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Development of A Virtual Laparoscopic Trainer Using Accelerometer Augmented Tools to Assess Performance in Surgical Training

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The Problem : Laparoscopic training is a critical area

It is expensive for training and using with current simulator technologies

More specifically, area lacking for e-learning measures;

1. allow surgeons to train with appropriate inexpensive tools,
2. chart progress of a trainee surgeon,
3. give feedback on vital scenarios

Consider in particular: FOR TRAINEES

1. The seniors need to learn the technology before the trainees
2. Cannot learn 'on the job' as much
3. Not ethical to 'practise' on a patient!

What we use today

1. Specialised plastics laparoscopic trainer boxes
2. Computer software tutorial guides for learning
3. Virtual Reality Training (VRT) Simulators

How else can we do this?

VALHALLA is a hardware and software solution we developed that synthesises current state of the art visualisation with existing laparoscopic tools (IPEG 2009) and now integrates with well established training methods such as using material plastics like trainer boxes. It aims to

1. Make it affordable and easy to learn by use of existing techniques and instruments
2. Enable training with existing tools to have a charted progression in learning when simulating its interactivity within a 3D world.

In simple terms, VALHALLA

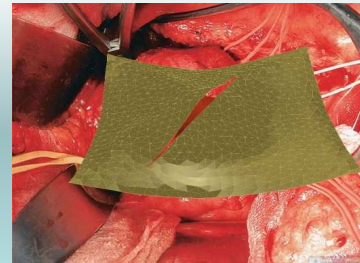
turns this ...



into this.



The Valhalla Tool: "A modified laparoscopic instrument with wireless digital motion sensors" IPEG 2009



VALHALLA, second iteration

Takes our prior art further by facilitating:

- Assessment of Gestural Surgical Trainee Performance (GSTP, 2010) using **Game Theory User Interaction**
 - i. branching scenarios
 - ii. timers to measure confidence intervals in scenarios
 - iii. precision hit targets with pre and post conditional states
 - iv. replay modes for reviewing, eliciting ghost modes for re-instruction by seniors.
- **Sensors attached to existing laparoscopic tools (patented and reported in IPEG 2009)**, completely tether less, that mimic **3D mouse motion technology** as a high resolution input for interacting in a 3D environment.
- Since we are using **existing** laparoscopic tools, we **make use of existing plastics laparoscopic trainer boxes**, cheap haptics feedback – no need for expensive computer sensory haptics.
- Full **gesture recording of orientation and positional data collected** on trainee surgeon's performance in simulation, with transposition of plastics-world entity into virtual simulated environment.
- **Game theory assists** in providing **analytical methods** on **charting a trainee's improvement** in practicing with scenarios.
- **High sensitivity in motion capture** reflecting **delicate precision** in motion control – considers trainee needs
 - i. Basic to advanced laparoscopic procedures and skills
 - ii. Camera driving
 - iii. Hands-on skills training
 - iv. Psychomotor skills
 - v. Hand-eye coordination
 - vi. Depth perception