Virtual Humans

By Scott R. Gourley

About the same time these pages are reaching readers' hands (and screens), soldiers at the Maneuver Center of Excellence at Fort Benning, Ga., will begin to receive greetings on their own screens by the latest generation of "virtual humans."

Virtual humans, computer-generated interactive characters that look and act like real people and with the ability to understand, speak, gesture, reason and exhibit emotions, are the brainchild of the comprehensive research projects under way at the University of Southern California (USC) Institute for Creative Technologies (ICT).

Established in 1999 and sponsored by the U.S. Army as a university affiliated research center, ICT unites film and game industry artists with computer and social scientists to develop interactive media for military training, health therapies and other service applications.

Previously delivered examples of these ICT efforts range from the Joint Fires and Effects Training System at the Fires Center of Excellence at Fort Sill, Okla., to the Mobile Counter IED Interactive Trainer developed for the Joint Improvised Explosive Device Defeat Organization.

"The U.S. Army and ICT partnership is creating immersive technologies that are changing the way we train, rehabilitate, educate and promote resilience," explained Randall W. Hill Jr., Ph.D., executive director of ICT. "But we're not just trying to create cool immersive experiences. We're creating experiences that matter in the virtual arena."

Several of the new "experiences that matter" involve applications of ICT's virtual human efforts, which employ advances in artificial intelligence, graphics and animation to provide lifelike characters.

"There is a common area of confusion between an avatar and a virtual human," said Kim LeMasters, ICT's creative director. "An avatar is a puppet that is controlled by a human being in some way or some fashion. But what we are saying about these virtual humans is that they are autonomous. They 'think' on their own. They are capable of perceiving where you are as a human being in place. They are capable of processing language so that they can respond to what you say. They are fully gesticulated with the ability for eye movements, mouth movements and so on. The result is that we can get a full body experience here in communicating how we as human beings communicate, which is with the entire thing we call 'us'—way beyond what language does."

Two related applications now reaching the military are the Immersive Naval Officer Training System (INOTS) and the Emergent Leader Interactive Training Environment (ELITE). INOTS was recently installed at the U.S. Navy's Officer Training Command in Newport, R.I., and ELITE is slated for initial operations at the Maneuver Center of Excellence at Fort Benning, Ga., sometime in the fall.

Both venues present the virtual humans in a digital immersive virtual environment (DIVE). The U.S. Navy's DIVE at Newport is housed in a lifelike replication of officers' quarters aboard a ship, with hatches and other ship

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props transferred from the decommissioned USS *Saratoga*. The ELITE at Fort Benning will be somewhat less elaborate, representing a platoon leader's office. With each, an associated classroom will be used to transfer the learning experience to a larger group and to provide the services with expanded training throughput.

"Both systems right now are for interpersonal communication skills training," LeMasters explained. "That is really important and something that the Army is focusing on more and more as they do the human dimension. It is even more important as more and more problems crop up among junior leaders dealing with issues they have never been exposed to before. We don't try to go into every specific situation that might occur; instead, we have come up with a certain architecture on how interpersonal communication skills can be developed and then use them with these virtual human characters.

"The thing that makes these characters amazing and different from any kind of avatar is that they are not only autonomous but are also capable of arousal levels," LeMasters said. "So they can get angry at you and you can feel it. In fact, in the experimental testing that we have done we have seen people react emotionally back to the virtual humans, which is 'hugely unbelievable.'"

In one study performed at ICT, nearly 60 Naval Reserve Officer Training Corps cadets from both USC and the University of California Los Angeles were run through the project facing both the virtual characters and human beings playing the virtual characters. "Except for some eye movement issues the virtual humans were scored the same if not higher than the human being in the scenarios," LeMasters said.

