

AMERICAN COLLEGE OF SURGEONS

ACS Chapter | **Italy**

A.I. for training and coaching

WHITE PAPER FOR COLLABORATIONS



100+years

AMERICAN COLLEGE OF SURGEONS

*Inspiring Quality:
Highest Standards, Better Outcomes*

Disclosure

FEDERICO GHEZA, UNIBS

Consultant for CMR Surgical Ltd

Consultant for Medtronic

Work for equity IASO 3D

Consultant for IRCAD

Coach at Surgical Coaching Academy



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100+years

Background

TERMINOLOGY

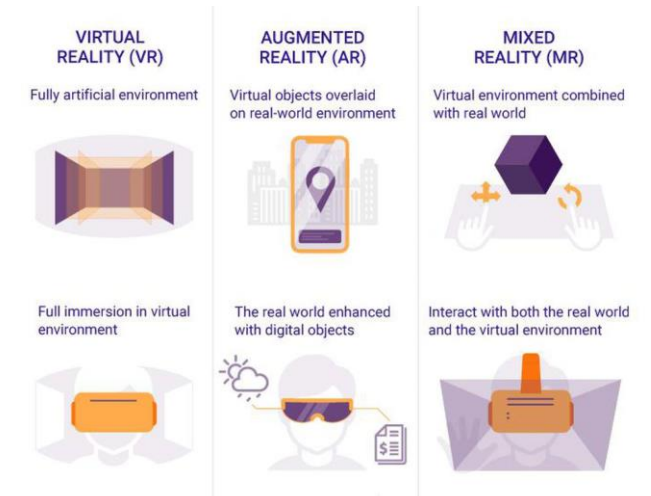
Virtual Reality, Augmented Reality, Mixed Reality, Immersive Content

HMD (Head Mounted Display) or Mobile VR

Interactive VR

Augmented Reality: *Pokemon Go* by Niantic

Mixed Reality: Greenscreen technology



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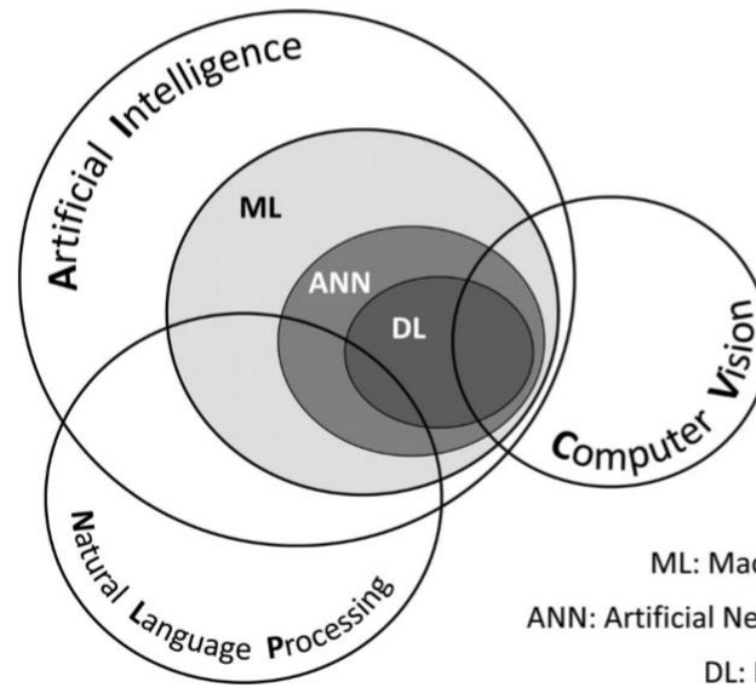
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Comment on “The Limit
for Artificial Intelligence’s
Potentiality in Surgery
Doesn’t Have to Be the
Surgeon”

To the Editor:

Letters to the Editor

Annals of Surgery • Volume 269, Number 6, June 2019



ML: Machine Learning
ANN: Artificial Neural Networks
DL: Deep Learning

FIGURE 1. Hypothetical representation of AI subfields. AI indicates artificial intelligence.

