

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



Background

TERMINOLOGY

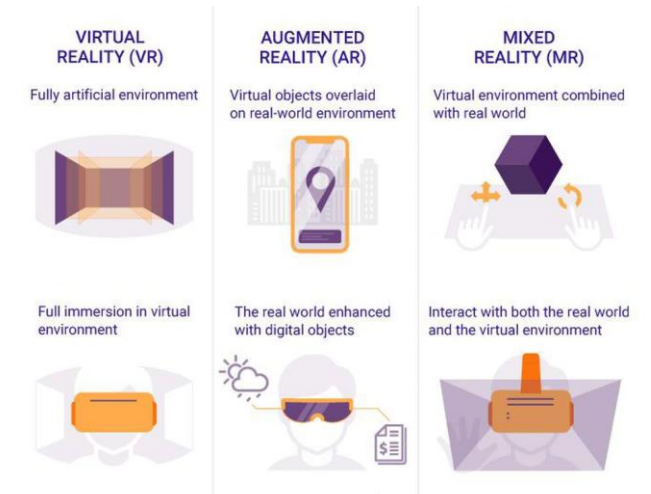
Virtual Reality, Augmented Reality, Mixed Reality, Immersive Content

HMD (Head Mounted Display) or Mobile VR

Interactive VR

Augmented Reality: *Pokemon Go* by Niantic

Mixed Reality: Greenscreen technology



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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

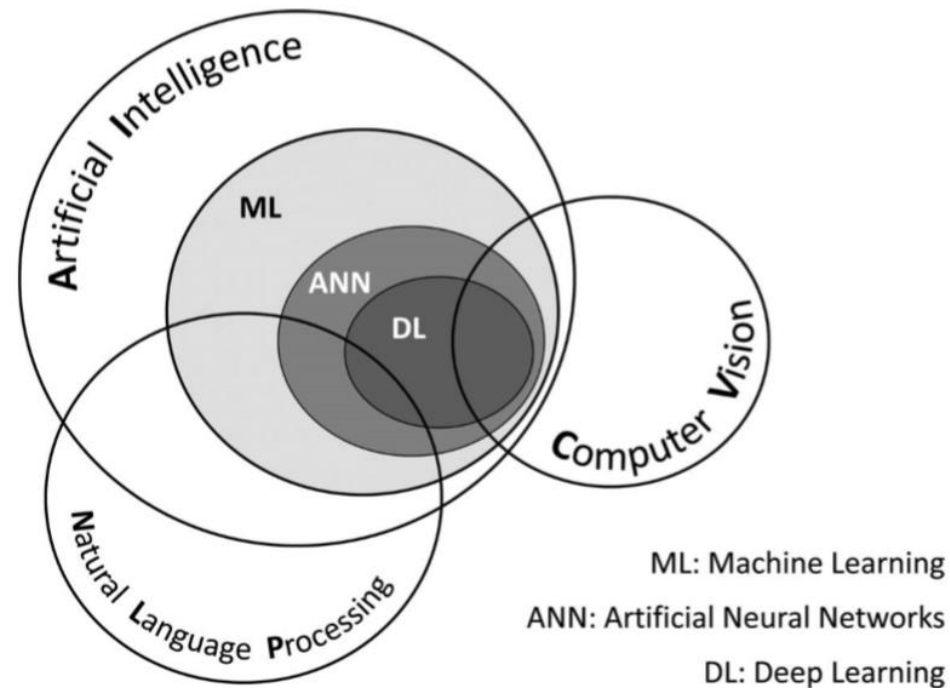


FIGURE 1. Hypothetical representation of AI subfields. AI indicates artificial intelligence.

