"Towards The Next Generation Of Innovative And Multi-touch Based Virtual Reality 3D Labs In Biomedical Field. A Case Study."

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Visible Human Project – first generation

Second generation
Anatomage Table

Our multitouch, 2D/3D VR Anatomy Lab - third generation

Next generation…?
Project POSDRU: “Advanced Technologies for Quality in Future Oriented University/Tehnologii avansate pentru calitate în universitatea orientată spre viitor”

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Calitate
Inovație
Tehnologii avansate
I. The development and use of advanced educational ITC solutions:

1. An Innovative And Multitouch Based Virtual Reality 2D/3D Anatomy Dissection Lab – a Pilot VR Anatomy Lab
3. The Development of a Next Generation E-learning/Educational Platform: RoELME (Romanian E-learning Made Easy)
AnATOMIA [virtualis?] clavis et clavus medicinae est…

Some facts about “Anatomia clavis medicinae est”:
• the dissection of a human cadaver is still the proper and the most traditional method for studying Human Anatomy.
• But, in the last decade, it seems there is a chronic shortage of the human cadavers available for the Medical Schools all over the World [1, 2].

Solutions…and some major drawbacks…
• No dedicated hardware based virtual environment at all !!!
• Single touch, proprietary and expensive hardware and software…and no possibility for 3D environment
Some E-learning solutions for Human Anatomy Classes, proposed by us

1. Digitization of some existent Human Anatomy samples = A Virtual Human Anatomy Museum, by using:
   • 3D scanning of Human Anatomy Samples
   • Recording of real life Human Cadaver Dissections using 3D cameras

2. Using “virtual cadavers” – e.g. from Visible Human Project, in a multitouch VR/AR 2D/3D “dissection” environment

3. Much more simplified Educational Content generation – e.g. by using RoELME’s next generation E-Content Generator – at the end of the “virtual dissection” an annotated movie is already available to be uploaded to an e-learning platform
A Virtual Human Anatomy Museum (360°/2D/3D)

- Digital and 360° Rotating 2D Virtual Anatomy Samples and Models captured with dedicated 2D cameras hardware/software solutions
- 3D photo/video cameras,
- real time 2D/3D conversion Matrix Display solutions using Passive 3D Glasses technology

E. G.
Photosimile 5000 (for small/medium size objects)
OR
Photosimile 360
(for large objects)
Virtual reality (http://en.wikipedia.org/wiki/Virtual_reality)

Virtual reality (VR), is a term that applies to computer-simulated environments that can simulate physical presence in places in the real world, as well as in imaginary worlds. Most current virtual reality environments are primarily visual experiences, displayed either on a computer screen or through special stereoscopic displays, but some simulations include additional sensory information, such as sound through speakers or headphones. Some advanced, haptic systems now include tactile information, generally known as force feedback, in medical and gaming applications.

Augmented reality (http://en.wikipedia.org/wiki/Augmented_reality)

Augmented reality (AR) is a live, direct or indirect, view of a physical, real-world environment whose elements are augmented by computer-generated sensory input such as sound, video, graphics or GPS data. It is related to a more general concept called mediated reality, in which a view of reality is modified (possibly even diminished rather than augmented) by a computer. As a result, the technology functions by enhancing one’s current perception of reality.
The chronic shortage of the human cadavers available for the Medical Schools all over the World – > Visible Human Project


“It is the creation of complete, anatomically detailed, three-dimensional representations of the normal male and female human bodies. Acquisition of transverse CT, MR and cryosection images of representative male and female cadavers has been completed. The long-term goal of the Visible Human Project® is to produce a system of knowledge structures that will transparently link visual knowledge forms to symbolic knowledge formats such as the names of body parts.”

e.g. Visible Human Server – École polytechnique fédérale de Lausanne
http://visiblehuman.epfl.ch/

Virtual Reality???, Augmented Reality???

Close enough, but NOT YET!
Visible Human Project – What is really missing to achieve a proper VR/AR “dissection environment”?

