

CROWD CONTROL

COMPUTER PROGRAM SIMULATES CROWD BEHAVIOR IN MILITARY SITUATIONS

BY ELIZABETH O. COOPER

During World War II, the Korean Conflict and the Vietnam War, American soldiers mainly encountered their enemies in fields using conventional weapons, but warfare in the last decade has increasingly involved adversaries with whom the military has been largely unprepared to contend.

“U.S. military actions in Mogadishu, Bosnia and Iraq exemplify the significant effects crowds may have on military operations,” says Frederic D. (Rick) McKenzie, assistant professor of electrical and computer engineering, who is working with researchers from the Virginia Modeling, Analysis and Simulation Center (VMASC) to develop a crowd federate computer program for the military to use in training simulations. A federate is a simulation model that is integrated with other simulation models developed by the military and allows disparate, heterogeneous models, such as tank simulators and vice plane simulators, to interact with each other. The group’s crowd behavior model is the first of this sophistication that interacts with military simulators.

“Our federate generates realistic civilian behavior,” McKenzie says. “It plays with military simulations that generate soldiers’ behavior and creates the control forces. Control forces interact with the civilian crowds in various ways including the use of non-lethal weapons.”

According to McKenzie, crowds of civilians often do not carry guns or other weapons; however, they are playing more and more of a role in modern military operations and often create substantial difficulties for the military forces. He notes that in Somalia, U.S. forces frequently faced hostile crowds brandishing and using lethal weapons, while in Bosnia, U.S. Army soldiers were forced to disperse angry

mobs of rock-throwing Serb hardliners near the town of Brcko. Currently, troops in Iraq are facing mobs of angry insurgents.

“The military now does a lot of peacekeeping. It’s factions the soldiers are fighting against, not the whole country,” McKenzie explains. “This federate trains people to interact with civilians who are not rioting, or if they are rioting, it trains the military to contain it.” He adds that traditional military training simulates an environment in which the crowd is absent, or the crowd is fairly small and unengaged. “The models don’t really have reactive or thinking type behavior,” McKenzie says. “That’s not very realistic to the war fighter. What we want to do is provide a realistic crowd scenario with a crowd that’s involved, and the soldier can react to the environment.”

TRAINING FOR CROWD BEHAVIOR

Crowd behavior is a part of modern warfare that has been largely neglected, but with future troop engagements expected to involve smaller forces in urban settings, military officials are realizing the need to train soldiers in what to expect from hostile crowds. The Defense Modeling and Simulation Organization contracted VMASC to look at how crowd behaviors are composed. McKenzie and his colleagues decided to look at crowd behavior. Their work resulted in two follow-up contracts. The Joint Forces Command, which trains war fighters, also asked McKenzie’s group to install a draft version of their federate on its computer systems. That version is slated to be installed this summer.

The researchers have designed the software with an eye for flexibility, scalability and reconfigurability. The software configuration can change and specify feats for scalability and

flexibility of data and can create crowd and group behaviors. The federate runs on a Microsoft personal computer operating system, with models used on networked computers.

“Our crowd behavior model is psychologically based,” McKenzie says. “A crowd is made up of different individuals and groups. Some crowd members may be there to demonstrate.”

He adds that the psychology of crowd behavior has changed significantly over the last several hundred years. “It’s so difficult to nail down. You don’t have an equation for the human mind, but our architecture is flexible enough to be updated to our changing understanding of crowds.”

For example, McKenzie notes that Nazi leader Adolf Hitler concurred with the prevailing belief of the 1930s that crowds were homogenous masses who could be led like sheep. “Hitler took that understanding to heart and thought of the people he tried to control as homogenous sheep. We now know that to be wrong. Crowds are not homogenous. Different groups do different things, and different individuals might be headstrong and do different things as well. From there, you get emergent behaviors.”

With that in mind, the question arises – does the crowd mentality emerge from individuals or is there a crowd mind? In many computational models, only the individual is represented, and in others, the crowd mind is modeled. “We’re meeting somewhere in the middle,” McKenzie says. “We’ve created an architecture that can support a swap-out of different types of models. Our architecture allows individuals, as well as groups of individuals, to be integrated.”

McKenzie and Mikel D. Petty, research professor at VMASC, worked with Ryland C. Gaskins III, senior research scientist at VMASC, to devise various scenarios of how crowds react and to develop parameters that dictate why crowds react in a certain way. They set up experiments to obtain statistical data to weight the parameters during which they viewed videos of crowds, such as those demonstrating during the 1999 World Trade Organization meeting in Seattle. In addition, they developed survey instruments for members of the military returning from Iraq who had dealt with crowds during their tour of duty.

