara doing both siblings' voices) and their terrifying father, the Moon King (Ralph Fiennes). "It's a story about loss and healing and forgiveness," is how Knight sees it. "It's about how loving someone or something can make you vulnerable, but also

give you strength."

Knight began his career toiling as an animator at Will Vinton Studios, the stop-motion company that, in the 1980s, came up with the California Raisins ad campaign and invented the word "Claymation" (or at least trademarked it). But by the early 2000s, Will Vinton, ravaged by the recession and the flattening of the stop-motion industry by CGI, was teetering on collapse. Out of nowhere, a white Knight appeared — this one named Phil — who invested huge sums of money in the company and changed its name to Laika (after a Russian word for "dog") in 2005. His son later got a big promotion; he became president and CEO.

[promo:955260]

What might have appeared at first as blatant nepotism turned out to be a sound business plan. Travis had a knack for running the place and right away turned things around with a series of features that pleased both animation elites and general audiences. Laika's first film release was 2009's *Coraline*, which was nominated for an Oscar and grossed \$124.6 million worldwide. Its second movie, 2012's *ParaNorman*, also was Oscar nominated and grossed more than \$100 million. Ditto its third, 2014's *The Boxtrolls*.

But *Kubo and the Two Strings* is the first film Knight has taken upon himself to direct. And it's by far the most ambitious project his company has attempted, pushing the envelope of 3D printing in animation to new levels (the gadget played a big role in the shooting of almost all of the figures in this film). It also may be the most expensive, with a budget reportedly nearing \$60 million (Knight insists it's less, but declines to give a number). Even thematically, its material is more daring, dealing with such difficult subjects as loss and death. "I wanted to approach [the subject of death] with sincerity and honesty," says Knight, who suffered his own loss in 2004, when

his brother died in a tragic diving accident. "The understanding that while [the dead] are not physically with us, we can carry them with us in our lives — that's the understanding and resolution Kubo comes to in the movie. It took me years to come to that resolution myself."



Courtesy of Laika Studios/Focus Features

Knight (center) on the set.



Courtesy of Laika Studios/Focus Features

McConaughey, who performs the voice of Beetle, read the script to his children as a bedtime story.

The idea for the film came from a former character designer on *Coraline*, Shannon Tindle, who pitched it to Knight in 2011 while he was producing *ParaNorman*. A sucker for fantasy and a fan of Japanese culture (he first traveled to Japan at age 8 with his dad), Knight kicked the concept to a couple of writers, Marc Haimés and Chris Butler (who wrote and directed *ParaNorman*). Somewhere along the way, Knight decided not only to greenlight the project, but also to lens it himself. And not just lens it, but do some of the actual animation.

"I bit off more than I could chew," he admits. "I figured I could direct, animate and run the company, no problem. But it was more than I could handle. I would come in the early morning and crank out a few frames before the day would begin, and then at the end of the day, I'd go back and crank out a few more. As an animator, it was really frustrating to work that way. But I love it. I can't not do it."



Jason Ptaszek/Laika Studios/Focus Features

"Many settings were built full-scale; others were a combination of miniatures, classic matte paintings and CG set extensions," says production designer Nelson Lowry.



Courtesy of Laika Studios/Focus Features

Kubo and Monkey search ancient Japan for clues to Kubo's family history. "Making this movie was the most demanding thing I've ever done," says Knight. "But it was also the most creatively satisfying."

