Get Schooled
Learn How Science and Storytelling Come Together to Benefit Soldiers, Students and Society
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On the Cover
Arts and Sciences Technical artist Randy Nolta serves as both subject and photographer during a motion capture shoot to gather realistic movement and gesture animation data to inform the development of a virtual patient character. Some ICT virtual patients are being developed with the USC School of Social Work’s Center for Innovation and Research on Veterans and Military Families in order to help train future clinicians in the school’s specialization in military social work.

Get Schooled

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Eye Catching: David Krum of ICT’s MxR Lab shines in one of the lab’s research prototypes, an individualized head-mounted projector that enables each user to perceive whether a virtual character is looking at them or at someone else.
Randall W. Hill, Jr.
ICT Executive Director

Growing up, I never dared to daydream in class. Now I imagine for a living.

As the leader of the University of Southern California Institute for Creative Technologies, I brainstorm with the brightest academics and artists I know, conjuring up meaningful methods to improve how we teach and train, heal and help.

Through rigorous research and compelling content, we are transforming traditional military instruction, health therapies, STEM education and more. With science and story, we are shaping the future of how we interact with computers and what we use them for.

» Envision a veteran going online to speak anonymously to an interactive virtual coach who can remotely recognize signs of depression, post-traumatic stress and suicide risk and point the person in need to resources that can help.

» Picture a soldier learning how to address a case of sexual harassment through practice with a computer-generated virtual human education system that can role-play conversations and teach a classroom of participants the best way to handle these and other personnel issues.

» Consider computer games available to troops stationed around the globe that can simulate what goes wrong when they don’t consider the cultural sensitivities and indirect consequences of even their smallest interactions.

These ideas with impact, as well as more you will read about in the following pages, are products of what I like to call the ICT school of thought. It is a powerful process – addressing issues including how we make decisions, communicate with others and handle stress - that is making a difference today and paving the way for what is possible tomorrow.

Now that is something to think about.

I invite you to join us as we discover all we can do when we put our minds to it.

Sincerely,

Randall W. Hill, Jr.

Executive Director
Institute for Creative Technologies
University of Southern California

Bright Ideas Members of the ICT Graphics Lab gather inside Light Stage X, the institute’s latest LED-filled sphere used to help create realistic virtual characters for military training and education projects as well as for making movie magic. Development of these systems — employed to produce believable digital doubles in Hollywood blockbusters like Avatar, Spider-Man 2, and The Curious Case of Benjamin Button — earned ICT’s Paul Debevec and his collaborators an Academy Award in 2010.
» Established in 1999, the University of Southern California Institute for Creative Technologies combines techniques from Hollywood, gaming and artificial intelligence to advance the state of the art in immersive experiences for training, education and more. Research specializations include virtual humans and story-based learning environments.

» The institute is a DoD University Affiliated Research Center. These are prestigious institutions where universities at the forefront of science and innovation in a specific area conduct relevant research where breakthroughs are likely to enable revolutionary capabilities.

» The U.S. Army selected the University of Southern California as a strategic partner in the development of ICT because of the university’s unique confluence of scientific capabilities and entertainment industry relationships necessary for leadership in simulation.

» ICT leverages the University of Southern California’s expertise to create engaging and meaningful experiences to improve skills in decision-making, cultural awareness, leadership and coping. Collaborators include the USC Viterbi School of Engineering, the USC Rossier School of Education, the USC Marshall School of Business, the USC School of Cinematic Arts, the USC Annenberg School for Communication and Journalism, and the Keck School of Medicine at USC.

» Faculty hold USC appointments at the Department of Computer Science, the Interactive Media Division, the Department of Psychiatry and the USC Davis School of Gerontology.

» ICT projects that have successfully transitioned are currently being used to improve performance and reduce costs across many military sites.

» Interactive projects leverage inexpensive off-the-shelf technologies like the Microsoft Kinect and smartphones to create immersive learning environments.

» Beyond military applications, ICT’s virtual human museum guides are a National Science Foundation-funded STEM education project. Virtual Sprouts is a National Institutes of Health-supported USC collaboration aimed at obesity prevention.

» Other education projects include virtual characters for students to practice interviewing skills and creating a virtual Holocaust survivor who can answer questions based on real experiences. Additional work addresses stroke rehabilitation and stress reduction.
Virtual Reality – Real Relief

ICT’s Skip Rizzo (foreground) and Bradley Newman demonstrate the institute’s virtual reality exposure therapy for treating post-traumatic stress. Rizzo’s system — inspired by video games and their popularity — incorporates VR technology into evidence-based treatment as a way to break down barriers to care among service members and veterans who might not seek or be comfortable with traditional talk therapy.

U.S. Army Chief of Staff General Raymond Odierno recently visited ICT to see demonstrations of the institute’s breakthroughs in graphics, virtual human and mixed reality technologies, exploring how these advances can continue to have a positive impact on Soldiers, from pre-deployment leader development to on-site training to post-deployment recovery.

