VEUSim: A Virtual Endoscopic/Endovaginal Ultrasound Simulator for Physician and Medical Student Training

Todd Doehring, Neal Handly, Todd Doehring and Chris Redmann

Introduction

- There is a great need for immersive training systems for Endoscopic and Endovaginal Ultrasound procedures
- "Live" persons are not available for training for this procedure
- VEUSim takes advantage of new, inexpensive graphics and haptic devices to create a realistic training experience.

Hardware

- 3D computer workstation
- Phantom Omni haptic device (provides realistic "feel")
- Development of new 'drivers' for intuitive response viz soft materials/tissues
- Total rework of wand and hardware components underway.

Phantom Omni haptic device

3D Worksation
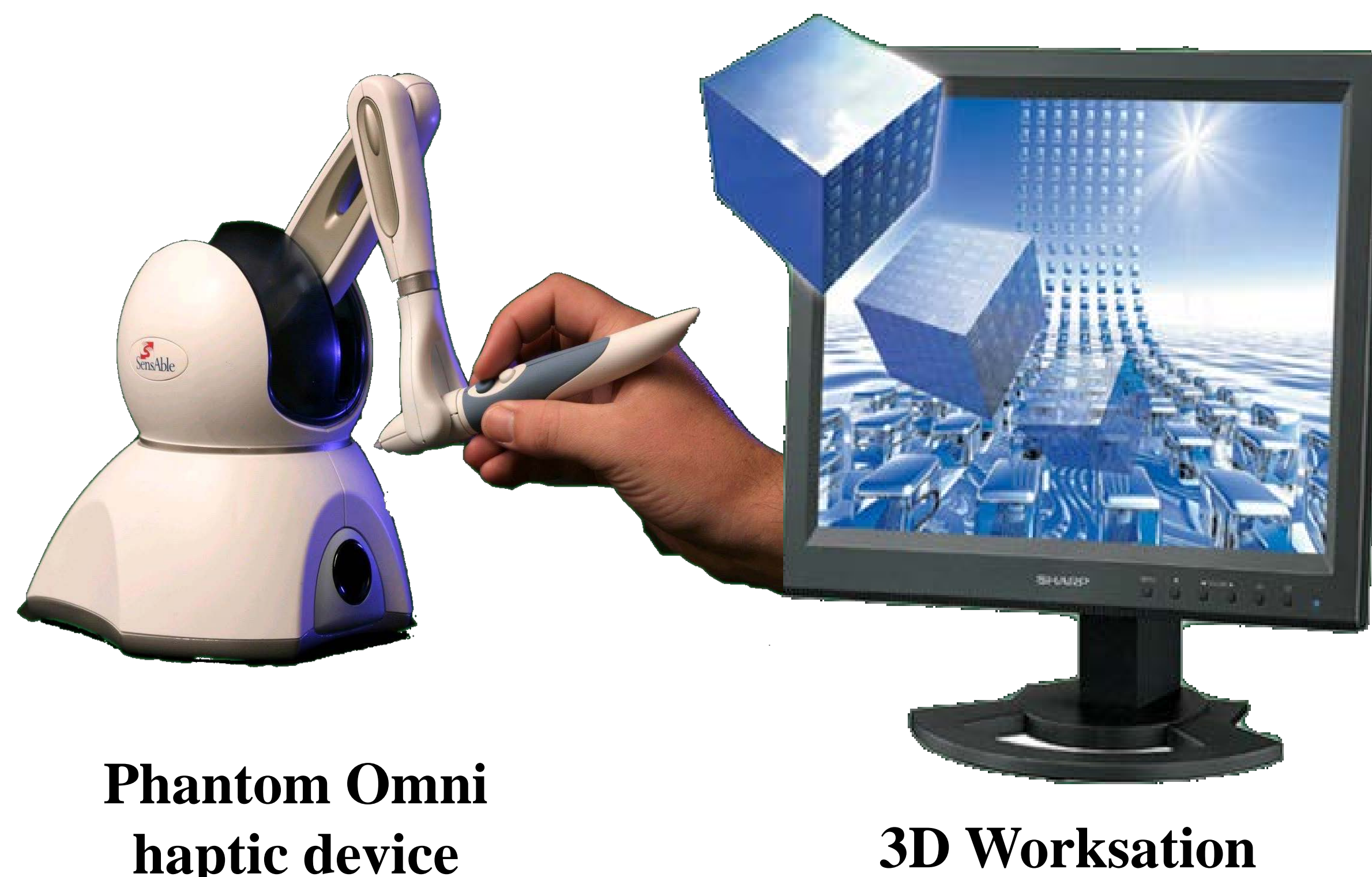
Tech/Business Summary

- VEUSim was licensed by Net Scientific Inc. in 2010.
- Development work continues for a wide range of training procedures.
- Further grants have been obtained from the Turkish Government
- Estimated to market in Q3, 2013.
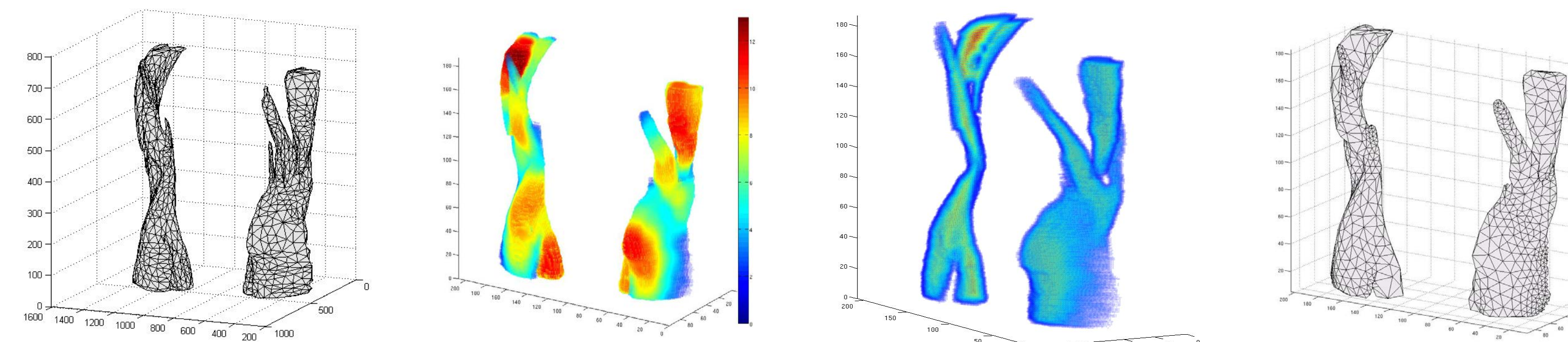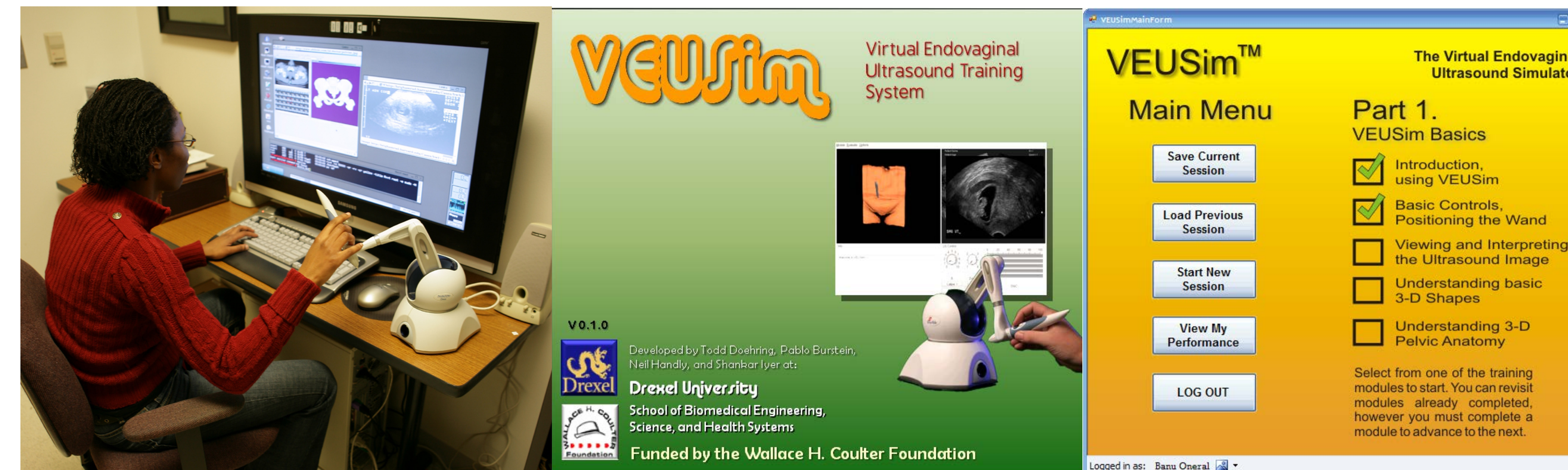
3D Reconstruction: One of the most important aspects of accurate/fast visualization for realistic modeling is the need for optimized meshes of the highly complex pelvic anatomy. Above is shown four major steps of this process that we have developed for the VEUSim prototype. First, the rough mesh (A) which was obtained directly from MRI scan is converted to a voxel image (B), then the local thickness (C) is computed, and finally a volumetric energy minimization algorithm is used to compute an optimal surface mesh. Polygons are reduced by 60% and the model is 'smoother' for more accurate haptic feedback, improved simulation speed, and more realistic "feel".

Software

- GUI: programmed using the OpenHaptics toolkit and FTLK. Provides 3D view of pelvic anatomy and ultrasound simulation
- 3-D reconstruction is done using our in-house SuperSlicer (superslicer.net) software.
- Polygon mesh to voxel image conversion using newly developed software (mesh2vox package)
- Polygon mesh optimization using energy equilibrium based optimization
- These software tools will be released 'open source' via the MIT license.

Acknowledgement

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