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APRIL 2010

ALICE IN WONDERLAND

DARIUSZ WOLSKI, ASC GOES
DOWN THE RABBIT HOLE



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American Cinematographer

The International Journal of Motion Imaging

On Our Cover: Alice (Mia Wasikowska) returns to the magical world of her childhood adventure in *Alice in Wonderland*, shot by Dariusz Wolski, ASC. (Photo by Leah Gallo, courtesy of Disney Enterprises, Inc.)

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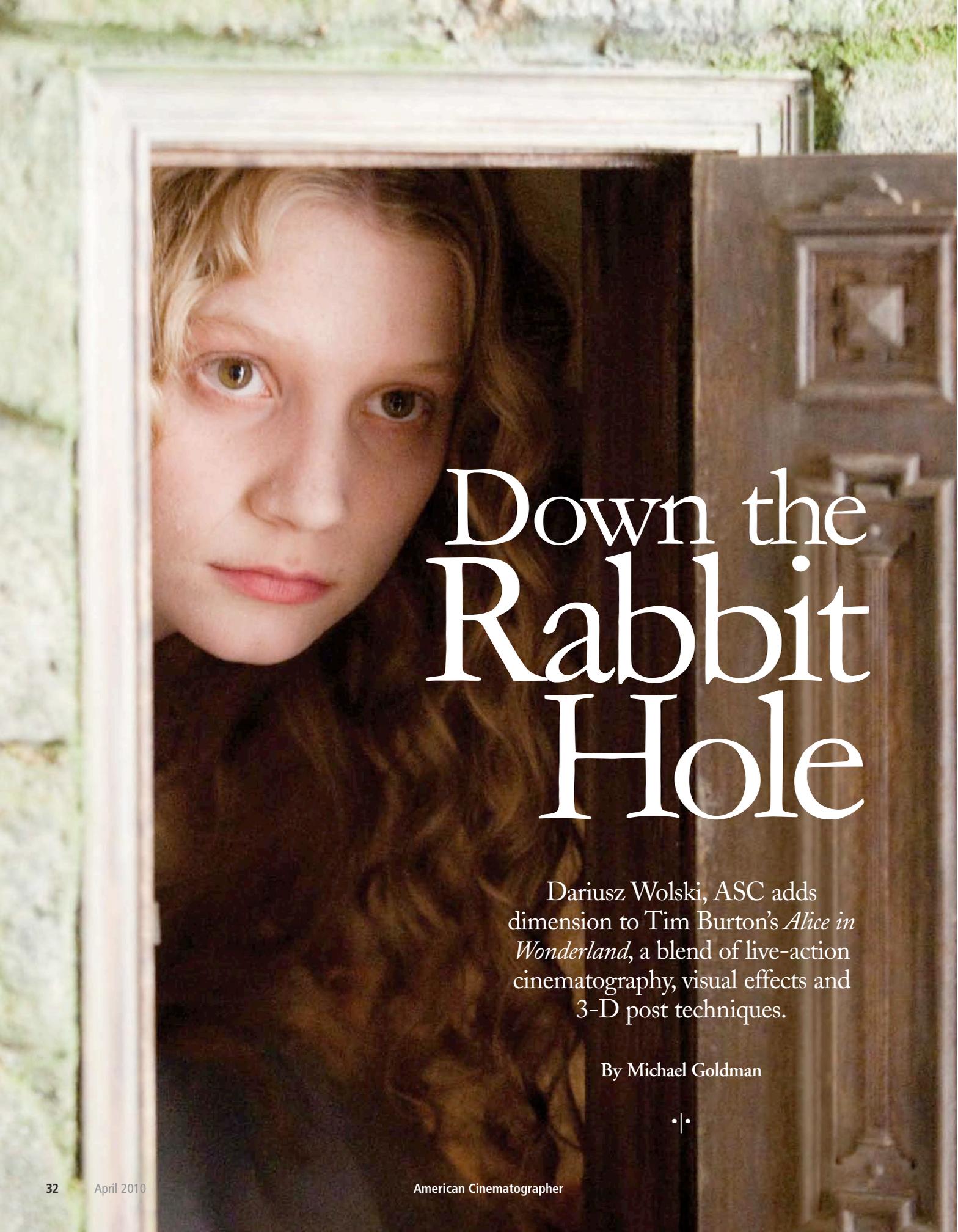
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Down the Rabbit Hole

Dariusz Wolski, ASC adds dimension to Tim Burton's *Alice in Wonderland*, a blend of live-action cinematography, visual effects and 3-D post techniques.