“The work that is being done here is something that I think is critical for us as we move to the future,” said Odierno. “It is important for the Army to work with institutions such as this – which have the creative capability, the expertise and the phenomenal credentials of people who work here – to try to utilize their knowledge.”

Odierno saw examples of current ICT work addressing improvised explosive devices and post-traumatic stress as well as projects in the research pipeline that aim to increase the effectiveness and bring down the costs of virtual reality-based simulations.

“To me these ideas are absolutely phenomenal in helping us to try to solve some of these real difficult issues that we have,” he said.

U.S. Army Chief of Staff in the Halls of ICT
STUDY GROUPS

THE GRAPHICS LAB develops new techniques for creating and displaying photo-real computer graphics of people, objects and environments. Research areas include image-based lighting and 3-D displays. The lab’s Light Stage systems for creating detailed digital doubles inform more realistic ICT virtual characters and have been used in major motion pictures.

THE LEARNING SCIENCES GROUP applies evidence-based learning principles, tutoring methods and assessment techniques to improve computer-mediated instruction. Areas include instructional design, cognitive task analysis, intelligent tutoring and the basic study of human memory and learning.

THE MEDICAL VIRTUAL REALITY LAB explores and evaluates clinical areas where virtual reality can add value over traditional assessment and intervention approaches. Areas of specialization are in using VR for mental health therapy, motor skills rehabilitation, cognitive assessment and clinical skills training.

MIXED REALITY RESEARCH AND DEVELOPMENT specializes in techniques and technologies to improve the fluency of human-computer interactions and create visceral experiences. Research and prototypes focus on immersive systems for education and training simulations that incorporate both real and virtual elements.

THE NARRATIVE GROUP investigates storytelling and the human mind, exploring how people experience, interpret and narrate events in their lives. Research efforts include the large-scale analysis of narrative in social media, the logical formalization of commonsense reasoning, and the creation of story-based learning environments.

THE SOCIAL SIMULATION LAB focuses on developing accurate models of real-world social interactions at the group level and on producing mechanisms for giving scenario authors immediate feedback about their content. Work aims to benefit fundamental research in social and computer science while leading to improved simulations.

THE VIRTUAL HUMANS GROUP advances research in computer-generated characters that use language, have appropriate gestures, show emotion and react to verbal and non-verbal stimuli. ICT’s virtual human technologies have application in training and education and in furthering social science research.

THE VIRTUAL WORLDS AND AVATARS GROUP probes the potential of virtual worlds and characters to address real world needs and affect positive change in participants who use them. Topic areas include training, education, health, telehealth and social support for children and adults.

Research

ICT’s multidisciplinary research explores and expands how people engage with computers through virtual characters, video games, simulated scenarios and other immersive technologies.
Where Creativity Meets Technology

Compelling stories, characters and special effects. This winning Hollywood formula is at the core of all we do. Basic research efforts advance our understanding of how people look, think, feel and behave. This knowledge forms the foundation for technology transitions making a difference today - training soldiers, treating patients, teaching students and more.

Virtual humans and dramatic plotlines improve performance in cultural awareness, counseling and other tasks that require practice in people skills.

Immersive technologies and techniques get participants engaged. Off-the-shelf head-mounted displays and game controllers transform into successful virtual reality therapy for treating post-traumatic stress. Institute-created computer games teach thousands of U.S. forces how to negotiate, detect IEDs and recover from injury.

All these tools, applied with the latest research on how best people learn, make for experiences that are memorable and meaningful.

Jacquelyn Ford Morie, head of the Virtual Worlds and Avatars Group, uses controlled breathing into a headset microphone to enable her avatar to jog in the virtual world Second Life. Morie’s research is part of a larger effort that explores using social networks to develop relaxation techniques that people can access from home or any remote location.

A patient with spinal cord injuries helps physical therapist Belinda Lange test Jewel Mine, a research prototype that uses the Microsoft Kinect to allow for individualized balance training and upper limb exercises. At ICT, Lange leads the Games for Rehabilitation Lab, creating virtual reality game-based technology to improve motor and cognitive skills.

FOX2GO is a software and hardware kit, developed by ICT’s MxR Lab, in collaboration with the USC School of Cinematic Arts, that supports the creation of immersive virtual reality experiences using smartphones and tablets. CNET Senior Writer Daniel Terdiman called it “one of the coolest things I’ve ever seen done with an iPhone.”
A virtual human is a computer-generated interactive character that looks and acts like a real person. It can understand, speak, gesture, reason and exhibit emotions.

Widely considered the most comprehensive research project of its kind, ICT’s virtual human effort achieves advances in artificial intelligence, graphics and animation to bring these characters to life.