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

Ruth Aylett
Centre for Virtual Environments
University of Salford
Salford, M5 4WT
United Kingdom

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

Laparoscopic simulator

LAPAROSCOPIC SURGICAL SIMULATION

VIDEO

VIDEO

VIDEO

VIDEO

VIDEO

CAE

LAPAROSCOPY SIMULATOR
LAPVR

workstation

SIMENDO

LAPAROSCOPY SIMULATOR

workstation

Applied Medical

TRAINING SIMULATOR
LT001

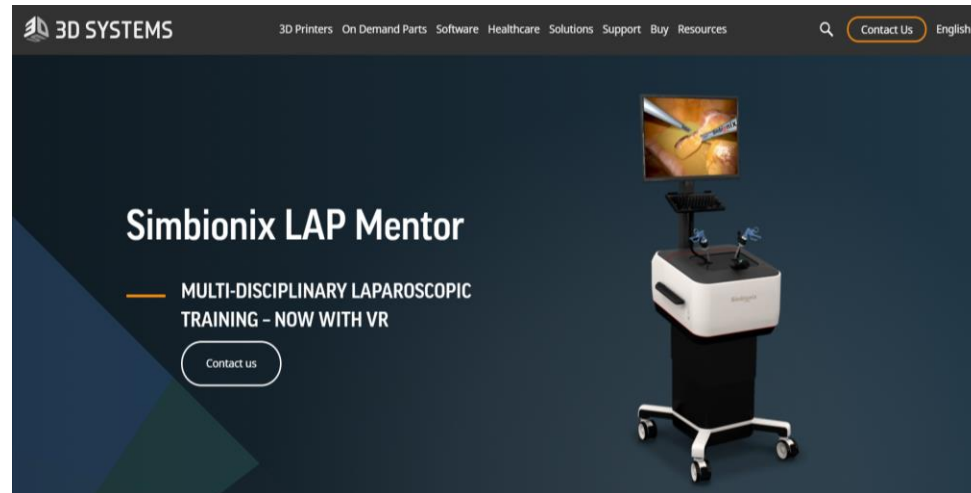
for laparoscopy
workstation
portable

LAPARO
Medical Simulators

TRAINING SIMULATOR
ASPIRE

laparoscopy
workstation
portable

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.

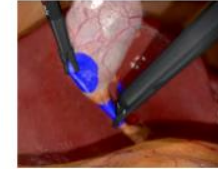
LAP Mentor VR

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

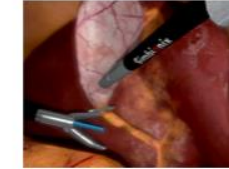
GENERAL SURGERY



Procedural Tasks - Lap Chole



Lap Chole



Cholangiography



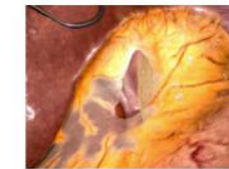
Incisional Hernia



Appendectomy



Inguinal Hernia



Nissen Fundoplication

BARIATRIC SURGERY



Gastric Bypass

COLORECTAL SURGERY



Sigmoidectomy

UROLOGY SURGERY



Nephrectomy

THORACIC SURGERY



Lobectomy

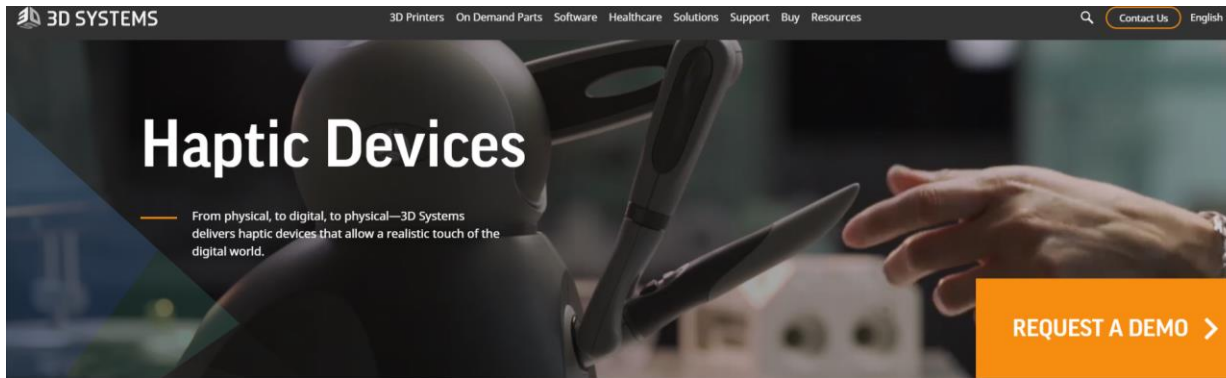
Over 80 validation studies including VR to OR transfer of skills

