Special Session in Honor of Randy Pausch

Caitlin Kelleher
Computer Science and Eng.
Washington Univ. in St. Louis
ckelleher@cse.wustl.edu

Brad A. Myers
Human Computer Interaction Inst.
Carnegie Mellon University
bam@cs.cmu.edu

Daniel P. Siewiorek
Human Computer Interaction Inst.
Carnegie Mellon University
dps@cs.cmu.edu

Dennis Cosgrove
Human Computer Interaction Inst.
Carnegie Mellon University
dennisc@cs.cmu.edu

Jeffrey S. Pierce
IBM Almaden Research Center
San Jose, CA 95120
jspierce@us.ibm.com

Matt Conway
Director, Expedia Labs
Expedia, Inc.
mconway@expedia.com

Don Marinelli
Executive Producer of the
Entertainment Technology Center
Drama and Arts Management
Carnegie Mellon University
thedon@cmu.edu

CHI 2008, April 5 – April 10, 2008, Florence, Italy
ACM 978-1-60558-012-8/08/04.

Abstract
Randy Pausch is an inspiration to all with his research, teaching, the way he has lived his life, and his courage while confronting pancreatic cancer. This session brings together people he has touched through various phases of his career to discuss his research and legacy.

Keywords
SUIT, Toolkits, Virtual Reality, Alice, Last Lecture, Entertainment Technology

ACM Classification Keywords
A.0 GENERAL: Biographies. D.2.2 Design Tools and Techniques. D.2.3 Coding Tools and Techniques. H.5.1 Multimedia Information Systems: Artificial, augmented, and virtual realities. H.5.2 User Interfaces. K.3.2 Computer and Information Science Education.

Introduction
Dr. Randy Pausch is a valued member of the SIGCHI community. He gave the keynote speech at CHI'2005, he is an ACM Fellow, and will be inducted into the CHI Academy at CHI'2008. He was diagnosed with pancreatic cancer and was told he had just a few months to live. In honor of his many contributions to research and education, this session brings together a number of his colleagues, friends, and former students.

CHI Research

Randy's early research efforts at the University of Virginia on SUIT, the Simple User Interface Toolkit [8], allowed users to build graphical interfaces using buttons, scroll bars, etc. with less effort and a lower learning time than other toolkits of the time. Over 10,000 free copies of SUIT (and one paid license!) were distributed during its lifetime, and served as an inspiration for how toolkits could be designed better based on usability concerns.

Randy's work on virtual reality (VR) began modestly, with the creation of a low-cost demonstration platform he called "Virtual Reality on Five Dollars a Day" [5], constructed from off-the-shelf components in a time when more capable VR systems cost many times as much. The $5000 system was simple, but attracted enough attention to help bootstrap Randy's growing research program in VR.

Randy's VR research next turned to what he saw as a critical bottleneck: the software needed to control 3D environments was too difficult to construct and the interaction techniques were too weak, too few, and took too much effort to develop. To explore this rich set of questions, Randy launched the 3D interactive graphics programming environment called Alice [7]. By the late 90s, Alice had matured into a Python-based scripting system that was both easy for students to learn and powerful enough to support academic research into immersive VR interaction techniques. From this work, Randy and the "Stage 3" research team published research results on both the Alice platform itself and on the immersive interaction techniques that were created using it, including "Worlds in Miniature" [6], 3D Lenses, and Interactive Image Plane techniques [2].

Randy supported two other areas of research during this time, with two very productive cross-disciplinary collaborations: one with Neurosurgery, the other with Psychology (see, e.g., [3]).

It was during this time that Randy Pausch formed his research collaboration with Dr. Denny Proffitt at the University of Virginia. Randy and Denny quickly formed a unique bond, both socially and professionally, and while both argued that they existed on opposite ends of any spectrum one could conceive, this is exactly what made the team so strong. They also shared a passion for combining our understanding of the human being and of technology to create impactful human-technology systems (see, e.g., [9]).

Their work on large and multiple display systems that implicitly provide cues to improve human memory and decision making was a novel approach that gained them much academic infamy. Further exploiting their symbiotic relationship, the duo led the emerging field of Augmented Cognition, which seeks to extend human abilities via computational technologies. This field has blossomed and now serves as inspiration for psychologists and technologists alike.