Results of this interdisciplinary approach can be seen in the many ICT-developed virtual humans that serve as characters in training scenarios, guides in museums, patients in clinical practice sessions, online support coaches and even a gunslinger in a Western-style saloon.
ICT at Work in the Real World

A Selection of Deployed Projects

ONLINE VIRTUAL COACH: SimCoach
- ICT's first web-based interactive virtual human
- Designed for military service members, veterans, and others who might not otherwise seek help
- Deployed on braveheartveterans.org, a regional veteran support initiative of the Atlanta Braves and Emory University

COUNTER-IED TRAINERS: MCIT* and DICE-T
- Combine physical, visual, aural and virtual elements, including narrative video and multi-player games
- Over 50,000 Soldiers, Marines and cadets trained
- Foreign language versions deployed to NATO allies overseas
*Developed with A-T Solutions

MIXED REALITY TRAINING: JFETS
- Installed at Fort Sill in 2004
- Over 22,000 Soldiers trained
- Transitioned to the Army PEO STRI in 2008
- Certified as an alternative to live training by the Joint Close Air Support Executive Steering Committee

INTERACTIVE CLASSROOM TOOLS: INOTS and ELITE
- Virtual human technologies and real-time data tracking tools support the instruction, practice and assessment of interpersonal communication skills
- Army and Navy versions provide leader development to thousands of Soldiers and Sailors

POST-TRAUMATIC STRESS THERAPY: BRAVEMIND
- Adds virtual reality to traditional exposure therapy as a treatment for PTS
- Early studies showed meaningful reduction in PTS symptoms with more clinical trials ongoing
- System being adapted for pre-deployment resiliency exercises

STEM EDUCATORS: Ada and Grace
- NSF-funded virtual human museum guides advance awareness of computer science and emerging learning technologies
- Estimated 200,000 museum visitors have interacted with Ada and Grace at the Boston Museum of Science

MIXED REALITY TRAINING: JFETS
- Developed with A-T Solutions

EDUCATIONAL VIDEO GAMES: UrbanSim and BiLAT
- Include behavior models and intelligent tutoring
- Provide practice environments for principles of counter-insurgency, negotiation and cultural awareness
- Can be downloaded from the U.S. Army's MilGaming website

FILMED CASE STUDIES: Army Excellence in Leadership (AXL)
- 10,000+ Soldiers and West Point cadets have used AXL for leader development
- Focus on moral and ethical decision-making on the battlefield
- ARI-led assessment showed effectiveness
18th Annual Satava Award for Lifetime Achievement in Medical Simulation at the Medicine Meets Virtual Reality Conference 2012  
Skip Rizzo

Best Demo Award at IEEE Virtual Reality 2012  
David Krum, Evan Suma and Mark Bolas

Kurzweil Prize for Best Artificial General Intelligence Idea at the Fourth Conference on Artificial Intelligence 2011  
Paul Rosenbloom

First Place in the Video Sub-Challenge of the Audio-Visual Emotion Challenge at the Affective Computing and Intelligent Interaction 2011 Conference  
Geovany Ramirez, Tadas Baltrusaitis and Louis-Philippe Morency

Best Paper Award at the 8th IEEE International Workshop in Projector-Camera Systems 2011  
Joel Junk, Andrew Jones, Mark Bolas and Paul Debevec

Best Paper Award at the Human-Computer Interaction International Conference 2011  
Luke Yeh, Belinda Lange and Skip Rizzo

Best Paper Award at the 11th International Conference on Intelligent Virtual Agents 2011  
Jason Tsai, Emma Bowman, Stacy Marsella and Milind Tambe

Best Paper Award at the Interservice/Industry Training, Simulation and Education Conference 2011  
Belinda Lange, Skip Rizzo, Chien-Yen Chang, Evan Suma and Mark Bolas

American Psychological Association Award for Outstanding Contributions to the Practice of Trauma Psychology 2010  
Skip Rizzo, Barbara Rothbaum, JoAnn Difede and Greg Reger

ACM Special Interest Group on Artificial Intelligence Autonomous Agents Award at the International Conference on Autonomous Agents and Multiagent Systems Awards 2010  
Jonathan Gratch and Stacy Marsella

Best Paper Award at the 9th International Conference on Autonomous Agents and Multiagent Systems 2010  
Lixing Huang, Louis-Philippe Morency and Jonathan Gratch

Robert S. Engelmore Memorial Lecture Award 2009  
William Swartout

AI’s 10 to Watch Award by IEEE Intelligent Systems 2008  
Louis-Philippe Morency

Best Training Category Winner at the Army Modeling and Simulation Awards 2008 and 2006  
BiLAT, DCMT and SLIM-ES3

The University of Southern California Institute for Creative Technologies is a University Affiliated Research Center sponsored by the U.S. Army and managed by the Simulation and Training Technology Center.