

'Virtual operating room' to sharpen surgeons' smarts and skills

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(Medical Xpress) -- Even for highly trained physicians and surgeons, there's no teacher like experience.

This is the reason engineering researchers at Rensselaer Polytechnic Institute are working to develop a virtual reality [operating room](#). Similar to how fledgling pilots train on flight simulators before ever leaving the ground in an aircraft, the virtual operating room will allow budding surgeons to experience the stresses and nuances of the operating room before they ever perform a procedure on a live patient.

Earlier this year, the National Institutes of Health (NIH) awarded a new \$2.7 million grant to Rensselaer Professor Suvranu De to create, test, and validate a virtual reality simulator that seeks to replicate—as closely as possible—the environment of an operating room. Most surgery simulators existing today are solely focused on enhancing and assessing a surgeon's hand movements and motor skills. The new system will expand this focus to enhancing and assessing a surgeon's understanding of the overall procedure as well as the cause-and-effect of their actions.

The system will feature touch-sensitive surgical instruments enabling users to touch, feel, and manipulate virtual tissues and organs through surgical tool handles used in actual surgery. The system will also include an immersive 3-D headset with highly realistic graphics, and a “virtual mentor” who offers tips, criticisms, visual and auditory cues, and other feedback to help guide the surgeon's actions and decisions.

For the study, De and his team will create a virtual operating room to simulate an emerging minimally invasive surgical technique known as single-incision laparoscopic surgery for procedures such as gallbladder removal and gastric banding. Rensselaer will partner with Beth Israel Deaconess Medical Center and Tufts University in Boston on the project. Once perfected, the simulator should be expandable to other types of surgical procedures.

“While a variety of virtual reality-based skill trainers currently exist, their major drawback is that they provide primarily psycho-motor skill training, such as training for hand-eye coordination and motor skills necessary for tasks such as tool movement, cutting, and suturing,” said De, a member of the Department of Mechanical, Aerospace, and Nuclear Engineering at Rensselaer, with a joint appointment in the Department of Biomedical Engineering. “We believe that for a simulator to be truly effective, in addition to psycho-motor skill training, it must also provide cognitive skill training. This argument is supported by adult-learning theories and research in flight simulation technology.”

The project builds on De’s past work developing virtual reality tools to train, test, and assess tomorrow’s surgeons. He said these kinds of personalized surgical training environments will expose surgical residents and surgeons to a variety of rare adverse events, standardize the process of skill training, and allow objective quantification of performance that will start to result in improved patient outcomes, reduced patient morbidity, and—ultimately—a healthier nation and better health care system.

Over the past few years, the Accreditation Council for Graduate Medical Education (ACGME) mandated simulation to be part of resident education, and the American Board of Surgery (ABS) required that simulation be provided as a criterion for board certification in surgery.

This new focus on simulation directly acknowledges the fact that the skill of a surgeon is the single most important factor determining the success of minimally invasive surgical procedures, De said. One study reports a complication rate of 14.7 per 1,000 patients for surgeons who have performed less than 100 such procedures, in contrast to 3.8 complications per 1,000 procedures for more experienced [surgeons](#). Another report, by the Institute of Medicine, cites “error in the performance of an operation” as a major contributor to the approximately 98,000 deaths per year attributable to medical errors—a number that exceeds deaths from motor vehicle accidents, breast cancer, or AIDS.

“Looking at the overall goal of improving health care and making surgery safer and more effective for patients, virtual reality simulators are a low-hanging fruit. There’s still much work to be done, but this new and exciting technology holds the promise of a better, safer tomorrow,” De said.

Provided by Rensselaer Polytechnic Institute

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