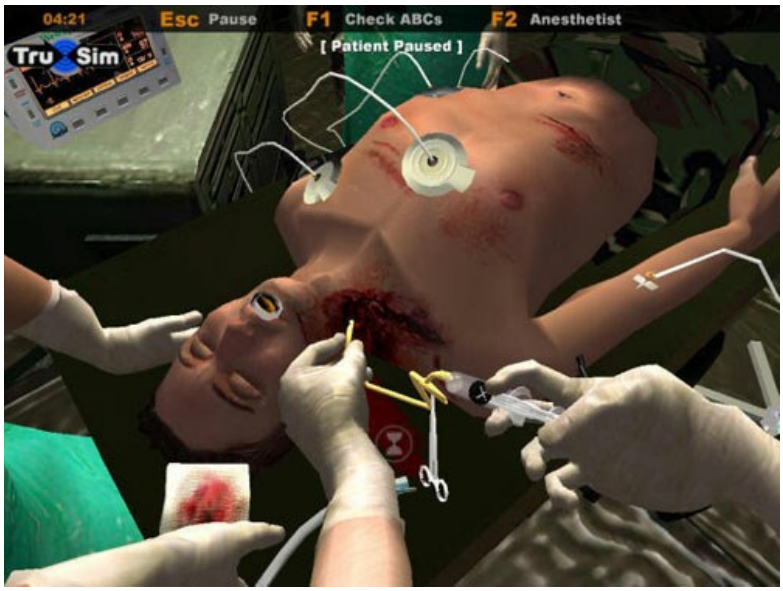
The Interactive Visualisation and synthetic environments

Interactive visualisation is an exciting research domain which focuses on the development of advanced human-computer interfaces based on real-time 3D graphics, enhanced, where appropriate, by the integration of additional technologies delivering (for example) sound, touch and force feedback. Exploiting these technologies, based on sound human-centred design principles, will enable the computer user to interact intuitively with real-time applications in training, education, design and scientific analysis. Contrary to popular opinion, the principal research challenge in interactive visualisation is not technology-oriented. Rather, it is the ability to analyse the tasks expected of the end user and to design interactive systems that deliver only those sensory, real-time experiences that are required to meet the requirements of that user. It is this challenge that was ignored in the closing decade of the 20th Century – the "Virtual Reality (VR) Era" – leading to a widespread failure of VR to live up to its earlier, revolutionary promises. However, due in part to a resurrection of interest in interactive visualisation brought about by the "serious gaming" community, this challenge is being met head-on by new and internationally acclaimed processes and technologies under development at the University of Birmingham.

The Human Interface Technologies, or HIT Team (part of the Department of Electronic, Electrical and Computer Engineering), has an active and groundbreaking programme of research and development in the field of interactive visualisation, focusing on such applications as medical and surgical training, national heritage and defence. In the medical and surgery arena, the HIT Team is working closely with medical institutions in Birmingham and Manchester to investigate the use of interactive 3D and games engine technologies in training future surgeons. One particular goal of the research is to use simulated human bodies to investigate why surgeons sometimes fail to recognise subtle ("aberrant") differences in human anatomy and physiology, resulting in inter- and post-operative complications. In heritage, HIT Team researchers have been integrating artificial life algorithms with 3D topographical models of the North Sea basin to simulate the propagation of plant life around a recently discovered large river bed – a river that existed in the Mesolithic Era, long before the onset of widespread regional flooding, separating the UK from its Continental neighbours. In the defence sector, and as one of the major academic partners of the Human factors Integration Defence Technology Centre (www.hfidtc.com), the Team has been active in world-class research leading to, for example, the development of wearable computers for command and control activities, a low-cost simulator investigating supervisory and direct manual control of unmanned air vehicles (UAVs) for urban operations, and a new method of rapidly analysing real-world tasks for the purposes of defining Synthetic Environment (SE) training systems. As well as laboratory-based work, the Team regularly conducts field trials, collecting data from front-line personnel in all three branches of the Armed Forces.

One recent project illustrating the importance of collecting human factors data from subject matter experts in the field has led to the development of a unique Interactive Trauma Trainer, designed to help foster life-saving decisions on the part of battlefield surgeons. Working in close collaboration with the Royal Centre for Defence Medicine and Blitz Games of Leamington Spa, the project commenced with a focused task analysis session which, for logistical and experiential reasons, took place in the Johannesburg Central Morgue, backed up by Field Hospital Trials in the UK. The task selected for study and implementation related to a "zone 1" neck fragmentation wound, causing pulsatile haemorrhage, tracheal constriction and rapid patient decline. The human factors analysis helped to capture those visual and behavioural elements of the task that were central to the successful development of the Trauma Trainer. Delivered in the form of a "first person" gaming environment, the Trainer has received critical acclaim from the MoD, NATO and civilian medical organisations.

A screenshot of the Interactive Trauma Trainer



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