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

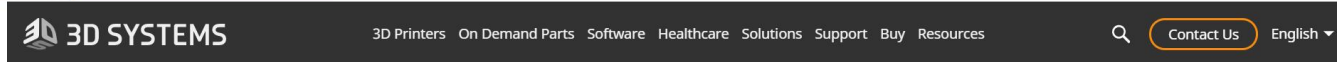


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Haptic Devices

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

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Reverse Engineering

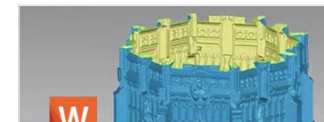
Deliver precise digital 3D models and CAD assemblies of physical objects for design, engineering, and manufacturing. Geomagic® reverse engineering software makes the process of digitally representing and engineering from the physical world fast, easy, and accurate. **Download an eBook to learn how to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



Dx

Geomagic Design X

Reverse Engineering Software



W

Geomagic Wrap

3D Scanning Software



Gs

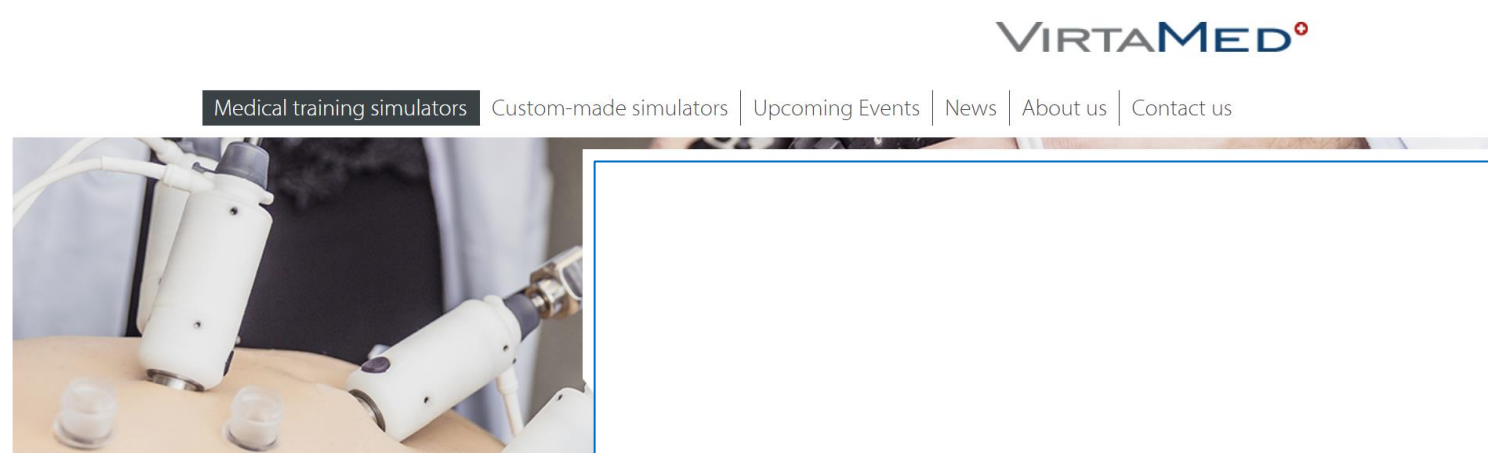
Geomagic for SOLIDWORKS

Reverse Engineering Software Geomagic Wrap 2021 è qui



Total virtual simulation

VIRTAMED

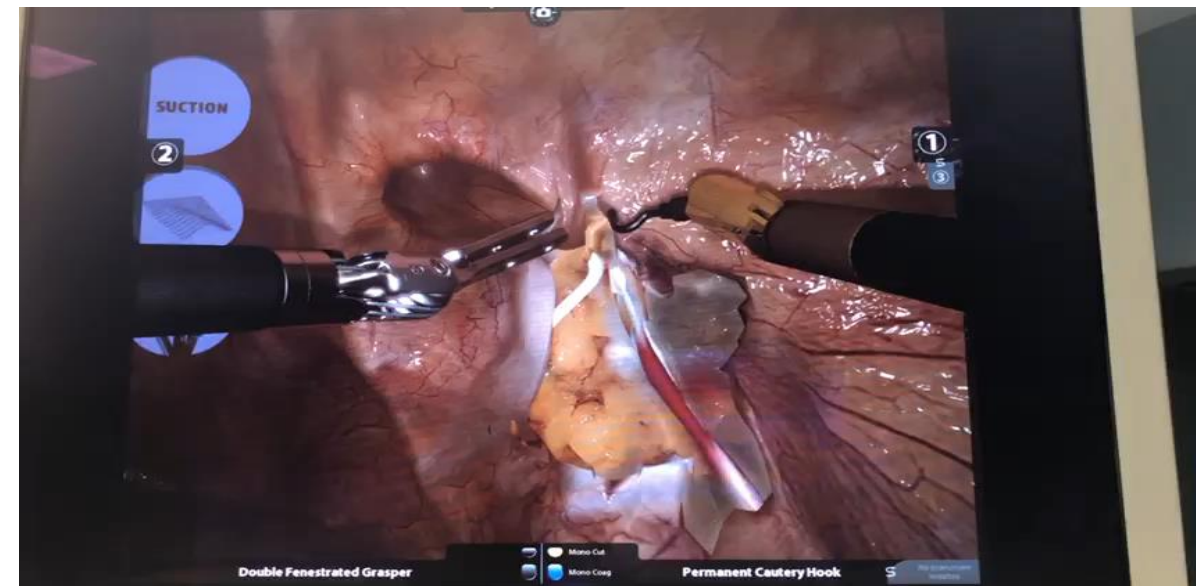
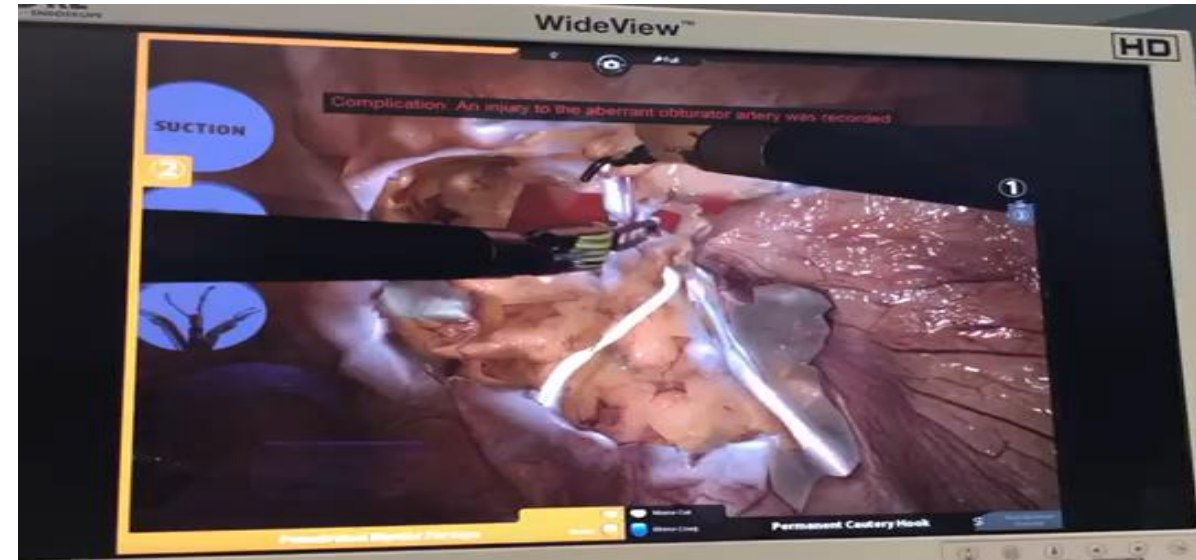