By Michael Goldman



As Tim Burton's team plowed down the home stretch while finishing the 3-D fantasy *Alice in Wonderland*, director of photography Dariusz Wolski, ASC waxed philosophical about having a somewhat atypical role on a strange project that some might consider a distant cousin of *Avatar*. "This is one of those modern movies that makes it really hard to define the role of the cinematographer," he observes. "It's a film that really defined itself during preproduction. When we started, we had no idea exactly how we would make it."

The project's schedule, budget, ambitious visual effects, unique design and stereoscopic-exhibition requirements, when combined, were not conducive to a traditional cinematography process — nor to adopting a native stereo-capture method. Burton and his collaborators decided that the imagery they had in mind could best be constructed through a continually evolving, communal effort in which boundaries between the camera and visual-effects departments were often blurred. Wolski and his crew captured actor performances on a series of green-screen stages at Culver Studios in Culver City, and then senior visual-effects supervisor Ken Ralston and a team at Sony Pictures Imageworks set



Opposite: Years after her original adventure, 19-year-old Alice (Mia Wasikowska) revisits Wonderland and its eccentric cast of characters. This page, top: The sequence in which Alice re-enters the magical realm involved extensive size and perspective shifts as the character both shrinks and grows. Middle: Cinematographer Dariusz Wolski, ASC (far left), Wasikowska and director Tim Burton check out the set. Bottom: Although this section of the film also required extensive digital manipulation, it was also one of the few scenes in *Wonderland* that was partly shot on traditional set pieces, allowing the growth illusion to be achieved in-camera.

Down the Rabbit Hole

about blending that material with all-CG environments and characters, in some instances digitally altering the actors' faces and bodies in the process. Key collaborators were the virtual art department, led by production designer Robert Stromberg; Sony Pictures Imageworks stereographer Corey Turner and visual-effects supervisors Carey Villegas and Sean Phillips; and the digital-intermediate team at Company 3, led by colorist Stefan Sonnenfeld.

Burton recalls that the approach

didn't bubble to the surface until late in prep, and even then, he says, it "often felt like we were making it up as we went along, which is not the best way to do it. But because we were mixing technologies heavily and dealing with a short shooting schedule [50 days of principal photography], it was inevitable. It was fun to experiment and try different things, but it was a very strange process — almost the opposite of making a traditional film, in the sense that we didn't see what we had until the end."

Although *Alice* shares some

prominent similarities with *Avatar*, Burton's film took a different track, not only because his project's time and finances were comparatively modest, but also because he wanted to work organically with a sizable cast, which includes Johnny Depp (as the Mad Hatter), Helena Bonham Carter (as the Red Queen) and Mia Wasikowska (as Alice). Burton rejected an all-motion-capture approach but fell in love with the notion of exotic, all-CG environments and extensive scale and perspective manipulations within the frame. Thus, shooting the movie digitally on a greenscreen stage eventually ripened into the only feasible option.

However, Burton also wanted what he calls "a vast movie." He wanted to honor some of Lewis Carroll's iconic imagery and yet "do [it] in a way that has never been seen before." He elaborates, "We wanted to show that Wonderland has fallen on hard times a bit, and we also wanted to use color to establish each character — each has its own kind of color scheme, in a way. That informed our approach and gave us something to hang onto while dealing with greenscreen all day long."

