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# MIST VR: a virtual reality trainer for laparoscopic surgery assesses performance

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The introduction of a mandatory Basic Surgical Skills Course (BSSC), by The Royal College of Surgeons of England underlines the need for objective assessment of trainees' manual dexterity. The BSSC includes a laparoscopic surgery module where the trainees perform various basic tasks using traditional laparoscopic trainers. There is a need to provide a more objective scoring in order to assess and monitor ability and progress, since existing assessments rely on qualitative judgements.

The MIST VR (Minimally Invasive Surgery Trainer —Virtual Reality) system has been specifically designed to provide trainees with a realistic and assessable environment. MIST VR has been developed as part of a joint venture between the Wolfson Centre and VR Solutions *(1)*. It allows suitable tasks to be performed using standard laparoscopic instruments.

The system comprises of a 200 MHz Pentium® PC with a 32 Mb RAM. This is linked to a jig containing two laparoscopic instruments held in position-sensing gimbals with 6° of freedom (Fig. 1). The movement of the instruments is translated as a real-time graphical display of the instruments. An accurately scaled operating volume of 10 $cm^3$ is represented by a three-dimensional cube on the computer screen. The overall image size and the sizes of the target objects can be varied for different skill levels as well as 'camera' zoom. Targets appear randomly within the operating volume according to the task and can be 'grasped' and 'manipulated' (Fig. 2).

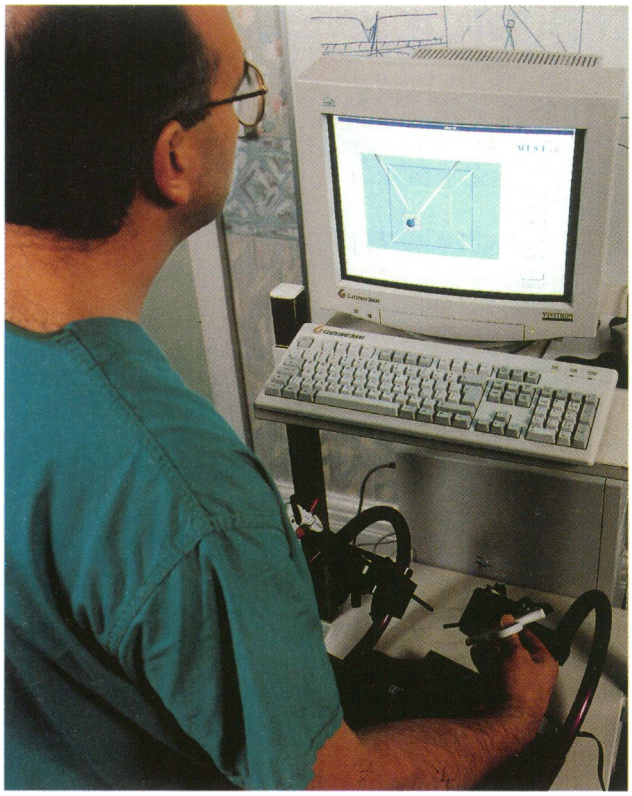

*Figure 1.* MIST VR trainer: two laparoscopic instruments on a jig with motion-detecting potentiometers linked to the PC.

MIST VR has tutorial, training, examination, analysis and configuration modes. Six tasks have been designed to

