

1-1C Interactive Simulation of Biopsy Puncture Training Procedures Using Immersive Virtual Reality and Haptic Technology for Motor Skills Training

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This study aims to enhance conventional surgical skills and anatomical knowledge teaching to novices using virtual reality (VR). By proposing an immersive and interactive experience within a virtual dissection laboratory, we aim to support the development of those fine motor skills that are required in a liver biopsy procedure. This simulation empowers users with enhanced control of a virtual biopsy needle using a force feedback haptic device allowing multiple rehearsals of the retrieval of tumour samples from a patient in a safe and reliable environment.

This study has been developed using CT and MRI scan data; models of the abdomen have been developed and textured to create an accurate representation of real life anatomical structures. Immersion within the virtual environment using the HTC Vive allows the users to explore realistic anatomical structures in context. When performing the liver biopsy, an in-app ultrasound camera was created to allow the user can see inside the abdomen, with the purpose of training users to interpret scan data, something that is done in real biopsy procedures. Users can manipulate a Phantom Omni device to insert the virtual needle into the patient and receive force feedback from the application.

A heuristics study involving an expert radiologist was performed to configure and verify the haptic accuracy of the system. This expert-validated application has real potential to be developed further to create a helpful tool for trainee surgeons. This pilot study demonstrates that visualisation and VR has great potential to be an effective tool for learning due to improved engagement and interaction of users.