The Formation of the Entertainment Technology Center

Motivated by his successes with Alice and inspired by a life-long childhood dream, Randy joined Disney Imagineering in 1996 for a sabbatical. While there, Randy innovated in how to perform formal user testing for theme park attractions and virtual reality, capitalizing on having hundreds and even thousands of subjects. He tested major theme park attractions at DisneyQuest (Aladdin's Magic Carpet Ride, Alien Invasion, Virtual

Jungle Cruise, Virtual Pirates of the Carribean), EPCOT Center (DisneyVision, Experience Brasil interactive audience show), and Disney's California Adventure (Ursula's Grotto, Enchanted Book). This work resulted in a SIGGRAPH paper [10] which provided the lessons learned on the importance of story and content from the exit surveys of 45,000 guests. One of the hallmarks of Disney Imagineering's approach to theme park attraction design is a close partnership between artists and engineers. Randy left Imagineering thinking about how to create similar working relationships between artists and engineers in an academic setting.

Randy moved on to Carnegie Mellon, in part because he felt it afforded a greater opportunity to get artists and engineers to work together. He created a course called "Building Virtual Worlds" (BVW) in which small teams of artists and engineers were lured into working together with the goal of creating virtual environments. The students work in teams of modelers, texture painters, animators, and programmers for 2-3 weeks to create these interactive worlds. The course culminates in a stage show where a juried selection of the best work is shared with the entire university community. Almost a thousand students have taken this class since its inception in 1998.

BVW became a campus phenomenon at Carnegie Mellon, with students lining up for hours to see to get seats to the end-of-semester shows.

Randy was the co-founder of the Entertainment Technology Center at Carnegie Mellon, which has innovated the interdisciplinary research and teaching necessary to educate students in the very real world of entertainment experiences made possible by the advent of primarily computer-mediated digital technologies.

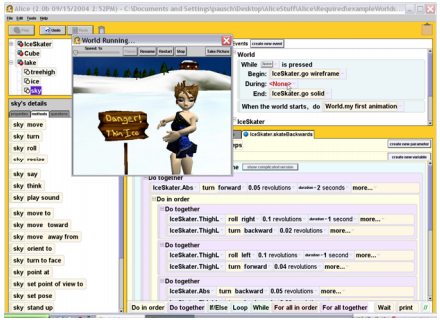
Randy Pausch's vigorous commitment to engaging students at every level with compelling intellectually rigorous projects and his appealing lecture style are a role model for every teacher and lecturer. His work has helped to make team project experiences and educational computing research more common and respected. ETC encompasses every aspect of interactive digital media including videogame design and production, theme park rides and experiences, edutainment, interactive animatronic robots, unique input and display devices, augmented reality, visualization software, and game and animation engine development. To date, approximately 250 ETC alumni are employed in the entertainment industry working at Walt Disney Imagineering, Industrial Light and Magic, Pixar, Dreamworks, SONY, Electronic Arts, Activision, Crystal Dynamics, Rock Star, and myriad other entertainment companies.

Alice and Introductory Programming

The first version of Alice was very much a traditional programming environment, meant to support scripting, with a great deal of effort going into the usability design testing of a traditional API. This sort of environment demanded a lot of typing and a lot of syntax struggles for non-programmers, a long-held goal of the Alice project. To reach these users, Alice would need a redesign.

In the late 1990's, the focus of the Alice project shifted from enabling non-programmers to explore the medium of 3D graphics to helping novice programmers learn to program.

On a long car trip, Randy introduced his then middle school-aged nephew to Alice. While Randy's nephew understood how to get the Alice character's to behave



the way he wanted them to, he repeatedly struggled with the syntax. This experience, reinforced by similar results from extensive user testing among college-age novice programmers, cemented the goal for the next version of Alice: remove the necessity for novice programmers to tackle syntax. Inspired by Squeak eToys (http://www.squeakland.org/), Alice 2 provided an interface in which users drag and drop graphical tiles to construct programs.

At the CHI conference in 1998, Randy met Wanda Dann and Steve Cooper. Wanda and Steve arrived at their first meeting with Randy with a thick stack of curricular materials they had developed for an introductory course using an older version of Alice. This meeting led to a collaboration which resulted in the publication of a textbook: Learning to Program with Alice [1]. This textbook uses Alice to provide an introduction to programming and computer science, and is in use in 261 colleges and universities (about 10% of the universities in the United States) and at least 100 high schools and middle schools. Over 311,613 copies of Alice 2 have been downloaded in the past year alone.

A formal evaluation of Alice 2 with at-risk college freshman majoring in computer science found that those who took an Alice course before or concurrent with CS1 performed a letter grade better (B vs C average) in CS1 and were more likely to continue as computer science majors (88% vs 47%).