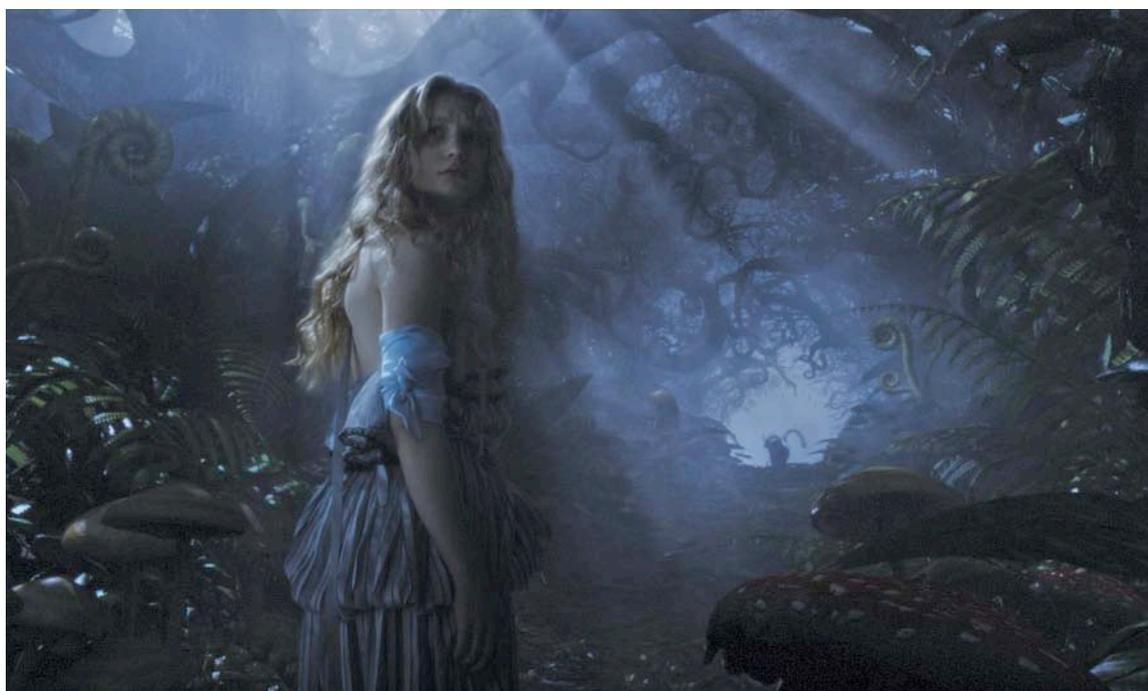
Alice approaches the rabbit hole that will send her tumbling back to Wonderland. This portion of the film was captured on 35mm film.



Throughout prep, the filmmakers presumed they would shoot *Alice* in native stereo. Thus, Wolski spent several weeks testing the Fusion 3-D Camera System developed by Vince Pace and James Cameron and used on *Avatar* (*AC* Jan. '10). Wolski says those tests taught him and Burton a great deal about composing imagery to achieve the correct depth, camera moves and perspective for a big-screen stereo presentation, but, at the end of the day, they concluded they wouldn't have the time to set up the infrastructure necessary to shoot high-end native stereo. Because their "live" characters would be composited into a wide range of CG environments at Imageworks, the filmmakers decided to ask Imageworks to also apply its dimensionalization process — to transform the 2-D images into 3-D in post. "We studied examples of 2-D movies that had been turned into 3-D and agreed the results looked amazing," recalls Wolski. "So, at the last minute, we decided to achieve 3-D in post. But the tests we shot with the Fusion rig were helpful, because they enabled us to understand the whole concept of convergence, how to design the space and so on. They helped us



The Cheshire Cat (top) and the Blue Caterpillar (middle) are two of the offbeat creatures who greet Alice. Sony Pictures Imageworks contributed a variety of complex CG creations. Bottom: Alice explores Wonderland's forest, one of the settings filled with extremely detailed CG scenery conjured by Burton and production designer Robert Stromberg. Taking advantage of previsualization tools, Stromberg was able to help Burton visualize Wasikowska's movements within the show's virtual environments.