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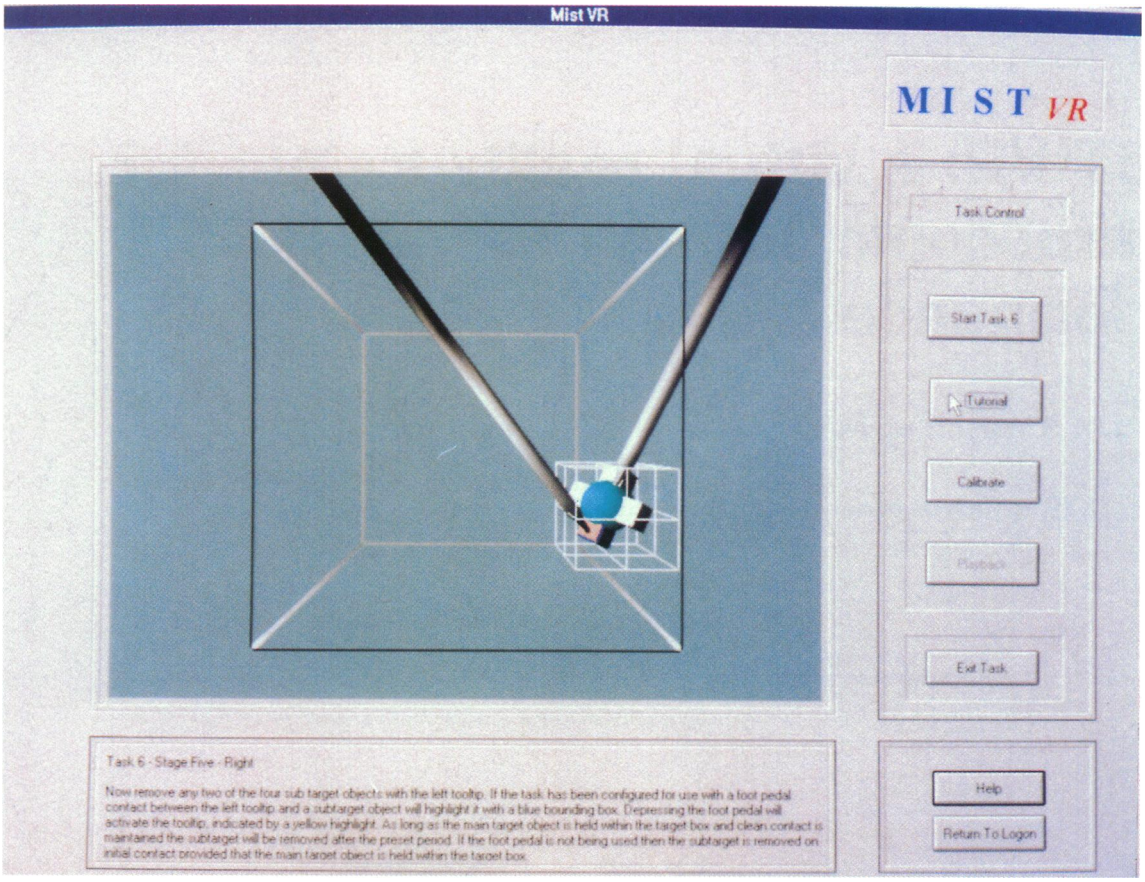


*Figure 2.* Examples of a complex task. The ball is grasped by one instrument, passed to a second instrument and is then placed and held in a randomly positioned graphics 'cage'. The first instrument is then withdrawn from view and is 'exchanged' for a diathermy tool tip. 'Nodes' appear on the ball and are 'diathermied' off by contact for a few seconds (and the node turns red before disappearing) using a foot pedal control.

simulate some of the basic manoeuvres performed during a laparoscopic cholecystectomy and the user can at any time refer to a video sequence demonstrating the use of a particular skill. The system software can be adapted for different operations requiring different skills with instruments such as arthroscopes or endoscopes.

During the tasks, accuracy, errors and time to completion are logged on a spreadsheet. After completion, data analyses permit overall and individual task performances as well as right or left handedness to be quantified and displayed. Comparisons can be made between training sessions and trainees. Modem transfer of the data to a centralised assessor and database could enable widespread assessment of trainees in an objective fashion.

The applications of MIST VR will be primarily as an assessment or examination tool rather than just a pure laparoscopic trainer. Quantification of manual laparoscopic ability is possible, the effect of courses to improve skills can be measured and MIST VR could even be used to assess competence to practice. Its main advantages are that it uses a high-end PC, is portable, reasonably priced and commercially available (from Ethiskill, a Division of Ethicon Ltd).

MIST VR is based on abstracted graphics so that surgeons are not distracted by the appearance of 'virtual organs' which have been shown not to enhance training. This makes the system multidisciplinary and simple and able to run on an affordable computer. The quantification of performance provides a powerful new tool for surgical training.

## Reference

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