The sacred doctor-user-interface-patient relationship

Michael Leveridge

CUAJ Editor-in-Chief

I was the kid in the mid '80s with the Sega Master System and not the Nintendo. I became *excellent* at Shinobi, Outrun, and Wonder Boy while most of my pals crushed Mario, Contra, and Blades of Steel. A curious thing happened with the crossover smash Double Dragon, however; I knew exactly what to do (kick dude in neck; jump over dude; club dude in head) but when I played on my buddy's NES, I was hopeless, as was he on my Sega. We both flailed when feeding quarters into the console at the arcade. Of course, it wasn't an issue of different rules but of different *controllers* determining how our intention to kick necks became kicked necks on screen. It was the user interface (UI) — in this case the controller design — that baffled us on unfamiliar systems.

Forgive me if this isn't obvious, but you may have heard that new robotic surgery systems are beginning their global rollout, and I got to thinking about UI and how an expert in robotic partial nephrectomy would be vexed if asked to hunker down at a novel console and treat a patient. I recall this bafflement early in fellowship, when my Baumrucker TUR expertise met a perplexing Iglesias setup, and I treated the back of a few bladder walls like the Punch-a-Bunch board on The Price is Right. Again, the issue isn't knowledge, intention, or skill, but of the UI that links said intentions with action inside the patient.

Surgical instruments have so far filled the gap between surgeon and patient; the action of the hands translated directly to the field. One could get semantically fussy about intermediaries like lasers and cautery and retractors as force multipliers, but there remains a stimulus-response straight line to the action. Calipers-as-pincers, clutches, and motion damping *feel* like they transfer the surgeon's intentions to the field, but the wire connection is a fundamental shift that we may come to see as the thin edge of the wedge of a very different way of being for surgery. I'm not sure we think often enough about what it means to have third-party design choices and software positioned between us and the effectors of our work.

We are most often faced with UI design decisions when navigating our EMRs. These Byzantine frustration engines universally sacrifice usability for comprehensiveness. If I want to check on a CT, pathology, GFR, and last clinic note in my EMR, I'm bobbing for data with sequential dives into menus with titles like "Interdisciplinary/ambulatory ALL" to extract single details, then up for air to plunge back three more times to achieve something that software *ought* to serve up with a click or two. In the clinic, we know that UI design is a driver of our productivity and our external brain. When the computer system fails, so goes the clinic.

This is no blanket critique of technology and design liaising between doctors and patients. Organizing and sifting through paper charts is a pain, and patients spangled with hemostats instead of pinch-burns does not sound like a golden age of surgery. Technology is helpful! Better dexterity, less invasiveness, and 3D optics rule! The point is not that all UI are bad, but that we must contend with the fact that we are their subjects as much as they are ours; we can only wrestle with them within their design constraints. The further we integrate proprietary technologies and UI into our practices, the more fragility builds. When a company withers on bad bets or management, is acquired and sunsetted, or pummeled in market competition, so might go the ability of skilled surgeons to ply their trade or of doctors to manage patients.

So, we've established that tech UIs break the direct link between operator and subject and influence how inputs become outputs. Let's have some philosophical futurism fun with this. I envision two possible futures for UI design. The first is one that iterates to become so intuitive as to be second nature. User intentions convert to action with no friction; the software serves the user with total fidelity. The second is that the interface slowly becomes less visible and its inputs fewer and fewer as greater numbers of tasks are accomplished on board the system after simple instructions.

Consider whether the *feel* of the input need be congruent with the output. As it stands, we might think, "I want the July CT report," or "I want to move this grasper to hoist up the prostate." Currently, we search for the "imaging" tab or menu item and click to get a step closer or make arm movements that glide in an arc that the robotic arm mimics. In each case, we perform a *process* towards an *outcome*, but there is no reason the process has to be so literal. The computer was always capable of these outputs, it was just programmed in such a way that the user is granted a sense of agency by the input process. Programmed another way, one might speak into the air, "I'd like the July CT report," and the same output comes up as before (yes, I'm describing Siri). Perhaps a "surgeon" at a screen uses the telestrator function (or any other interface — a sensor-studded glove, a grid of IR beams, arms waving with a VR headset, etc.) to simply point where they'd like the robot to go and which move to apply on arrival.

Taken further, if the computer can coordinate the moves we conceive of, perhaps *goal states* (ligated DVC; stone fragments ≤2 mm; adenoma enucleated) instead of *processes* will come to be standard. A mentor of mine envisioned a type of CNC (computer numerical control) machine for partial nephrectomy, using high-resolution imaging input to bloodlessly remove a renal mass like an engine block might be hewn from a cube of aluminum. We see artificial intelligence programs like DALL-E and GPT-3 already rendering cogent art and prose from basic text instructions. Of course, surgery and medicine are complex and not just complicated; the substrate changes during the act of care and biological variability is staggering, so it's hard to compute (pun intended) a machine having the adaptiveness to modify a surgical plan on the fly and think clinically, as well as procedurally. Understand though that surgeons may hone their skills and intuition through perhaps 1000 of a given case over a career; a computer may have access to recordings of *any* robotic prostatectomy *ever* recorded in building its skillset.

Well, we've managed to go from tapping A & B buttons on '80s consoles to a bleak future of autonomous robo-surgeons in 1200 words, but our AI replacement is not imminent. There are still only 30-odd robots in Canada, and the state-of-the-art prostate imaging takes a $6 million machine the size of a car 45 minutes in a 2000 square foot electromagnetic cage to render an image that looks like a jacked-up cookie your toddler made. It's just an angle on innovation that reminds us that our ability to take care of patients is tariffed by interface decisions outside our ken and control. We reap both the efficiencies and the fragility.

Correspondence: Dr. Michael Leveridge, Department of Urology, Queen's University, Kingston, ON, Canada; Michael.Leveridge@kingstonhsc.ca