Down the Rabbit Hole

Top: The Red Queen (Helena Bonham Carter) reigns supreme in her colorful realm. Middle: The Queen's castle, realized as an eye-popping digital vista. Bottom: Tweedledee, Tweedledum and the White Rabbit are three all-CG characters who routinely interact with real actors in CG environments. Tweedledee and Tweedledum were animated via motion-capture data recorded from sensors worn by actor Matt Lucas and his double, while the White Rabbit was hand-animated.



keep a 3-D image in the back of our minds while we were shooting.”

After deciding on a 1.85:1 aspect ratio, the filmmakers took a mixed-format approach to acquisition, mingling high-definition video with 4K digital capture and 35mm. Panavision's Genesis was the primary tool, and the Dalsa Evolution 4K camera was used to acquire plates for some visual-effects work. The film's opening and closing “bookends” were shot on 35mm to create a visual distinction between Alice's world above ground and the scenes that occur after she falls down the rabbit hole.

Wolski notes that at the time — late 2008 — Sony's F35 was not yet available, so the only Sony HD system he considered was the F23. “I think the resolution of the F23 is better than that of the Genesis, but it has a smaller chip, and I found that wide shots were not as sharp as they were with the Genesis,” he says. “In the tests, I struggled with wide shots, especially when characters wore pale costumes and pale makeup in soft light. Shooting against greenscreen, you don't have all the sharpness and detail that comes with shooting a real set. Under those circumstances, I thought the wide shots were sharper with the Genesis.” ➤

Down the Rabbit Hole



Top: The Mad Hatter (Johnny Depp) is always ready to pour some tea. Middle: The White Rabbit joins the party. Burton notes that in his film, *Wonderland* has “fallen on hard times,” which is reflected in the picture’s color schemes. Certain shots were desaturated during the DI process, but individual palettes were also designed for specific characters, so environments tend to brighten up considerably when Alice is around. Bottom: After sipping her tea, Alice shrinks once again and eventually winds up being stuffed into a teapot.



Using two Genesis bodies, the filmmakers shot raw imagery at 1/2 Gain on the Tungsten setting, recording uncompressed to Codex Recorders. “At the end of each day, the master recordings on the ‘exposed’ diskpacks, so to speak, would go to the video-control truck, where there was an LTO [data tape] transfer station,” explains Wayne Tidwell, the production’s data-capture engineer. “Masters were laid off to LTO tape for archival and safety backup, and the diskpacks were recycled once the data was verified. During production, I’d transfer takes from a scene onto an external Firewire drive using DNX HD36 files. We had about 15 to 20 FireWire drives cycling constantly to editorial.”

Working with a large set of Panavision Primo primes and two encoded 4:1 Primo zoom lenses (along with converted Leica lenses for the Dalsa), Wolski applied what he had learned from testing 3-D rigs. “With 3-D, it’s best to shoot on the wider end,” he says. “Our biggest close-ups were 75mm. I don’t think we went longer than that.” For scenes depicting Alice’s adventures in the rabbit hole — which comprise most of the picture — the

Down the Rabbit Hole

The Red Queen's distorted head size was one of the movie's most complex visual effects. The first step was achieved by shooting Carter on a greenscreen stage. Dalsa's 4K Evolution camera system was used to create plates at high resolution; this allowed the filmmakers to enlarge portions of the frame in post and then seamlessly stitch those elements together with images shot at lower resolutions.