The architecture of the crowd federate includes three layers. The physical layer drives the movement and animation of crowd members producing motions and visual characteristics seen on the computer screen, while the cognitive layer is the thinking layer, with crowd members deciding to chant or perform some other action. The cognitive layer tells the physical layer to carry out the chanting in an animated fashion.

The third layer, the Crowd Behavior Application Programmers Interface, allows operators to swap cognitive and physical models.

Animations are applied to the characters being simulated using Motion Builder, a Microsoft Windows graphical-development environment. The crowd federate also uses Game Artificial Intelligence software.

CIVILIAN CROWDS ALTER MILITARY STRATEGIES

McKenzie notes that crowds can dramatically affect a military mission. “If it’s just one individual, that can be handled much more easily than if there are 1,000 individuals. The average soldier is not trained to interact with civilians. They are trained to kill first and ask questions later, but in peacekeeping missions they have to put that mentality behind them and figure out what to do. It’s those complex decision-making tasks that can ruin someone’s career or cause civilian casualties.”

The crowd federate uses two reference scenarios based on historical events, with care taken to reproduce the events as precisely as possible. The reference scenarios include terrain, military force personnel and equipment, military mission and rules of engagement, military orders, crowd size and composition and crowd behavior range. One scenario uses the Battle of the Black Sea in Mogadishu, Somalia, the largest and longest sustained firefight experienced by American forces since the Vietnam War. In October 1993, more than 100 men of Task Force Ranger fought Somali combatants for 18 hours in a routine mission to capture two chief lieutenants of Mohamed Farrah Aidid, the leader of one of the principal warring factions in Mogadishu. The mission was planned to take less than one hour, but two Black Hawk helicopters were shot down, and a portion of the force was pinned down overnight before being rescued the next day. The mission led to the capture of two high-ranking Aidid supporters and left 18 U.S. troops dead and more than 75 wounded. In addition, hundreds or even thousands of Somali casualties occurred. The Mogadishu mission became the subject of the book and movie, “Black Hawk Down.”

The Mogadishu scenario was used because it was a well-documented historical event and because the crowd included militia and civilians, whose actions included fleeing, obstructing the military’s progress and engaging in combat with the troops. The crowds contributed to the length of the

“THE AVERAGE SOLDIER IS NOT TRAINED TO INTERACT WITH CIVILIANS.

THEY ARE TRAINED TO KILL FIRST AND ASK QUESTIONS LATER, BUT IN PEACEKEEPING MISSIONS THEY HAVE TO PUT THAT MENTALITY BEHIND THEM AND FIGURE OUT WHAT TO DO. IT’S THOSE COMPLEX DECISION-MAKING TASKS THAT CAN RUIN SOMEONE’S CAREER OR CAUSE CIVILIAN CASUALTIES.”

operation, as well as military and crowd casualties.

The other scenario uses Brcko, Bosnia, a town on a river near Croatia which had been run by Serbs until 1999 when it came under the control of all three of Bosnia's ethnic groups – Serbs, Croats and Muslims. Civilians in the area resented the presence of United Nations forces to preserve peace. "The townspeople were not happy about the U.N. forces there," McKenzie notes. "The groups organized a riot against the forces using non-lethal weapons. There were no guns, just sticks and stones and fisticuffs."

"We find out as much information regarding the historical events, reproduce the orders of the military force and provide a crowd and see how close the reproduction is," McKenzie says. "We make the behavior flexible enough so there is a core set of behaviors in any scenario. Ultimately, it's better to prepare the war fighter for what he may encounter in a given situation."