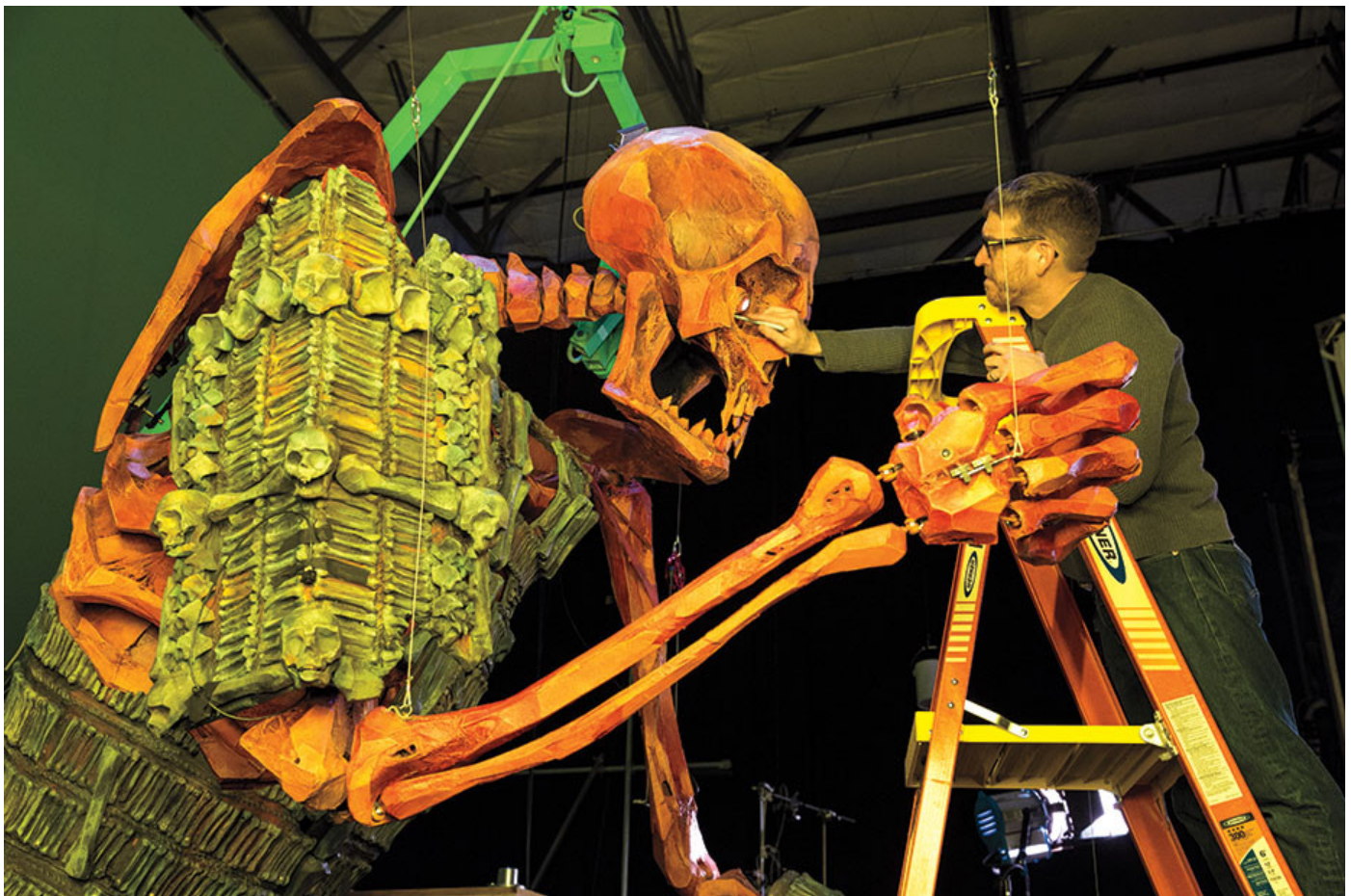
To "crank out" even a few frames of *Kubo* required a staggering amount of effort. Unlike, say, a *Wallace and Gromit* film, where animators use their hands to move clay models who have a limited (albeit adorable) repertoire of expressions, the creatures in *Kubo* virtually have unlimited expressive potential. This is where the 3D printer comes in: Laika's designers whip up thousands of versions of each character's eyes or mouth, render them on the 3D printer, then swap them onto the puppet's face, frame by frame, to create different expressions, all of which get smoothed over with a final layer of CG effects. It's a technique Laika has been pioneering for years — its developers won a scientific Academy Award for it earlier this year — and with *Kubo* it has advanced to next-generation levels. Kubo himself, a mere 9-inch puppet, has 11,007 unique mouth positions, 4,429 brow motions and a total of 23,187 difference faces with more than 48 million possible expressions.

This attention to detail didn't end with the characters' faces. Even the clothing the puppets wore required a deep dive into authenticity (see sidebar) while the overall feel of the film was heavily influenced by ancient Japanese aesthetics. "The look was very much based in Japanese wood-block art," says VFX supervisor Steve Emerson. "It's present in all of the effects, from the environments to the water surfaces to every raindrop in the storm."

[promo:955914]

That storm, incidentally, begins a prologue in which baby Kubo washes up on a shore after a shipwreck — one of the scenes that Knight animated himself. "It was all these tiny little grains of sand and mud — a nightmare to keep track of it all," he recalls of the scene. "Making this movie wore me out. I can't wait to do another."

In her own way, Deborah Cook is the most famous stylist in Portland, Ore. — it's just that most of her clients are 9 inches tall. As the costume designer for animation studio Laika, she's the artist who designs clothes for the stop-motion puppets in all of the studio's films, from *Coraline*'s shoes to the *Boxtrolls*' cardboard suits to Kubo's kimono. "His robe has been handed down from his father, one of the greatest samurai," she explains of the outfit of her latest creation. To design it, Cook traveled all the way to Japan, where she collected fabric samples and steeped herself in the culture. "I did an in-depth study not only of the culture and costumes of ancient Japan in the Jomon era — about 300 B.C. — but also present-day high fashion and vintage Japanese clothing." The biggest fashion challenge of the film? The evil twin Sisters (left), who wear feathered cloaks that would make a peacock envious. Says Cook, "They had about 400 individually shaped and etched feathers, all attached to the main puppet body."



Courtesy of John Leonhardt/Laika Studios/Focus Features

The skeleton weighs 400 pounds and has arms driven by rigs and counter-weights suspended from the soundstage ceiling.





Courtesy of Nelson Lowry/Laika Studios/Focus Features

The Garden of Eyes sequence was made with a single one-eyed puppet that was shot from multiple angles and composited into the underwater setting. The 11-foot puppet has an eye measuring 30 inches in diameter and is motion-controlled.



Courtesy of John Leonhardt/Laika Studios/Focus Features

The Moon Beast is Laika's first fully 3D-printed puppet. It has 881 parts.

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