Simulators are a standard component of training in many military activities, but have only recently become available for medical procedures. Today, medics, corpsmen, nurses, and even surgeons have access to full body mannequin simulators for trauma and anesthesiology and virtual reality trainers for endoscopic and laparoscopic procedures. Unfortunately, most current medical simulators address individual specific procedures and do not reproduce the operating environment that is always present when working with real patients. We know from other high risk domains that individual performance is moderated by contextual factors. Therefore, medical personnel need to train in a rich context that replicates the real operating environment. Further, current simulators do little or nothing to abate performance errors resulting from inappropriate equipment design; poor judgment and decision-making among team members; or changes in organizational policies, practices, and regulations.

The Virtual Operating Room (VOR) is an immersive virtual environment that provides the context for training surgical teams and studying individual and team decision-making, judgments, and interactions. The VOR is modeled on a standard OR and is outfitted with both real and virtual equipment. The VOR does not replicate existing medical simulation technology. Instead, it enables integration of technology and other medical simulators across platforms. Trainees interact with a surgical team comprised of real and/or virtual team members (e.g., attending surgeon, anesthesiologist, scrub technician, and circulating nurse). Communication with virtual team members is accomplished with voice recognition and text-to-speech software. A custom designed simulation controller manages the VOR and functionality of the rendering platform, speech recognition, and text-to-speech generation modules. The VOR offers several advantages over traditional simulation training centers.

The VOR provides:

- An opportunity for trainees to interact with virtual agents representing different members of a surgical team, all of whom are modeled on experts
- Tighter control over the training environment and scenarios
- Greater consistency in training experiences due to computer-based scenarios
- Improved standardization for performance assessment and after action reviews
- A laboratory for studying changes in organizational policies and individual/cultural differences in the OR

Most important, the VOR allows surgical teams to train the way they operate without putting a single patient at risk.

The Way Ahead… to increase the complexity of surgical team training scenarios by improving the detection of nonlinear task sequences. We also want to expand the programmability for scenario development. To fully vet the training system, we will need to conduct additional pilot studies with residents from Eastern Virginia Medical School with the supervision of a panel of subject matter experts.
C. Donald Combs, PhD serves as Vice President and Dean, School of Health Professions at the Eastern Virginia Medical School (EVMS). His responsibilities include strategic planning, oversight of EVMS’ health professions programs and medical modeling and simulation activities, program development, governmental and community relations, and directing educational outreach programs. Dr. Combs holds faculty appointments as Professor of Health Professions and Professor of Family and Community Medicine and as Adjunct Professor of Electrical and Computer Engineering at Old Dominion University. From 1996 to 2002, he also served as a Senior Fellow at the U.S. Naval Postgraduate School.

He has long-standing research interests in health and human services management, emergency response, health services research, health professions regulation, organizational development, strategic planning, and medical modeling and simulation. These interests are reflected in his professional publications and conference presentations, many consultancies with federal, state and local agencies, non-profit services organizations and businesses, and $110 million in external funding. He currently serves on several regional, state, and national boards and task forces that address national and international health policy. Dr. Combs is active in the Association of Academic Health Centers (AHC) and in national policy discussions addressing health workforce planning, emergency medical response to WMD, applied information systems and medical modeling and simulation. In the international arena, Dr. Combs has worked with colleagues at the Naval Postgraduate School to develop and implement the International Health Resource Management executive education program that served some 20 nations, including Moldova, Bulgaria, Macedonia, Nepal, Botswana and El Salvador.

He holds degrees received with distinction from South Plains College, Texas Tech University and the University of North Carolina - Chapel Hill. His most recent research presentations include 2020: Are We Preparing the Health Professionals That We Will Need?, a paper prepared for and published by the Association of Academic Health Centers and Startling Technologies Promise to Transform Medicine, a paper published in the British Medical Journal on December 26, 2006.

Mark W. Scerbo, PhD is a Professor of Human Factors Psychology at Old Dominion University and Co-Director of the National Center for Collaboration in Medical Modeling and Simulation. He leads a team of researchers and developers who are working to validate medical simulators, develop new simulation models and technology, integrate simulation into medical school curricula, and develop models for regional response to mass casualty events.

Dr. Scerbo received his Ph.D. from the University of Cincinnati in 1987. He is a Fellow of the Human Factors and Ergonomics Society and received his Modeling and Simulation Professional Certification in 2002. He has over 25 years of experience researching and designing systems and displays that improve user performance in academic, military, and industrial work environments. He has expertise in creating and testing visual and auditory displays, flexible and adaptive displays, as well as low and high fidelity simulations and virtual environments. He also studies human factors issues related to the behavioral and physiological factors that affect human interaction with simulation, automated systems, and adaptive interfaces. Dr. Scerbo is currently researching transfer of training issues for medical simulators, contextual factors that impact surgical performance using virtual environments, and stress and workload factors that contribute to medical errors. Dr. Scerbo teaches courses in human perception, experimental methodology, human factors psychology, human factors methods and techniques, and human-computer interaction.

Hector M. Garcia, M.Arch is the visualization laboratory manager for VMASC and the researcher most closely involved with the CAVE (Cave Automatic Virtual Environment) on ODU’s Norfolk Campus, has been a member of the team developing the virtual operating room and other capitol MS&V environments. Hector joined VMASC on September 1, 2000 as a Research Scientist. His position is responsible for the management of the Center’s Virtual Environments research area (VMASC-EAST). He also works closely with assigned Project Managers and Principal Investigators to develop richly interactive and visually compelling immersive simulations, scheduling and resourcing plans for the execution of their projects; supervises assigned research support staff and graduate students, assists in planning and participates in various events such as trade-shows, conventions, lectures and workshops; assists the Director and PI’s in writing and implementing research grants within the center as well as any other assigned projects. Mr. Garcia received an M.Arch from University of Houston in 1997, and a B.Arch from Universidad Regiomontana in Monterrey, N.L. Mexico. Mr. Garcia has worked in Immersive Visualization Environments since 1995. He previously worked for the Virtual Environments Technology Laboratory at the University of Houston.

VMASC is a university-wide multidisciplinary research center that emphasizes modeling, simulation, and visualization (MS&V) research, development and education. It is one of the world’s leading research centers for computer modeling, simulation, and visualization. The mission of the Center is to conduct collaborative MS&V research and development, provide expertise to government agencies and industry, and to promote Old Dominion University, Hampton Roads and Virginia as a center of MS&V activities. VMASC furthers the development and applications of modeling, simulation and visualization as enterprise decision-making tools to promote economic, business, and academic development. Annually, the Center conducts approximately $7M in funded research.

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