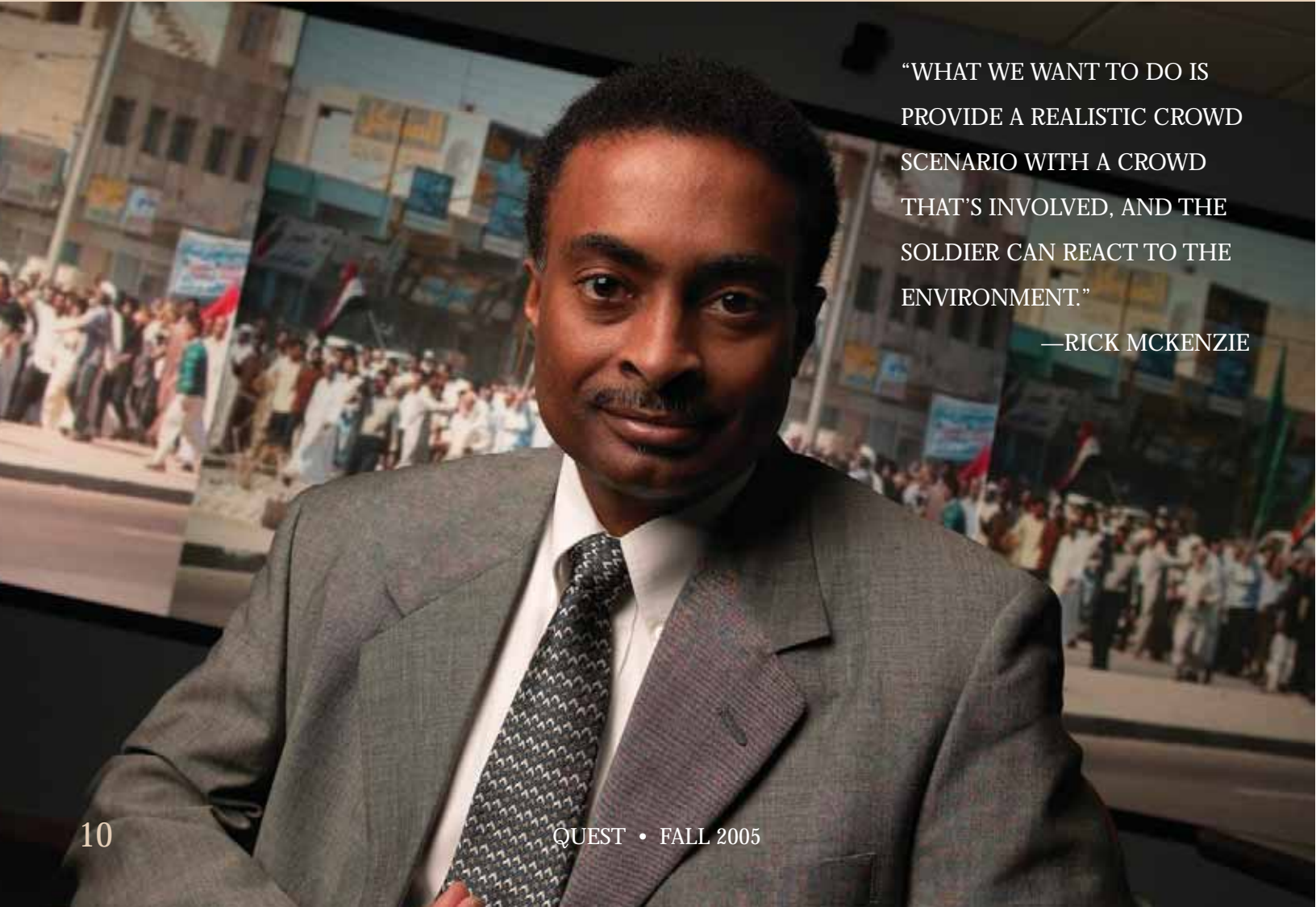
The simulations can also mimic circumstances in which the soldier is likely to find himself. A platoon leader could use a program that takes a troop through enemy territory to capture a building, while a battalion commander is faced with moving his forces to another town. "Our crowd federate is one of many federates networked together,"

McKenzie explains. "The war fighter can be in a tank simulator that's networked and can manipulate the tank simulator. It's very interactive to the war fighter and reactive to the environment."

Currently, role-playing is the main way members of the military learn to interact with civilian crowds. "They train with live exercises in which some soldiers dress up as a crowd, and other soldiers have bayonets and guns," McKenzie says. He adds that during one training session, a soldier acting as a member of the crowd taunted another soldier who reacted by stabbing the menacing "crowd member" with his bayonet.

The crowd federate simulation is undoubtedly safer for all concerned; yet, it still grades participants on meeting established objectives. "The decisions you make cause you to achieve those objectives or not," McKenzie notes. "You could fail if you got to the objective but killed 10 civilians along the way. The soldiers learn from doing and being evaluated on what they did."

"It's really been interesting that when people learn about it and look at demonstrations, they say they need that. People see it as a problem that needs to be addressed."



"WHAT WE WANT TO DO IS PROVIDE A REALISTIC CROWD SCENARIO WITH A CROWD THAT'S INVOLVED, AND THE SOLDIER CAN REACT TO THE ENVIRONMENT."

—RICK MCKENZIE