Your Next Surgeon May Be Trained by a Computer

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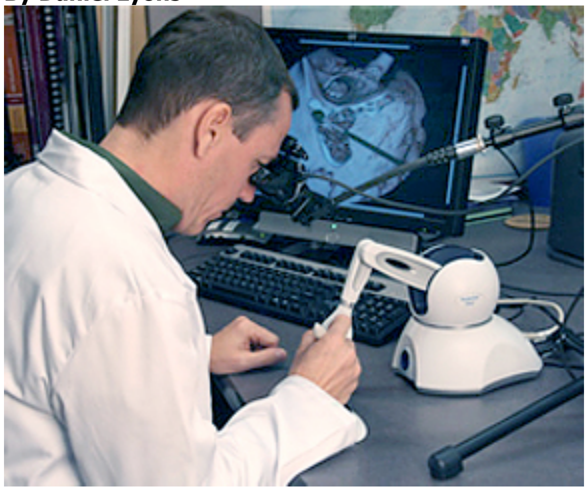
By Daniel Lyons



The funny thing about medicine is that in some ways it's so advanced, yet in other ways it remains really primitive. Take ear surgery. You know how young docs learn to do it? They sit in a lab with a temporal bone from a cadaver, and they grind away on it, basically the same kind of training that has existed "since anyone has been doing any skilled training in medicine—thousands of years," says Dr. Gregory Wiet, a surgeon and professor at Ohio State University.

Wiet and a team of computer scientists are working on a computer simulator that can train residents to perform the same surgery. I recently got a demo at Massachusetts Eye and Ear Infirmary, and while Wiet admits the simulator is far from perfect, he and others believe these simulators represent the future of surgical training. For one thing, it's a lot cheaper than providing every resident with a set of real skull bones. (Those cadavers get expensive.) But the docs also believe simulators could provide residents with better training than they've had in the past.

"This is the future," says Dr. Gerald Healy, an otolaryngologist at Massachusetts Eye and Ear Infirmary and a former president of the American College of Surgeons. Healy says that just as the military has long used simulators to train jet pilots, "we need to do the same thing in surgery." It's not just for ears, either. Teams of computer scientists and doctors are working on simulators for most other kinds of surgery. The Stanford University School of Medicine has made a big jump into this field with its Center for Immersive and Simulation-Based Learning.

Wiet's system is undergoing clinical trials at 10 medical centers, and he's hoping to get funding to continue research for another five years. The work is all funded by government grants. If all goes well, Wiet believes the simulators could take the place of cadaver-based training. Even now, he thinks the simulators could be useful, "with certain caveats, where it fits in"— perhaps as a supplement to other training.

The simulator is pretty easy to use. Instead of holding an actual drill against an actual temporal bone, you hold a probe, about the size of a pen, and draw it across an image of a temporal bone on a computer screen. The haptic device (made by SensAble Technologies of Woburn, Mass.) gives you feedback in your hand, letting you learn how hard to press, and so forth.

The tricky part, Wiet says, is writing the software that can accurately model the temporal bone. Wiet's system uses something called "volume rendering," in which the computer and graphics card is managing a 3-D image and is constantly rendering the entire volume of an object rather than just the surface of it. The project started seven years ago and has involved computer scientists from the Ohio Supercomputer Center as well as doctors from Ohio State University and Wiet, who also serves as a pediatric otolaryngologist at Nationwide Children's Hospital in Columbus, Ohio. "It really is a multidisciplinary project," he says.

Right now the system still doesn't come close enough to re-creating the experience of drilling on a real bone. But in theory, as the software gets better, simulator-based training could even be better than cadaver training in some ways. For one thing, some medical centers can't afford to give cadaver specimens to all residents; simulators would be a huge boon for them. For another, even when residents do get cadaver bones, no two are exactly alike. Simulators would make it possible for everyone to learn on the same specimen. Unlike cadaver bones, which are pristine, simulators could produce examples of various pathologies—tumors and so forth—so residents could practice on them. Finally, the simulator can re-create the way blood flows into the area while a surgeon is drilling—something a cadaver bone obviously can't do.

Healy at Massachusetts Eye and Ear thinks simulators could be useful tools for experienced surgeons as well. One idea: since no two ears are the same, docs never really know what they're going to find when they start operating on you. But with a simulator, your surgeon could make an image of your ear and practice on it the night before operating. Also, a surgeon who develops a new technique could share that by distributing it via software and training others on simulators—instead of what they do now, which is publish an article in a journal, do presentations at conferences, or travel to medical centers to do in-person training. Finally, Healy believes simulators could be useful in retraining and recertifying surgeons during the course of their careers.

Where is all this headed? Perhaps one day computers won't just be training surgeons—they'll be replacing them. Docs probably aren't too crazy about that scenario. But no worries. It's still a long, long way off.