1. **A multitouch Human Computer Interface - HCI (+ haptic devices with Force Feedback?!?)** (with at least 10 touch points …for at least 2 hands :)

2. **A 3D VR/AR Display environment**, to give the audience a immersive 3D experience and a “real life” dissection “feeling”

3. **A real-time and reliable e-content generator able to generate an A/V annotated 2D/3D movie of the VR “dissection”, ready to be uploaded to an E-learning Environment such as RoELME, Moodle, Khan Academy, Youtube EDU etc**
Anatomia (virtualis?) clavis et clavus medicinae est.

VR/AR Dissection environments - a new challenge for teaching Human Anatomy?

Our innovative solutions: 1. A multi-touch environment

1. A multi-touch Human Computer Interface – e.g. Microsoft Surface/ Samsung SUR40 – a similar design of a “regular dissection table”, with up to 50 contact points (but only using a dedicated “software layer”/framework !!), thus one can use both hands and even some rubber/plastic objects, to “emulate” the medical tools used in a real life dissection environment + a classical/familiar Windows OS interface and ready to run all educational/medical software that is available for Windows or the Web-enabled ones…


“The new generation of Microsoft Surface experience featuring PixelSense™ allows an LCD display to recognize fingers, hands, and objects placed on the screen, including more than 50 simultaneous touch points. With PixelSense™, pixels in the display see what’s touching the screen and that information is immediately processed and interpreted. Building from the innovation of the first version of Microsoft Surface and Samsung’s leading display technology, it is now possible for people to share, collaborate and explore together using a large, thin display that recognizes fingers, hands and other objects placed on the screen”

Some drawbacks: Surface/Samsung SUR40:

Some problems:
A) hardware multi-touch capabilities of the device are $\gg 1000$ Touch Points, but limited to up to 50 Touch Points from the software layer (MS Surface SDK) and Win 7 OS;
B) Every software should be (re)compiled using Surface SDK in order to fully benefit from the advanced multi-touch capabilities of the device

Some solutions:
 a) But we were able to “hack” it and to “activate” touch input up to 255 touch points even on a regular PC 😊
b) We were able to activate multi-touch response in some browsers, in order to use Web-enabled Virtual Anatomy Software in a multi-touch environment, without the advent of Surface SDK, but the capabilities are somehow limited (lack of multiple focus)
Our innovative solutions: **A 2D/3D VR/AR Display environment**, to give the audience a immersive 3D experience and a “real life” dissection-like “view”

- A Matrix of 2D/3D Displays (each one with a screen size > 50 inch), using passive 3D glasses and real-time image 2D/3D conversion

**Why a matrix and not a singular/huge display?**

- **real-time image 2D/3D conversion**
- the system is positioned and connected to **allow instant configuration** of either an immersive 3D experience using ALL the displays in the matrix OR to present a 3D image in one screen, while the other 2 are presenting the teacher’s book (PDF), the 360° rotated digitized anatomy sample
- **Cheap yet powerful passive 3D glasses technology**, letting the teacher/students to see simultaneously and properly both 2D and 3D images and/or movies
Our innovative solutions:

3. Inside the RoELME educational platform, there is a real-time and reliable e-content generator (RT screen annotator + screen recorder) able to generate an A/V annotated 2D/3D movie of the VR “dissection”, ready to be uploaded to an E-learning Environment such as RoELME, Moodle, Khan Academy, Youtube EDU etc.
Anatomia (virtualis?) clavis et clavus medicinae est...

Case Study - RoELME: our new 2D/3D virtual reality dissection lab
Some photos of the multi-touch, 2D/3D virtual lab...
And the results... annotated educational movies... on the RoELME platform...
And the Next Generation…may be…Oculus Rift…Samsung Gear VR…PlayStation VR…HTC Vive…???

NO! Hopefully it will be soon more like this Holographic Surgery Module from the movie 2057 – The Body

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Our multitouch, 2D/3D VR Anatomy Lab - third generation
E.g....Microsoft HoloLens Technology – Holo-like MIXED Reality
Microsoft HoloLens Technology – Holo-like MIXED Reality + Holo-Teleportation 😊
SuperHaptics Technology for Holographic environments

You can feel rain drops falling on your hand.
And the Next Generation... WILL BE HOLO-like Environments + multi-touch Haptics

TACTILE Sensations + FORCE FEEDBACK + …

Holographic Surgery Module from the movie 2057 – The Body

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