Published in final edited form as:

BMJ. ; 345: e8135.

Bringing surgical history to life

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Things change fast in surgery. Within a single generation, ways of operating that had been stable for decades have been overturned. New drugs have revolutionised what were once “surgical” conditions, and minimally invasive procedures have driven many “open” operations to the verge of extinction.

As surgical teams from an earlier generation retire or die, their collective memory of how things used to be done is being lost. Yet such experience may be of real practical value for today’s surgeons. This article investigates whether it is possible to preserve such expertise for future reference, using simulation to re-enact operations from the past.

The method

We start with open cholecystectomy—a standard operation 30 years ago, but now almost always performed laparoscopically. At first sight it may seem relatively simple to recapture such a procedure. Surely the surgical texts that trainees used at the time will provide step by step descriptions of the procedure. But the picture such sources paint can be highly misleading. Like medieval recipe books, surgical textbooks and journals assume a huge amount of contextual knowledge in their readers. “Take three quails and prepare as usual” spoke volumes in the 1500s, but such directions do not help today’s cook.

The same can be said for film, video, and even verbal descriptions of operations by those who used to perform them. Such sources privilege the surgeon’s viewpoint, while ignoring the contributions of assistants, scrub nurses, anaesthetists, and other members of the surgical team. To capture this unspoken context, we brought together retired surgical teams and invited them to re-enact operations that they used to carry out together—like the Rolling Stones coming together again for a concert. Instead of asking our teams to perform surgery on actual patients, we used simulation.

One of us (RK) has developed contextualised simulation to create realistic operating theatre environments.¹⁻³ Designed originally for surgical training, this approach combines clinical teams with key perceptual cues (instruments, equipment, and authentic sounds) to evoke a

powerful sense of taking part in an operation. Realistic models integrate silicon based prosthetic models with biological material (cadaveric animal organs) to re-create specific procedures. Participants find the experience highly convincing.⁴

The case study

We chose to re-enact the performance of open cholecystectomy in 1983. As the fourth most common general surgical operation at that time, this procedure had changed little since the early 20th century. Usually straightforward to perform, cholecystectomy was staple fare for surgeons at all levels of training, although at times it could tax the skills of the most experienced operator.

Two venues were selected: the London Science Museum and the distributed simulation inflatable operating theatre at Imperial College London (a low cost portable simulation environment).

The first step was to simulate a realistic operating theatre environment from 1983. Here the Science Museum's lower Wellcome gallery provided a unique resource. Created in 1980 and unchanged since then, it features a full scale operating theatre equipped with instruments, operating table, lamp, and anaesthetic machine. Other relevant information on layout, equipment, consumables, and staff was obtained from interviews (19 in-depth interviews by RK with retired surgeons, anaesthetists, and theatre nurses); textual sources (including journal articles, serial editions of standard surgical textbooks, and historical sources⁵); photographs of operating theatres; artefacts (private and museum collections of surgical equipment and instruments); film and video (including 1983 teaching videos of cholecystectomy and laparotomy by Harold Ellis); drama and documentary material (BBC); and personal recollection (RK was a surgical registrar at the time).

We then developed a custom built hybrid cholecystectomy model, positioning a cadaveric porcine liver and gallbladder within a realistic silicon abdominal cavity[↓]. Team members were garbed, gowned, and gloved appropriately, and we took great care to create a sense of realism. A 1980s anaesthetic machine (including Manley ventilator) was augmented by recorded sounds.

Through personal contacts we recruited two "senior" surgical teams, each with enormous experience of operating and teaching.

Senior team 1 included Harold Ellis (surgeon; HS) who qualified during the second world war and is well known to generations of surgeons and medical students as an iconic teacher and clinician. The other two members of the team were Stanley Feldman (anaesthetist) and Mary Neiland (theatre sister), who worked with Ellis for decades at Westminster Hospital, London until he retired from clinical practice in 1989.

Senior team 2 represented a later generation: John Black (surgeon; JB), Bruce Roscoe (anaesthetist), and Julia Radley (theatre sister) worked together for decades in Worcester until Black retired from clinical practice in 2006 (becoming president of the Royal College of Surgeons of England in 2008).

Each session re-created a “routine operating list,” headed by the consultant surgeon and assisted by current surgical trainees (aged about 30 years). The consultant performed one operation as primary surgeon then helped one of his trainees during a second case. All procedures were recorded in high definition using multiple static and roving videocams with sound. Footage included activities of the whole surgical team and close-up details of the operative field. Participants (including surgical trainees) took part in a recorded debriefing after each operation, and senior teams were followed up by subsequent interview $\downarrow$.

What we found

Both operating teams became fully immersed in the operation. Participants quickly suspended disbelief and assumed their customary roles as clinicians and teachers. Although subsequent interviews identified certain aspects of the simulation as unrealistic, both surgical technique and teaching style closely reflected ingrained practice. In both teams the anaesthetist and theatre sister commented on how true to life the surgeon’s behaviour appeared, and vice versa.

Operations in which trainees operated under supervision proved especially valuable. Here, surgeons verbalised ways of working that long experience had made subconscious and automatic for them. Their instructions and guidance, issued in everyday language, went beyond the specific technique of cholecystectomy to include more general “nuts and bolts” of surgical practice: how to improve exposure within the operating field; how to hold, position, and use instruments; and how to feel, handle, and dissect tissues. In one of our cases, the scrub nurse helped provide this information.