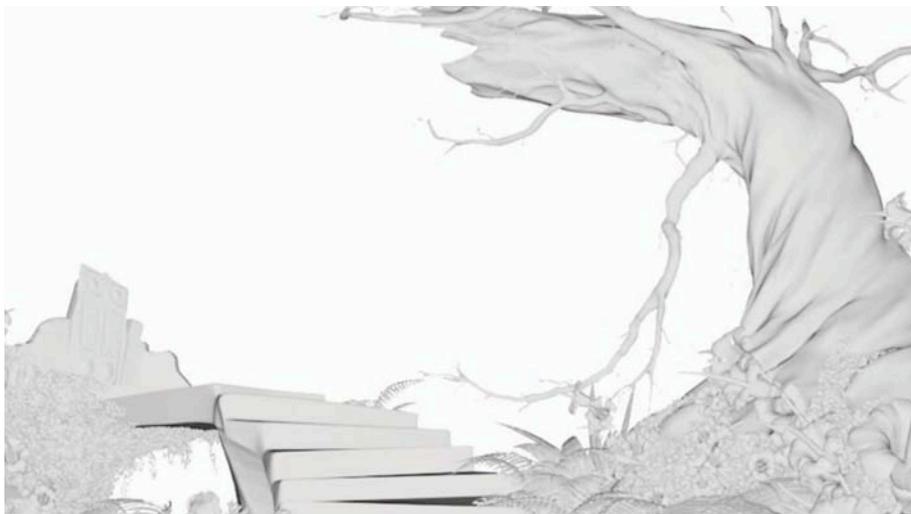


camera was on a 30' Technocrane with a Libra head.

One of the filmmakers' trickiest tasks was determining how to provide plates for shots that showed size and scale shifts within particular frames; certain characters, and sometimes certain body parts, were designed to be different sizes from other elements in the frame. The Red Queen, for instance, has a head far too big for her body. Likewise, Alice is more than 8' tall in some scenes and tiny in others. Wrangling those scale changes was a big challenge and part of a larger paradigm for the movie — virtually every shot is, one way or another, a visual effect. In fact, Ralston, whose credits include such memorable technical achievements as *The Polar Express* (AC Nov. '04) and *Who Framed Roger Rabbit?* (AC July '88), calls *Alice* “the biggest show I've ever done,” adding, “It's the most creatively involved I've ever been in this many areas of a major show.”

The team ruled out motion control for plates involving shifts in scale because that would have required shooting separate passes, and “Tim wanted to make sure the actors could play scenes together,” says Villegas. “We used a variety of methods to get eyelines correct on set, including platforms and stilts. Dariusz had the problem of not knowing how much head-room to leave on various shots because Tim didn't know, for example, exactly how big the Red Queen's head needed to be until we'd put it all together. So Dariusz decided to just shoot it the way he saw it and let us use our post solution.” ➤

Down the Rabbit Hole



That solution involved capturing those plates in 4K with the Dalsa Evolution, which was in the prototype stage at that time. (Ed. Note: Dalsa has since departed the motion-picture business.) With the Evolution, the team could capture the Red Queen or Alice together with other live characters in a single 4K frame and then scale portions of the frame up or down while maintaining a high-quality image.

In order to blend Dalsa footage with Genesis footage, the Imageworks team had to create software to ameliorate resolution differences between the two: the Evolution's 4K images were 4096x2048, whereas the Genesis' HD images are 1920x1080. Still, according to Villegas, the Dalsa was a helpful choice in the long run. "You can't blow up footage from an HD camera by 50 to 100 percent and maintain the quality we needed," says Villegas. "We needed a high-resolution camera like the Dalsa, but it had to co-exist with the Genesis in post — we knew we couldn't have two different pipelines for them.

"We wanted to maintain the Dalsa's 2:1 aspect ratio in order to make sure we could use the full raster of the images Dariusz shot on set," continues Villegas. "So we developed a process to

Almost every scene staged in *Wonderland* with real actors was shot on greenscreen stages. Environments were added later by Imageworks, which also handled the show's stereoscopic conversion process.





Tweedledee and Tweedledum give Alice conflicting directions to her next destination.

resize the Dalsa images down to 2160x1080, approximating the pixel space of the Genesis. The Dalsa resolution had about 120 extra pixels on each side of the frame, and that became the basis of those images. So if we kept Alice at the native resolution of the 4K camera and comped her back into a scene of the downsized Dalsa material, we were effectively getting an 89-percent blowup without doing any resizing." Imageworks achieved this with proprietary software called Recompose, which enabled the team to scale pieces of Wolski's photography up or down and establish a seamless relationship between enlarged portions of the frame and the rest of the frame.