Comment on “Mixed
Reality in Visceral Surgery:
Development of a Suitable
Workflow and Evaluation of
Intraoperative Usecases”

To the Editor:

*Dr. Gheza is a consultant for Med-
tronic. Dr. Raimondi has nothing to disclose.*

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Intelligent Virtual Environment (IVE)

TERMINOLOGY

VR, AR, XR, MR are not intrinsically Smart

VE can be enriched by smart processes or smart operators

AI and ML can be adopted at any level

Focused on where they make things possible

REDESIGN

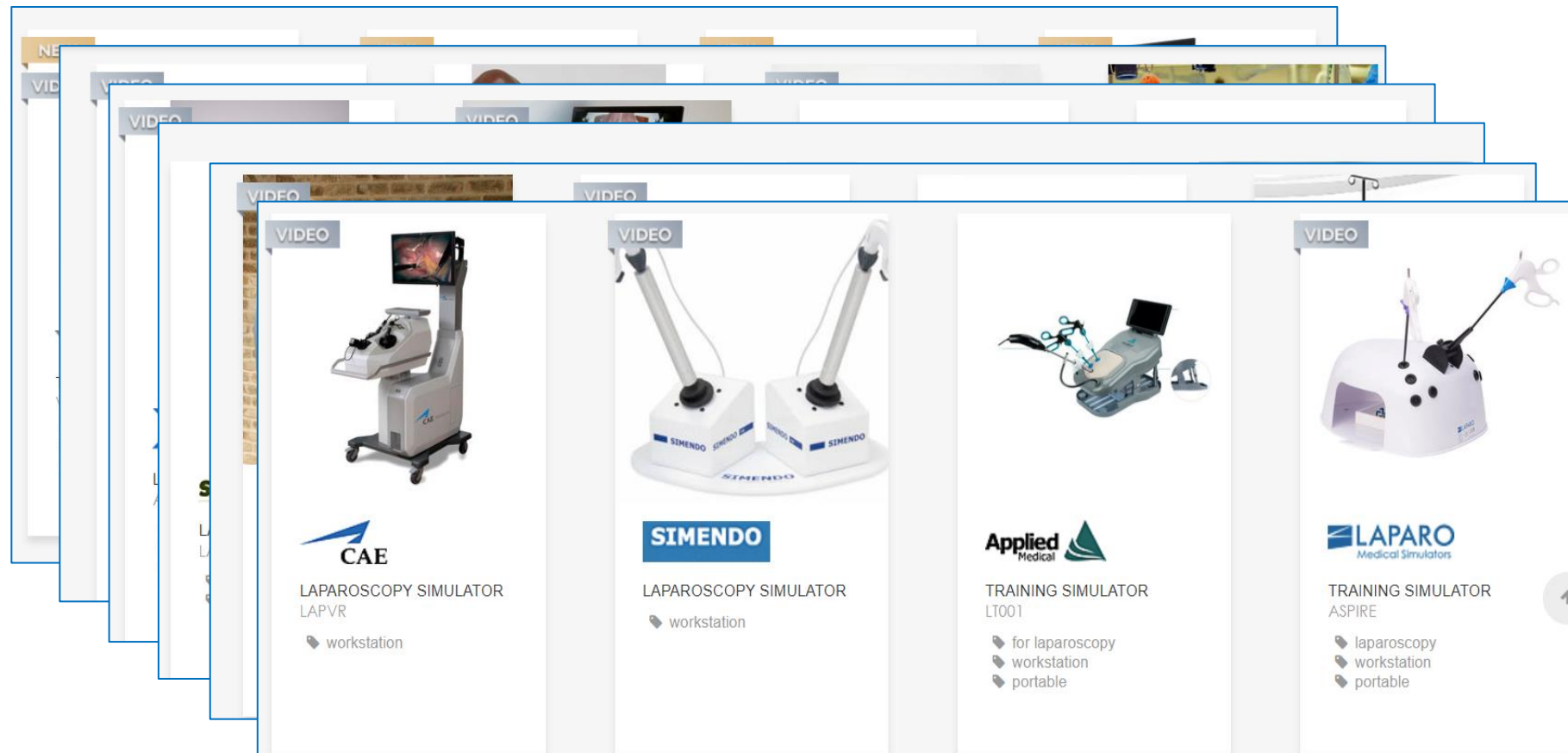
Intelligent Virtual Environments

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Centre for Virtual Environments
University of Salford
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United Kingdom