User testing of Alice 2 with middle school girls revealed that while most were capable of writing programs using Alice 2, many were not interested in doing so. This motivated a second line of research into supporting the activity of storytelling in order to motivate middle school girls to program. This led to the development of a modified version of Alice 2, called Storytelling Alice, which focuses on human characters and social interactions. A formal study comparing the programming behavior of middle school girls using Storytelling Alice and a version of Alice without storytelling support (Generic Alice) found that Storytelling Alice users spent 42% more time programming and were more than three times as likely to sneak extra time to continue programming [4].

Randy's sabbatical at Electronic Arts (EA) helped cement a deal to use the characters from The Sims 2 in Alice 3. This will support higher quality character-based storytelling which will help to lure a broader population into computing. Alice 3 will also address an important issue that teachers reported with Alice 2 — better supporting the transitioning of students to a professional programming language like Java. Alice 3 is scheduled to begin testing in the classroom setting in the fall of 2008.

On September 18, 2007, Randy gave a lecture at Carnegie Mellon University in the "Last Lecture" series, entitled "Really Achieving Your Childhood Dreams". The video of the lecture has been seen by over 6 million people on the Internet, and has been turned into a book [11].

The Pausch Legacy

Even more than the technology he creates, Randy's research style and humanity reflect goals to which the community aspires. He excels at assembling interdisciplinary teams and getting them to work together (e.g. Stage 3, Building Virtual Worlds). He is willing to break the norm and take large risks (VR on $5 a day). His "Time Machine" approach uses large amounts

of resources (money and people) to create the future today.

Randy's passion for education brings out the potential of his students and colleagues. He inspires our community to be more ambitious, more collaborative, more inclusive, and to be courageous and joyful. In every endeavor, Randy Pausch brings Wonderland to life.

Acknowledgements

We thank the CHI'2008 committee for making this session possible.

References

[1] Dann, W., Cooper, S., and Pausch, R., *Learning to Program With Alice.* 2003, Prentice-Hall. To be published in August, 2003.

[2] Durbin, J., Gossweiler, R., and Pausch, R. "Amortizing 3D Graphics Optimization Across Multiple Frames," in *Eighth Annual Symposium on User Interface Software and Technology.* Nov, 1995. Pittsburgh, PA: pp. 13-18. Proceedings UIST'95.

[3] Goble, J.C., Hinckley, K., Pausch, R., Snell, J.W., and Kassell, N.F., "Two-handed Spatial Interface Tools for Neurosurgical Planning." *IEEE Computer, special issue on Real Applications for Virtual Reality*, 1995. **28**(7)July.

[4] Kelleher, C., Pausch, R., and Kiesler, S. "Storytelling Alice Motivates Middle School Girls to Learn Computer Programming," in *CHI'2007: Conference on Human Factors in Computing Systems.* 2007. pp. 1455-1464.

[5] Pausch, R. "Virtual Reality on Five Dollars a Day," in *CHI'1991: ACM SIGCHI: Human Factors in Computing Systems.* April, 1991. pp. 265-270.

[6] Pausch, R., Burnette, T., Brockway, D., and Weiblen, M.E. "Navigation and Locomotion in Virtual Worlds via Flight into Hand-Held Miniatures," in *Computer Graphics: ACM SIGGRAPH `95 Conference.* July, 1995.

[7] Pausch, R., Burnette, T., Capehart, A.C., Conway, M., Cosgrove, D., DeLine, R., Durbin, J., Gossweiler, R., Koga, S., and White, J., "Alice: A Rapid Prototyping System for 3D Graphics." *IEEE Computer Graphics and Applications*, 1995. **15**(3): pp. 8-11. May.

[8] Pausch, R., Conway, M., and DeLine, R., "Lesson Learned from SUIT, the Simple User Interface Toolkit." *ACM Transactions on Information Systems*, Oct, 1992. **10**(4): pp. 320-344.

[9] Pausch, R., Proffitt, D., and Williams, G. "Quantifying immersion in virtual reality," in *SIGGRAPH '97: Proceedings of the 24th annual conference on Computer graphics and interactive techniques.* 1997. pp. 13-18.

[10] Pausch, R., Snoddy, J., Taylor, R., Watson, S., and Haseltine, E. "Disney's Aladdin: First Steps Toward Storytelling in Virtual Reality," in *ACM SIGGRAPH 96 Conference.* August, 1996. pp. 193 - 203.

[11] Pausch, R. and Zaslow, J., *The Last Lecture.* 2008, Hyperion Books.