In order for that work to be done, however, Wolski's crew had to record live-action plates to exacting standards on the greenscreen stages. Central among their challenges was how to light greenscreen delicately and mitigate the

pervasive green spill. The solution, says Wolski, lay in the shadows, and "was something we kind of invented as we went along.

▲
 "We studied examples of 2-D movies that had been turned into 3-D and agreed the results looked amazing."
 ▼

"On a 360-degree greenscreen stage, the spill goes everywhere," he continues. "If you want big shadows to fall on some of your subjects, those shadows often become green because there is so much green spill. So we used different shades of high-quality gray fabrics to create shadows. When we wanted to go real moody, we used a shade that was almost black. If it was a dusky day, we used a dark gray, and if it was day, we used light gray."

Above each greenscreen stage, gaffer Rafael Sanchez and his crew installed huge lightboxes to provide soft light. Each source comprised three soft boxes containing 32 6K space lights each, and all three were rigged with chain motors to facilitate extensive manipulation. This approach gave

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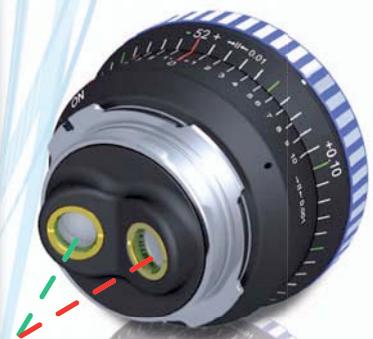


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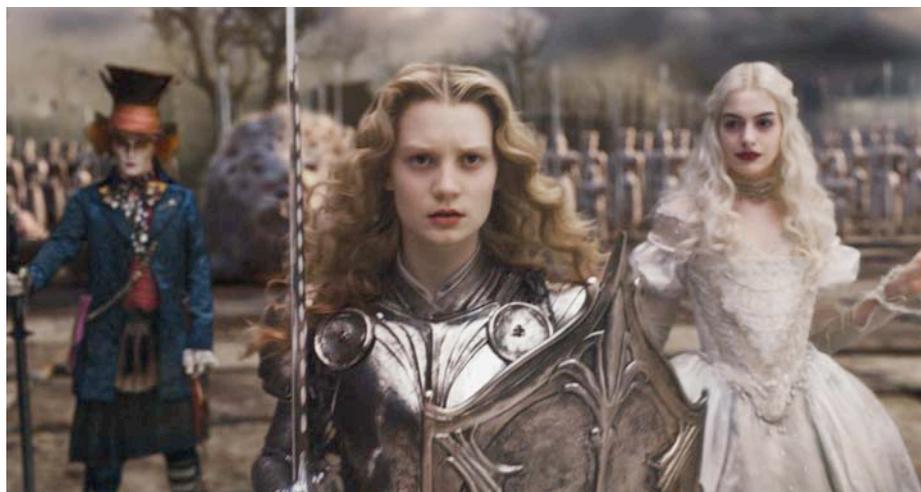


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Down the Rabbit Hole

Burton's desire to lend the movie "epic scope" is exemplified by scenes in the Red Queen's throne room and during battlefield action that pits the Red Queen's forces against those of her rival, the White Queen (Anne Hathaway).



Wolski "great flexibility in shaping the light," says Sanchez. "We even had control of each circuit in every space light." Outside the softboxes, the crew placed 80 Kino Flos for direct green-screen light, and they also used 20K Fresnels on scissorlifts and on the ground to build various sun sources that would eventually shine in through CG windows and doors.

"We put silks that had been dyed various shades of blue underneath the huge lightboxes," says Wolski. "I found that digital cameras don't like red or warm colors very much, and they tend to go a little pinkish or reddish, so I cooled the whole thing off a bit for a cloudy-day look. The silks we used most of the time were ¼ Blue, and we had one for night scenes that was Full Blue. With the scissorlifts, we could bring in the 20Ks if we wanted a soft sun, a soft glow or a hard sun."