Michael Luck
Department of Computer Science
University of Warwick
Coventry, CV4 7AL
United Kingdom

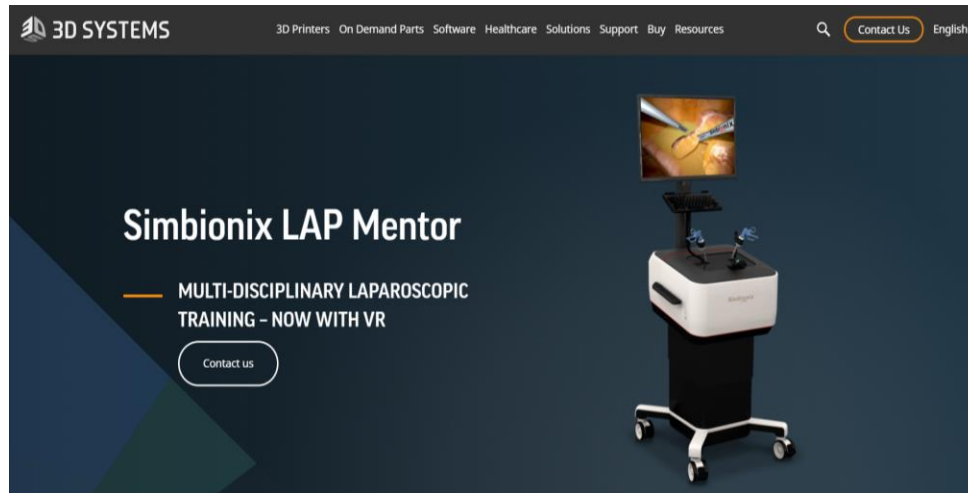
Laparoscopic simulator

LAPAROSCOPIC SURGICAL SIMULATION



Total virtual simulation

LAP MENTOR



LAP Mentor III

- Superior haptic feedback
- Ergonomic design: adjustable height



LAP Mentor Express

- Portable
- Cost effective
- Height adjustable tower
- Non-haptic

Total virtual simulation LAP MENTOR

Team Training

Enabled by combining the LAP Mentor Express with the haptic LAP Mentor to allow mastering the surgical assistant's roles, practice non-technical skills and enhance team performance.

Nurse Tool Selection

Allows the scrub nurse to select instruments during the case to enable effective surgeon-nurse teamwork, practice clear communication, and anticipate the surgeon's needs.



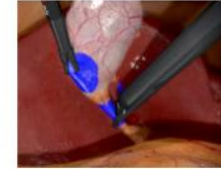
LAP Mentor VR

The LAP Mentor VR allows trainees to work on the simulator while wearing a VR headset, which enables a complete immersive experience in a realistic 3D operating room setting, featuring the OR team, the patient, OR equipment and real-life sound diversions. This setting provides the most true-to-life experience and teaches trainees how to cope with the stressful, and at times distracting, operating room atmosphere.



The Gold Standard of Laparoscopic Training Solutions

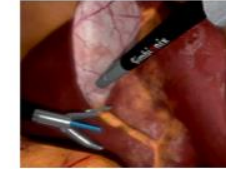
GENERAL SURGERY



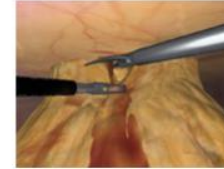
Procedural Tasks -
Lap Chole



Lap Chole



Cholangiography



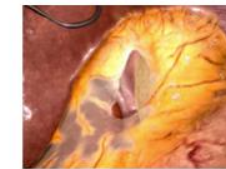
Incisional Hernia



Appendectomy



Inguinal Hernia



Nissen
Fundoplication

BARIATRIC SURGERY



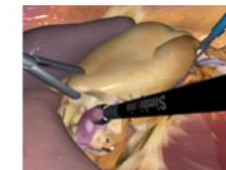
Gastric Bypass

COLORECTAL SURGERY



Sigmoidectomy

UROLOGY SURGERY



Nephrectomy

THORACIC SURGERY



Lobectomy

Over 80 validation studies including VR to OR transfer of skills

Laparoscopic warm-up exercises improve performance of senior-level trainees during laparoscopic renal surgery.
Lee JY et al. *J Endourol.* 2012 May;26(5):545-50