Surgeons included tips from their own experience, summarised different schools of thought, gave accounts of what might go wrong, and provided instruction on how to anticipate and manage difficulties. In this way, simulation allowed experienced clinicians to articulate and share their experience with today’s trainees, handing down age old techniques of manipulating instruments, developing tissue planes, anticipating complications, and avoiding mistakes. The trainees greatly valued the opportunity to learn in such tactile non-verbal ways (box).

Simulated re-enactment also provided valuable social insights into how members of long established surgical teams worked together. Their interactions were marked by banter, requests, and queries. We also found many examples of non-verbal unconscious interaction, such as the recognition of cues that indicated different phases in the operation, the unprompted selection and passing of instruments between theatre sister and surgeon, and the physical positioning of team members in relation to each other. The result was a seamless mode of working, in which team members anticipated each other’s needs and responded collectively to the situation as it evolved. When invited to review the video recordings after the procedure, team members were able to identify behaviours of which they had been unaware at the time.

This is an important finding because such ways of working are disappearing. The introduction of working time restrictions has spelt an end to stable “firms” with their “institutional memory” of collaborative skills. Today’s ephemeral groupings can no longer

rely on wordless understandings gained through years of working together. In demonstrating the importance and operation of such understandings, the value of simulation goes beyond the capture of surgical techniques, to include entire ways of working within the unique space of the operating theatre.

Where next?

So far as we are aware, this is the first attempt to document recent historical practices of surgery through re-enactment by clinicians who were there at the time. Our findings reveal that despite some obvious limitations (not least the absence of a real patient), simulation has the capacity to capture not just past surgical techniques, but tacit and embodied behaviours, and social ways of working that elude capture by other means.

The practices we have captured are not only of historical interest. They exemplify vanishing skills which may prove of real importance for present day surgeons. For example, if it becomes necessary to “convert” during a laparoscopic gallbladder operation (as still happens occasionally if complications arise), a new generation of surgical consultants can no longer draw on years of experience of open surgery to get them out of trouble. The same is starting to happen in many other branches of surgery, where open operations are fading from collective memory and expertise is being swept away. Examples include urological procedures and operations for upper and lower gastrointestinal cancer.

Of course not everything that is old should be preserved, and some practices are better abandoned. But knowing which to keep and which to discard is not easy. In the 1960s, for example, a widespread conviction that Victorian architecture was old fashioned and outdated led to wholesale demolition of houses and public buildings, making way for new construction on a massive scale. Only much later, when major problems emerged, was the value of what had been superseded recognised. But by that time many priceless buildings had been swept away. We argue that documenting vanishing surgical practices may prove more valuable in the future than we now appreciate.

As well as their expertise in everyday practice, our senior teams have lived through—and contributed to—many extraordinary advances and upheavals in 20th century surgery. Yet our access to this wealth of shared experience cannot last forever, and soon it will no longer be possible to reconstitute full teams from long ago.

“The past is a foreign country: they do things differently there.”⁶ LP Hartley’s famous first line from *The Go-Between* sums up the challenge of capturing a vanished time.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

We wish to acknowledge the invaluable assistance of numerous clinicians, especially Harold Ellis, Stanley Feldman, Mary Neiland, John Black, Bruce Roscoe, and Julia Radley. We also thank Sacha Harris, Jimmy Kyaw Tun, Anne Yeh, Jessica Tang, Jason Maroothernaden, and other researchers at Imperial College London for their invaluable contributions. We are also grateful for the assistance and support of the Science Museum and its curators

(Katie Maggs, Tim Boon, Robert Bud, and others) and of Paul Craddock and colleagues at London Consortium TV for video-recording operations. Max Campbell (Health Cuts) developed our hybrid cholecystectomy model.

Competing interests: All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf (available on request from the corresponding author) and declare: This work was funded by a Wellcome Trust research leave award for clinicians and scientists (to RK); development of the Distributed Simulation inflatable operating theatre concept was funded by London Deanery StELI; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

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Examples of sharing experience with trainees

Learning blunt dissection

Trainee surgeon (SH) is dissecting the gallbladder under JB's supervision

JB: "Just give it a little push with the peanut again—it was just coming up nicely, wasn't it? ... Now swing it the other way and do the same on the other side—nibble the peritoneum"

SH (dissecting the gallbladder): "Just being in the right plane makes it so much easier, doesn't it?"

JB: "You can say that again" (laughs)

JB: "Scissors aren't straight, because your hands are at that angle and you want to work that way ... Always use surgical instruments as if they were a knife and fork"

Learning applied anatomy

Trainee surgeon (JKT) is dissecting the gallbladder under HE's supervision

HE: "These are the little branches going into the gallbladder from the ... right hepatic artery, and the veins drain back into the right portal vein. That's why the inflamed gallbladder very rarely goes gangrenous, because it's got an excellent blood supply"

Discussion after operation

Trainee surgeon (SH) discussing the operation with JB and team, when asked what it was like for him as a learner:

SH: "Fascinating, because I've only been in two open cholecystectomies. One planned, when I was an F2 and didn't really understand what was going on very well, and once as an emergency ... so none of the teaching that Mr Black offered us"

JB (referring to teaching blunt dissection of gallbladder to a medical student): "You couldn't have done that in the real thing—we would not have felt safe letting you stick your finger down there"

Fig 1.
Lifelike appearance of cholecystectomy model

Fig 2.
Information transfer between experienced members of the team and trainees was of paramount importance