The nature of the production meant that there was no chance for the filmmakers to view the characters fully integrated with their environments on set during the shoot, nor could they take advantage of dailies in any useful way. They did, however, utilize a couple of on-set previsualization systems, according to Villegas. "We did real-time



Stayne (Crispin Glover) leads the Red Queen's minions into battle.

keying of the greenscreen into the environments on set so Tim could view a character walking inside the environment she would eventually be in," says Villegas. "It was a crude representation, but it did show him how the character would move and interact inside a set. Of course, to do a real-time composite of the greenscreens into the CG environments we built on set, we had to capture the camera move and replicate it in the computer."

This was accomplished in a couple of ways. First, the team used General Lift's Encodacam system to encode dollies and cranes so that on-set camera moves could be recorded for virtual-camera data. They also used InterSense optical motion-tracking sensor technology, incorporated into Lightcraft Technologies' Prevision system, to track movement of wild cameras. That data, along with zoom and pan-and-tilt data from the Libra head, and other signals criss-crossing the set, were interfaced through a Panavision Panahub.

To give everyone a consistent

visual reference as production moved along, Wolski pulled frames from the Codex Recorder each day for key scenes and color corrected them with Photoshop. "Dariusz also set a look-up table in the Codex for each scene to help with the color timing," says 1st

AC Trevor Loomis. Wolski notes, "Using my LUT [in the Codex], I created a book of prints that showed the looks we wanted for all the crucial scenes, so when the effects team went to do comps, they had something to match to. I went off for about a week and just printed simple photos, adding contrast or changing color here and there, to provide simple guidelines for everyone."

As elements were captured onstage or created in Imageworks' computers and then stitched together, Imageworks' stereo department set about adding the third dimension. Turner credits the recent feature *G-Force*, also done at Imageworks, for supplying a toolset and methodology for massaging 2-D footage of live-

▲
 "It was fun to experiment and try different things, but it was a very strange process."
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Down the Rabbit Hole



The White Queen promotes a kinder, gentler agenda from her part of the realm.

action characters and environments combined with CG characters into 3-D imagery. “*G-Force* gave us the experience of transforming 2-D [live-action] plates into 3-D, so we had a nice backbone to start the process on *Alice*,” says Turner. “But *Alice* posed a different challenge, in

that the primary task was to dimensionalize people. On *G-Force*, the team was dimensionalizing mostly objects.”

Both rotomotion and match-move techniques were used during the dimensionalization process for *Alice*. The chief tools used were customized

animation and compositing software, particularly Imageworks’ customized version of Maya 2009, which includes a custom stereo viewer; Imageworks’ proprietary compositing software, Katana3-D; Nuke compositing software (v. 5.1); and Imageworks’ in-house 3-D viewing tool, Itview.

Ralston and Turner emphasize that this effort involved a great deal of finely detailed manual work — so much so that at press time, as the DI process was beginning, they were still making revisions and tweaks. After the final grading session, Turner was slated to do a final convergence pass on the imagery to fine-tune screen depth one last time. “I’ll be looking for depth jumps or last-minute tweaks,” Turner explains. “At that late stage, you can’t add more depth to the shot, but you can adjust screen placement and screen depth. It’s a manual process, and I view it the way the cinematographer views his role: he has to frame shots the way the director

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Wolski, Burton and senior visual-effects supervisor Ken Ralston (right) stayed in very close contact throughout production.

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wants and fluidly hit those points. I do the same thing, only with depth.”

As the process wound down, Burton conceded it had been a grueling adventure. He notes there are “some things I would do differently, but sometimes you decide to try something and

get momentum going, and you just need to go for it. It’s fun to experiment — that’s the joy of filmmaking. Dariusz was willing to go for it, and so was everyone else, and we made this movie in that spirit. Somehow, we got it done.” ●



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