"All appendectomy tasks showed construct validity. A novel goal-directed VR curriculum for laparoscopic appendectomy was constructed."
Sinitsky DM et al., *Development of a structured virtual reality curriculum for laparoscopic appendectomy, The American Journal of Surgery*, <https://doi.org/10.1016/j.amjsurg.2019.04.020>

3D System

THE FUTURE

3D SYSTEMS

3D Printers On Demand Parts Software Healthcare Solutions Support Buy Resources

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Haptic Devices

From physical, to digital, to physical—3D Systems delivers haptic devices that allow a realistic touch of the digital world.

REQUEST A DEMO >



3D SYSTEMS

3D Printers On Demand Parts Software Healthcare Solutions Support Buy Resources

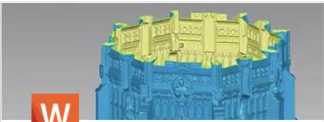
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Reverse Engineering

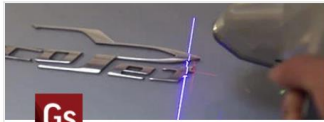
Deliver precise digital 3D models and CAD assemblies of physical objects for design, engineering, and manufacturing. Geomagic® reverse engineering software makes the process of digitally representing and engineering from the physical world fast, easy, and accurate. **Download an eBook to learn how to drive product innovation with reverse engineering.** Not sure which reverse-engineering software is right for you? **Download the decision tree.**



Geomagic Design X
Reverse Engineering Software



Geomagic Wrap
3D Scanning Software



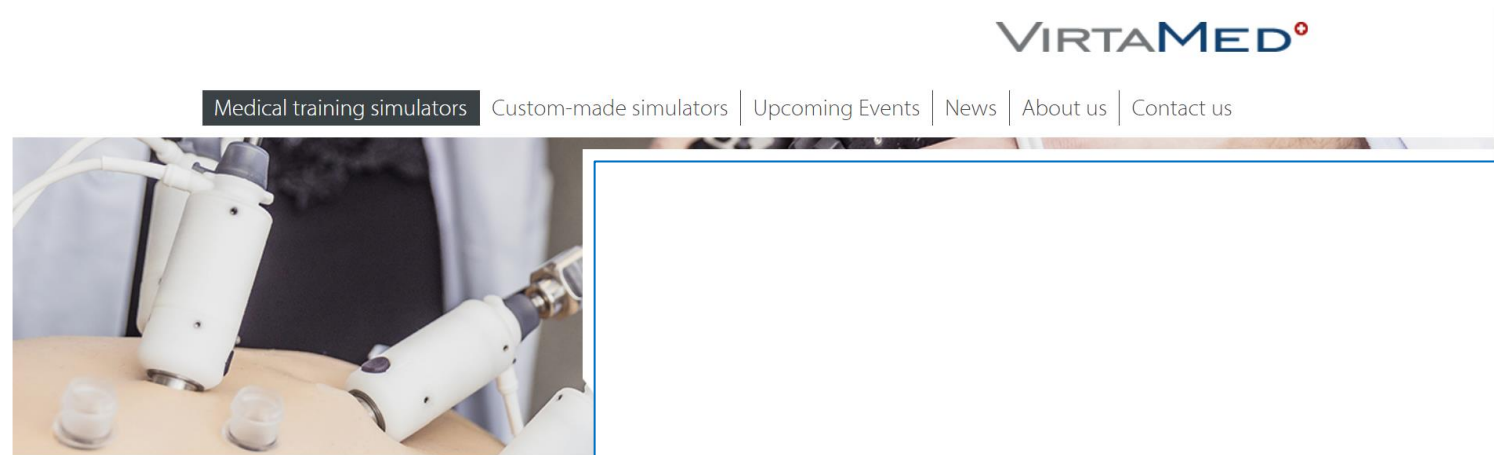
Geomagic for
SOLIDWORKS
Reverse Engineering
SOLIDWORKS S

Geomagic Wrap 2021 è qui!



