



## The Light of the Mind

By: David Barbour

A new bridge on the Carnegie Mellon campus pays tribute to a beloved member of the faculty

The Randy Pausch Memorial Bridge, which opened on the campus at Carnegie-Mellon University on October 30, 2009, is an unusual tribute to an unusual man. Randy Pausch was a popular, eminent professor of computer science and human-computer interaction at CMU; he was also a co-founder of the university's Entertainment Technology Center. Tragically, he was diagnosed with pancreatic cancer in 2006, and died in 2008; he was 47.

In 2007, Pausch contributed to a lecture series at CMU with a speech titled "Really Achieving Your Childhood Dreams." It was a summing up of his professional and personal life lessons, and it went viral on the Internet, eventually earning extensive coverage in the mainstream media. It was subsequently converted into a best-selling book, *The Last Lecture*, co-written with the journalist Jeff Zaslow.

Since Pausch's death, there have been many efforts to memorialize him. For example, a scholarship has been instituted in his name, which is devoted to fostering careers for women in the computer science field. Most notably, the Randy Pausch Memorial Footbridge has been erected on the campus of CMU. Appropriately, the bridge, which stands above a ravine, connects Purnell Center, one of the school's fine arts buildings, with the Gates & Hillman Centers, the new home on campus for computer science studies. (The latter building was designed by Mack Scogin Merrill Elam

Architects, working with a local affiliate, EDGE studio.)

It somehow seemed appropriate that any tribute to Pausch needed to be a kinetic, almost living, thing—a reflection of his highly original mind—and therefore the bridge features an unusually complex lighting design by Christopher Popowich and Cindy Limauro, of the firm C & C Lighting, LLC. (Both are intimately connected to the Carnegie Mellon community; Limauro is a professor of lighting design at CMU, and Popowich has taught there as well.)

"The bridge is a metaphor," notes Limauro, meaning that, in connecting two buildings—one devoted to the arts, one to the sciences—it is an expression of the work that defined Pausch's career. She adds that the original design for the structure consisted of railings with white LEDs built into their undersides. However, at a certain point, the LED manufacturer Philips Color Kinetics—which was founded by CMU alumni—got involved, offering to provide the lighting gear. This offer created a mandate for a lighting designer; Kevin Dowling, then vice president of Color Kinetics, suggested Limauro and Popowich, who, in addition to being well-known for their work, were already familiar with the project.

The original design for the bridge featured aluminum panels on both sides. Limauro says the architect gave her and Popowich samples of the panels, allowing them to experiment with front- and backlighting ideas. Popowich adds that

The bridge links the Purnell Center, a fine arts building, with the Gates & Hillman Centers, for computer science studies.

they did a mockup of their work in CMU's drama lighting lab, which was presented to the rest of the design team. Later, the design was changed, with frosted glass panels on the bridge's north side and aluminum panels on the opposite side. As originally planned, these frosted panels have a continuous row of white LEDs at their tops, for safety lighting and emergency backup.

The aluminum panels feature a series of abstract cut-outs of penguins; these constitute the most overt allusion to Pausch's career. Each year, he gave out Penguin Awards to the team of students "who had taken the biggest risk without realizing their goals." In an article he wrote for *Parade* magazine, he explained, "The award came from the idea that when penguins jump in water that might have predators, well, one of them's got to be the first penguin. In essence, it was a prize for 'glorious failure.'" "The penguins are depicted leaping out of water," says Limauro. "You really have to look for them to see them."

Sandwiched between the double aluminum panels is a continuous run of 7,000 programmable color-changing LEDs at the top and bottom; the designers went with Color Kinetics' ColorGraze Powercore, a linear fixture optimized for surface-grazing, wall-wash lighting and efficient signage illumination. Every foot of ColorGraze on the structure's 208' span is individually controlled to perform RGB color mixing, using the Light System Manager by Color Kinetics. Interestingly, Popowich says, the color mixing "is all software-driven. It's not done using DMX." The reason, he adds, is because "we discovered that the Color Kinetics system follows a perfect color curve, allowing us to get the kind of colors you can't get using a lighting console." It's often common for LED products to advertise the ability to create literally millions of colors—and here is evidence that the claim is true. Popowich adds that one of the looks he and

Limauro created uses a color palette reminiscent of the painter Claude Monet.

The lighting, which was programmed with the assistance of Rob Timmerman, of Color Kinetics (who Popowich calls "brilliant"), was also designed to reflect aspects of Pausch's philosophy. The result is 15-minute show that runs on a loop all night long. "We wanted something special for Randy Pausch's memory," says Limauro, adding that each look is a derived from an idea in *The Last Lecture*. For example, she notes, "We start with white light. Randy only used black and white crayons as a boy. The bridge panels start in darkness and fade up to white light." The colors start moving across the bridge toward the Purnell Center, creating a pattern of different-colored panels. The colors chosen are based on Pausch's favorite hues, as well as those of his wife, Jai, and his children Dylan, Logan, and Chloe. The colors then chase in two different directions, meeting in the middle.

Next comes the effect called "Space—The Last Frontier," in which the lighting simulates a rocket blastoff. (Pausch was an enormous *Star Trek* fan.) Against a purple background, a starburst of white light traverses the bridge, followed by an orange fire trail. Next comes "Make the Most of Each Day," a time-of-day cycle that pays tribute to Pausch's belief in living each day to the fullest. During this sequence, the entire set of panels shifts through a series of looks, from night to dawn to daylight to sunset.

Pausch's favorite animals return in "Be the First Penguin," in which the lighting creates images of water and motion to suggest that penguin jumping into unknown waters. This is followed by "Live Your Dreams." Pausch painted his bedroom with the image of an elevator, so the lighting, using a moving burst of white light across a darker background, creates the look of a moving elevator stopping at different floors. It lights up at every third floor, because, in his bedroom, Pausch had six floors with the number "3" illuminated.

This leads to the grand finale, "Disney and the Circus." Pausch refers to both of these in his book, and, because his Entertainment Technology Center is devoted to exploring cutting-edge technologies, Limauro and Popowich devised a series of pulses, chases, and color transformations, all meant to pay tribute to Pausch's love of the magical.

The evening show runs continuously from dusk until dawn, and it is designed to be a dynamic, constantly changing thing. Popowich mentions the possibility of adding wireless solar sensors, so the show would be changed by the movement of the sun. And plans are afoot to have CMU students get involved and make shows of their own, thereby turning the bridge into an elegant, and very public, light lab. (At this point, it's probably too obvious to note that, by using LEDs, the designers opted for the green solution, which will save money for the university.)

Also involved were Arup (structural and electrical engineers), Hanlon Electric (electrical contractors), and PJ Dick (contractors). ("Terry Hanlon came up with the idea of using vertical LED units to plug gaps in the structure," adds Popowich.) Representing CMU were Ralph Horgan (associ-



Philips Color Kinetics' ColorGraze Powercore, a linear lighting fixture, was used.



Using Color Kinetics' Light System Manager, every foot of ColorGraze on the bridge's 208' span is individually controlled.

ate vice provost), Andrew Reilly (senior project manager), and Joe Greenway (director of construction).

Like the lecture itself, the bridge's light show has gone viral, and can be seen on YouTube at <http://www.youtube.com/watch?v=4sL-8r3kMBw&feature=channel>.

Watching it, it's not too much to see the bridge as a kind of cerebral cortex, transmitting ideas about creativity between the two buildings it links. It's almost like watching the thought process—in full color. And, really, what could be a more fitting tribute to the life of Randy Pausch? 📶

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