"We did that study with Draper Labs," explained Kip Haynes, ICT's senior program analyst for INOTS and ELITE. "It was interesting because we sat a real human right in front of where we projected the virtual human. I
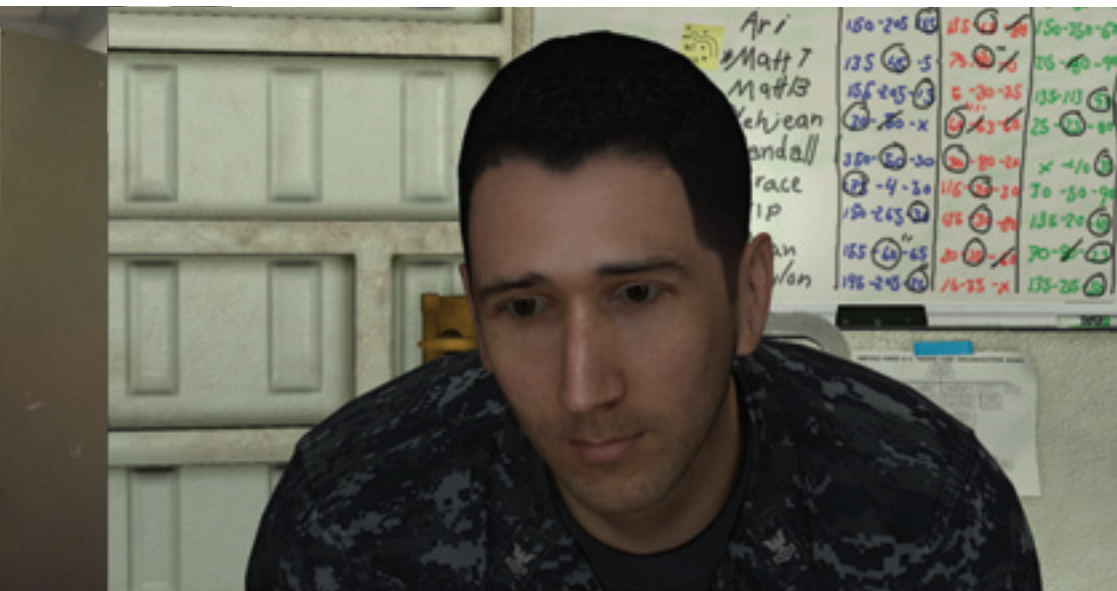
Virtual humans, computer generated interactive characters that look and act like real people, are used in interactive media for service applications such as the Emergent Leader Immersive Training Environment (above) and the Immersive Naval Officer Training Systems (opposite page and left).

SimCoach, an application slated for initial delivery later this year, was designed to encourage troops and their families, who might otherwise not seek help, to find information about care for post-traumatic stress, traumatic brain injury or other problems.

had a chance to observe the differences, and I could see why the physical measurements from the participants indicated that they were more engaged with the virtual humans. They just seemed more engaging with everything well put together with each reaction that they had. We worked quite hard on that."

"We acknowledge that there is a tremendous value for live role-players out there—right now they are day and night ahead," LeMasters continued. "But we are beginning to prove the point that you can get something out there that is more cost effective and is an effective—if not more effective—teacher because it replicates the same way every time. We think that replication of the same experience every time is important, because we, as a research institute, firmly believe in deliberate practice—that ability to go in under expert conditions and repeat something until you have a level of mastery and expertise.

"We've really been pushing this interaction with virtual human characters and trying to prove their worth in training environments," he added. "And I think we are getting very, very close to being very, very successful with that."

Another ICT effort slated for initial delivery later this year is SimCoach.

"SimCoach was initially developed as a potential solution to overcome the stigma related to veterans and their families seeking information about the care available to them for challenges such as post-traumatic stress, traumatic brain injury, depression in general, or family issues in general," explained Josh Williams, ICT's special project manager. "There were these domains on which the military had spent a lot of money putting resources online. But there wasn't any good way to see whether they were being ac-

cessed. And when the American Psychological Association did a formal study they found there was really no coordinated effort to understand how these services were being used. We thought that could go hand in hand with the work we were doing trying to overcome the stigma of seeking care in that we could benefit from pulling together information that was already available on all of these sites. Good money had already been spent getting the right information from the right people and having it freely available online. They just didn't have good enough metrics to prove that it was being accessed. And we also wanted to take advantage of the online forum as a great place for soldiers and their families to seek this information anonymously."

The resulting creation is a "suite" of SimCoach virtual humans designed to help provide online resources while also serving as a rehearsal for any follow-on interactions that the user might want to have with an actual human.