Total virtual simulation

VIRTAMED

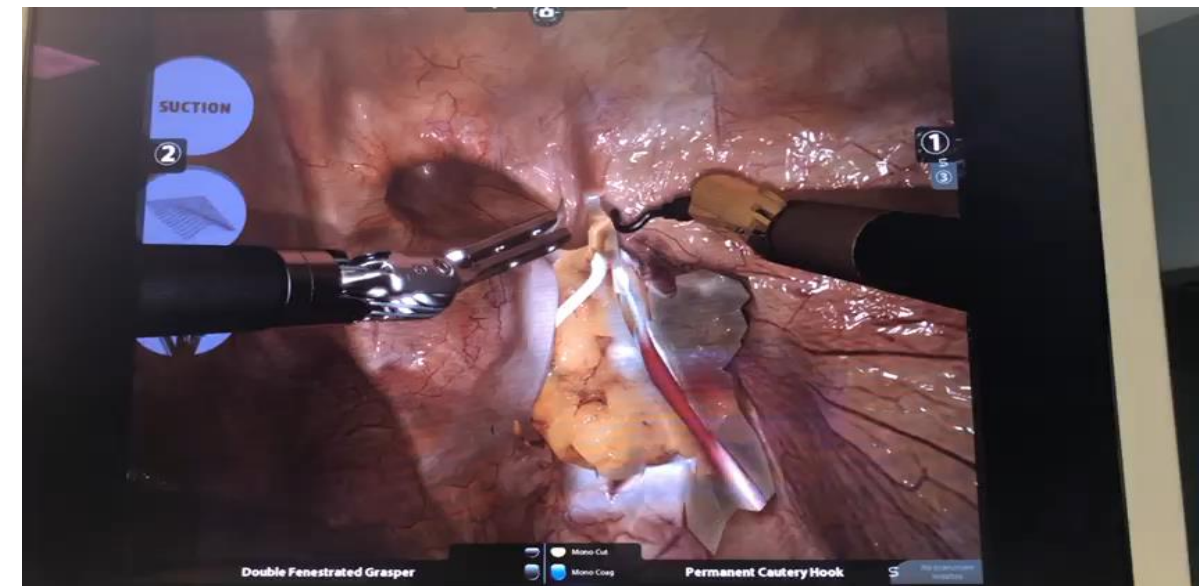


VirtaMed LaparoS™

- Innovative laparoscopic skills training derived from validated concepts
- Start with patient safety: abdomen positioning and trocar placement
- Condensed sequences teach key skills in realistic anatomical environments
- Motivational learning with proficiency-based progression

