It's all about the hair: Researcher develops better way to light and animate hair for Disney movies

September 29 2011

(PhysOrg.com) -- It’s not every day that computer science students get invited to a Hollywood premiere to recognize the work they have done. Yet that’s exactly what happened to Iman Sadeghi, who recently graduated with a Ph.D. in computer science from the Jacobs School of Engineering at UC San Diego.

Sadeghi got to rub shoulders with Hollywood celebrities, including Mandy Moore, at the premiere of “Tangled,” a retelling of the Brothers Grimm’s fairytale “Rapunzel. “ Sadeghi has developed a new way to light and animate characters’ hair. It is now part of Disney’s production pipeline and will be used in the company’s upcoming movies. His contribution was particularly timely. When he was an intern there, Disney’s animation studio was developing “Tangled,” whose lead

character sports 70 feet of blond hair.

“I think his work was critical,” said Heather Pritchett, the look development supervisor on “Tangled.” “He brought state of the art research into our studio.”

As part of his master’s thesis, Sadeghi surveyed the research available to improve the appearance of animated hair. He then worked for two summers at the Walt Disney Animation Studios in Burbank, Calif. During his first summer, he built a prototype for an artist-friendly hair shading system. During his second summer, he helped integrate the system into Disney’s production pipeline. The new system allows animators to light hair realistically, while also introducing artistic effects.

The new software he developed allowed artists to control the sheen, color and highlights in Rapunzel’s magical hair—and the hair for all the other characters in “Tangled,” including Maximus, the horse, and Flynn Rider, the main male character and Rapunzel’s love interest.
When Sadeghi first started working at Disney, artists could use two systems to shade characters’ hair. One is based on the physical laws that govern the way light interacts with hair, but doesn’t include any controls for artists. The other is fully controlled by artists, but doesn’t reflect how hair and light interact in the real world. Over two summers, Sadeghi brought them together.

He made a point to talk to artists about features the new software should include. “As engineers, it’s a good idea to know how the end users want to control the system. Otherwise, you end up with something that is not as useful as it could be,” Sadeghi said.

His task was complicated by the fact that Rapunzel is, well, blonde. That means sunlight bounces around in her fair head of hair for a long time before finally being absorbed or reflected, making it all the harder to

light. By contrast, Flynn Rider's hair is dark and quickly absorbs light that hits it. In technical terms, it's called light scattering, and blondes have a lot more of it than brunettes.

Sadeghi's experience at Disney landed him a film credit for his work, which he got to see while attending the "Tangled" premiere at the El Capital Theatre in Hollywood. He had his picture taken with Mandy Moore, who voices Rapunzel. He then saw the movie again over Thanksgiving break last year with his extended family on the East Coast and with fellow UC San Diego students when it screened here on campus at the Price Center Theater. He doesn't own the DVD yet.

His stints at Disney, as well as an internship at George Lucas' Industrial Light and Magic in the San Francisco Bay Area, also prepared him well for the job market, he said. After earning his Ph.D. at the Jacobs School, he landed a job as a software engineer in Google's graphic division, in Santa Monica, Calif. He credits his thesis advisor, computer science professor Henrik Wann Jensen, for connecting him with Disney and ILM. Jensen is no stranger to bringing techniques developed in academia to Hollywood. He won an Academy Award in 2004 for research that brought life-like skin to animated characters.

Sadeghi also published the results of his work on "Tangled" in the ACM Transactions on Graphics Journal, which covers important breakthroughs in computer graphics. He presented his paper at the SIGGRAPH conference last year.

Provided by University of California - San Diego