"We didn't try to create a 'doc in a box,'" Williams said. "We knew that the intelligence was not there such that we could expect to do therapy online. Obviously, the intelligence of these agents is nowhere near the capability to provide actual therapy. That said, we definitely needed these characters to be more than just buddies or a face on a web search. We wanted to have rapport and engagement established, and we wanted to be able to customize that experience to an individual's specific needs so that the individual felt that the character was listening … giving the family member or the person who needs the care the idea that talking about these issues may not be as bad as you thought, even if you are talking with a virtual human."

Multiple virtual human characters, both male and female, are presented for selection to allow individuals to pick a character based on their own comfort levels. Inter-

Scott R. Gourley, a freelance writer, is a contributing editor to ARMY.

estingly, early character-selection testing turned away from characters depicted in uniform, with one of the more popular alternatives bearing a strong resemblance to television news host Anderson Cooper.

"If you just want someone to fill out a checklist, you put it online, have someone fill it out, give them a score and tell them if they need to go get help," observed Albert (Skip) Rizzo, ICT's associate director for medical virtual reality. "The idea with SimCoach is to get that kind of information in a way that engages the user. It doesn't pathologize them. We hope that our use of a character makes it much different from a text-based Web site."

Once they are attracted by the curiosity and anonymity of the technology and are connected with preexisting resources, the individual can switch to a live provider.

"For the two years we have worked on this to bring it to the Web, I think we've done a good job," Rizzo said. "But now the real work begins in looking at how people relate to it. Of course we've been doing some of that through cycles of development along the way, but this is really the start. It may look pretty good, but believe it or not it's a 'Model T' compared to where we see things being in two, three or five years."

The current goal is that "some level of availability" of the present version will be online in December of this year.

ICT developers are quick to emphasize the criticality of privacy and anonymity in the SimCoach process. "You don't have to log in or register in any way to have this interaction," Williams said. "It is all anonymous and freely available to anyone who wants to have the interaction, right up until you say, 'I want you to remember me because I want to come back and talk to you again' or 'I do want to give you some more information so that you can have somebody reach out to me.' But otherwise we're only keeping the dialogues for improvement of the tool, not for tracking the users of the tool."

Virtual humans are also being used in ICT's program called Virtual Iraq/ Afghanistan.

"This is a system built to help therapists provide exposure therapy to soldiers and marines suffering from post-traumatic stress," Williams explained. "We have been working not only on potential methods that soldiers and marines can use to seek care for post-traumatic stress but also on increasing the throughput of those people as they get into a program to receive help."

According to Williams, the type of therapy that appears to be most successful over time is exposure therapy. This therapy was traditionally limited to imaginal exposure therapy, in which soldiers or marines might be asked to close their eyes and talk about a particular experience as if it were happening then and there. The ICT project uses a range of tools—from a helmet-mounted display to a "rumble floor" platform—that allow the therapist to develop an immersive environment that better replicates the experience.

Early versions of the capability are already deployed and in use at 55 locations across the United States as well as overseas.

Along with assisting in the diagnosis and treatment of individuals, ICT's virtual humans are also poised to enter the training arena for clinicians and care providers. One example is the Virtual Patient program. Currently being developed for the School of Social Work at USC, program designers identify a goal of "creating an emotionally evocative character to both simulate the thought processes that might be going on inside the head of a soldier as well as giving the students a practical chance to practice their interpersonal skills."

The program could represent a cost-effective and consistently repeatable alternative to current options of either student role-playing or hiring outside actors.

Summarizing the broad range of technologies coming together at ICT, executive director Randy Hill points to these and other ongoing efforts as "part of the movement of how we will interact with computers in the future."

"We are putting soldiers face to face in interactions with virtual humans and building toward the point where we will be able to infer emotion from statements and body language," Hill concluded. "And we have been encouraged to help the Army stay on the leading edge of that effort." ★

COL Michael J. Roy (left) and SGT Lenearo Ashford demonstrate an early version of a virtual humans program in 2008. The program now provides exposure therapy in more than 55 locations across the country and overseas to soldiers suffering from post-traumatic stress.

DoD/John J. Kruzel