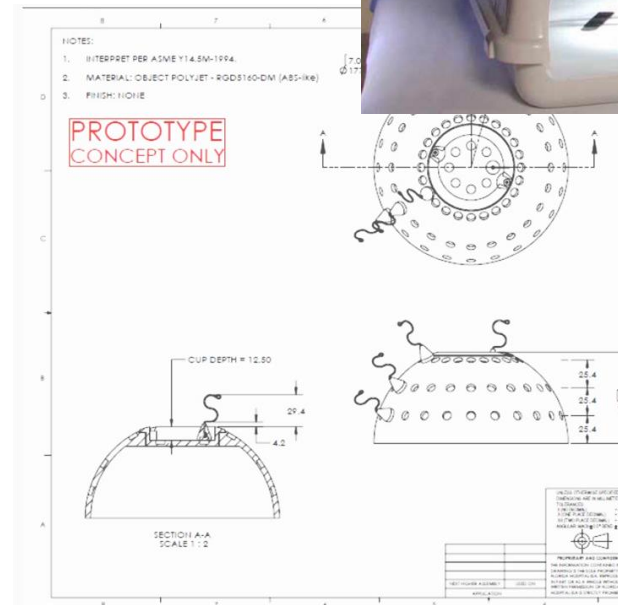
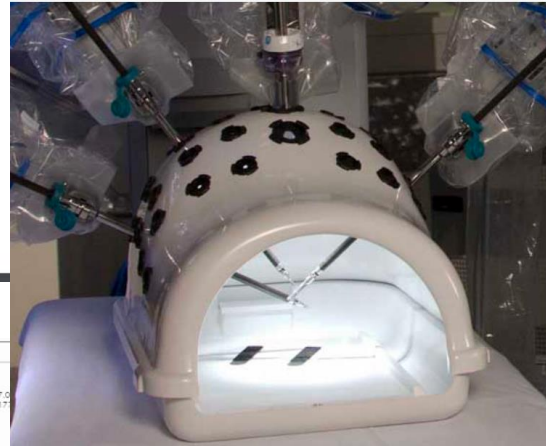
Robotic Surgery

DV SKILL SIMULATOR



Robotic Surgery

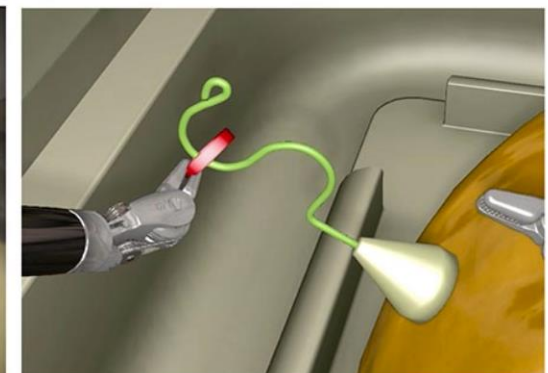
FRS



Physical Model



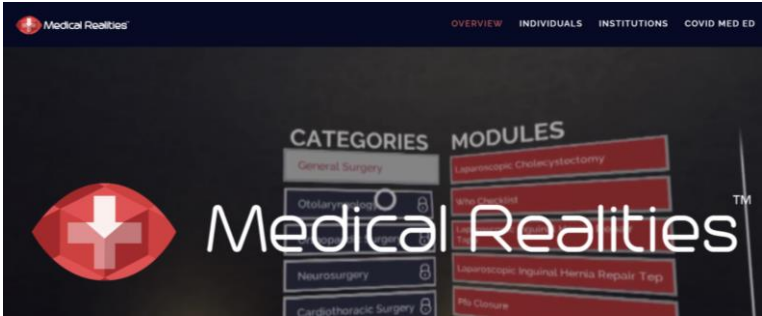
Simulation Model



These models will be studied in a validation study to determine if they are truly equivalent.

VR Surgical GAMES

MEDICAL REALITIES



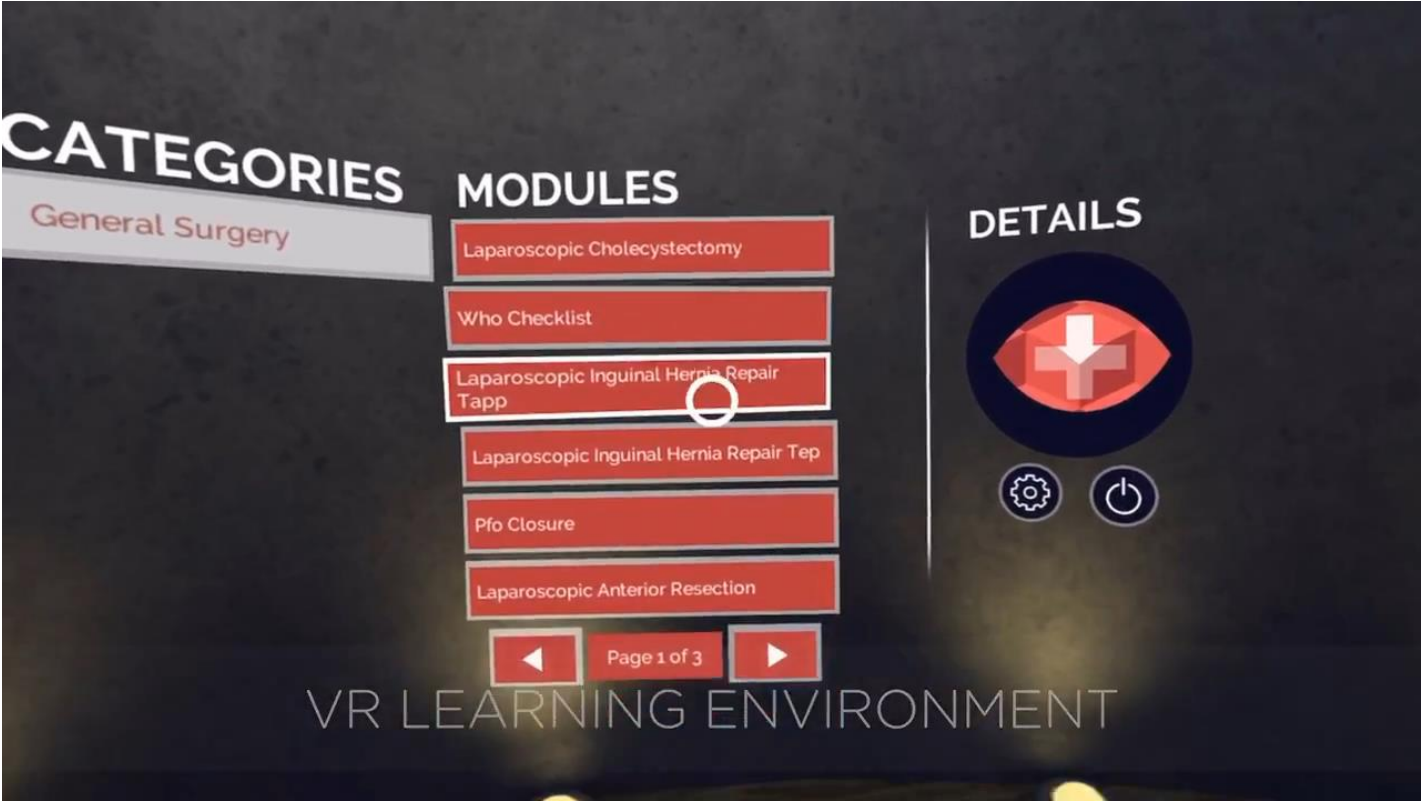
MEDICAL STUDENTS



HEALTHCARE PROFESSIONALS

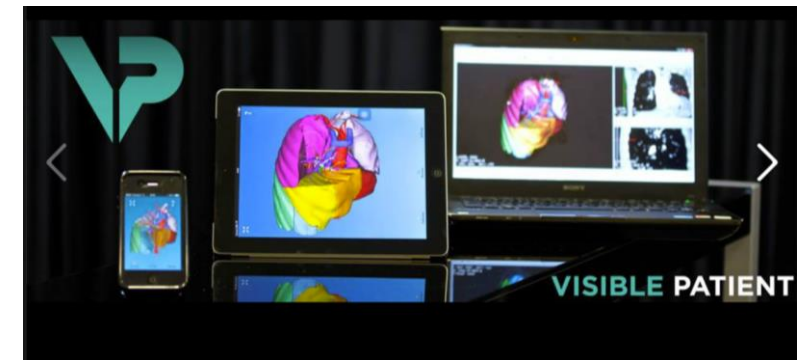
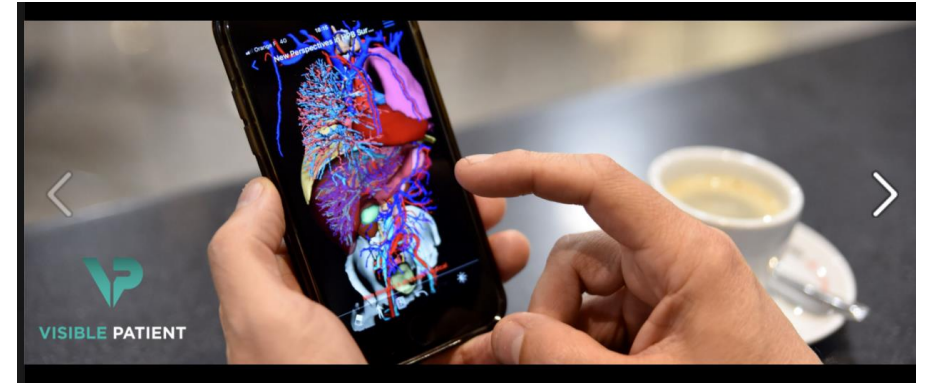
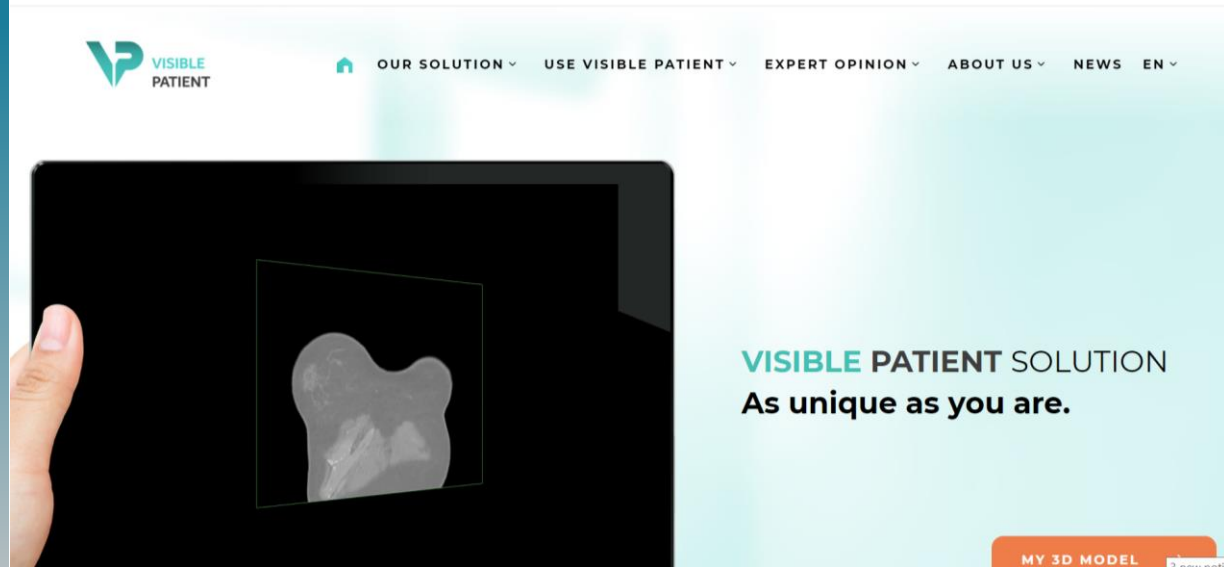


INSTITUTIONS



Surgical Planning

VISIBLE PATIENT



PRODUCTS CUSTOM PROJECTS COMPANY CONTACT UPLOAD DATA



ImmersiveTouch creates fully explorable 3D virtual reality models from a patient's own CT and MR data.

Surgical Coaching ACADEMY



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Coach Training Dates



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AI and coaching ...FOR NOW

From personalized training to precision training

Going beyond trainees's categorization

Data mining on skills' ontology



AI and coaching ...FOR NOW

NO AI

Different courses for different categories

Few variables

Little or no personalization

AI powered

Ontology and Profiling

No standard pathways

Milestones

Totally personalized



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Research Field ...OR LAB!

Core lab including pedagogues, argumentation engineers, clinicians, psychologists, data scientists, VR experts

Single projects/grants, but same vision

Big picture: autonomous surgery through surgical mindset and performance analysis



So...

TAKE OFFICE MESSAGE

Due to

specialization, technology, needing, shortage...

Surgical Training has to be considered a self standing new professional field

AI can make precision training/coaching possible



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