VirtaMed LaparoS™

- 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

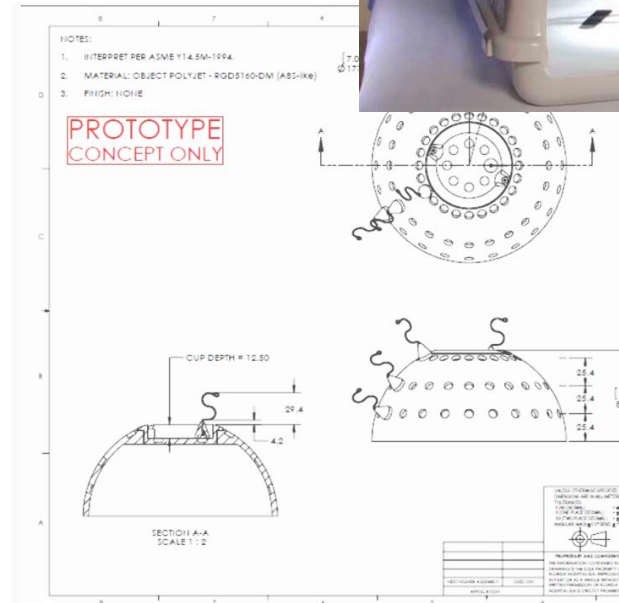
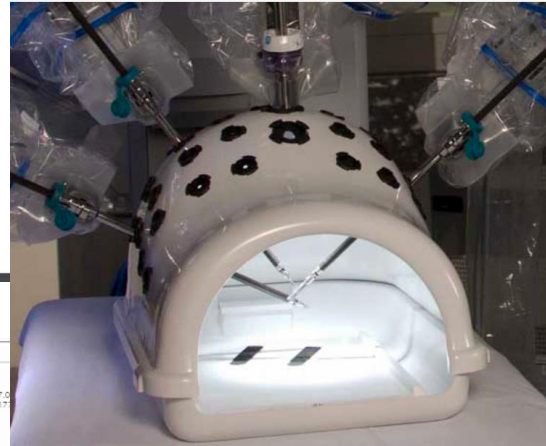


Robotic Surgery

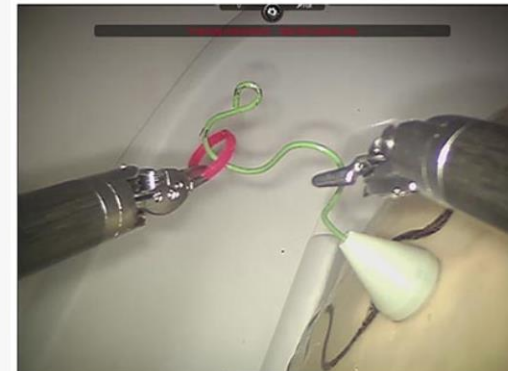
FRS



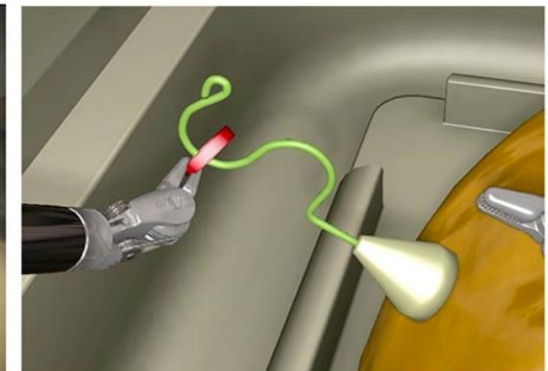
Fundamentals of Robotic Surgery



Physical Model

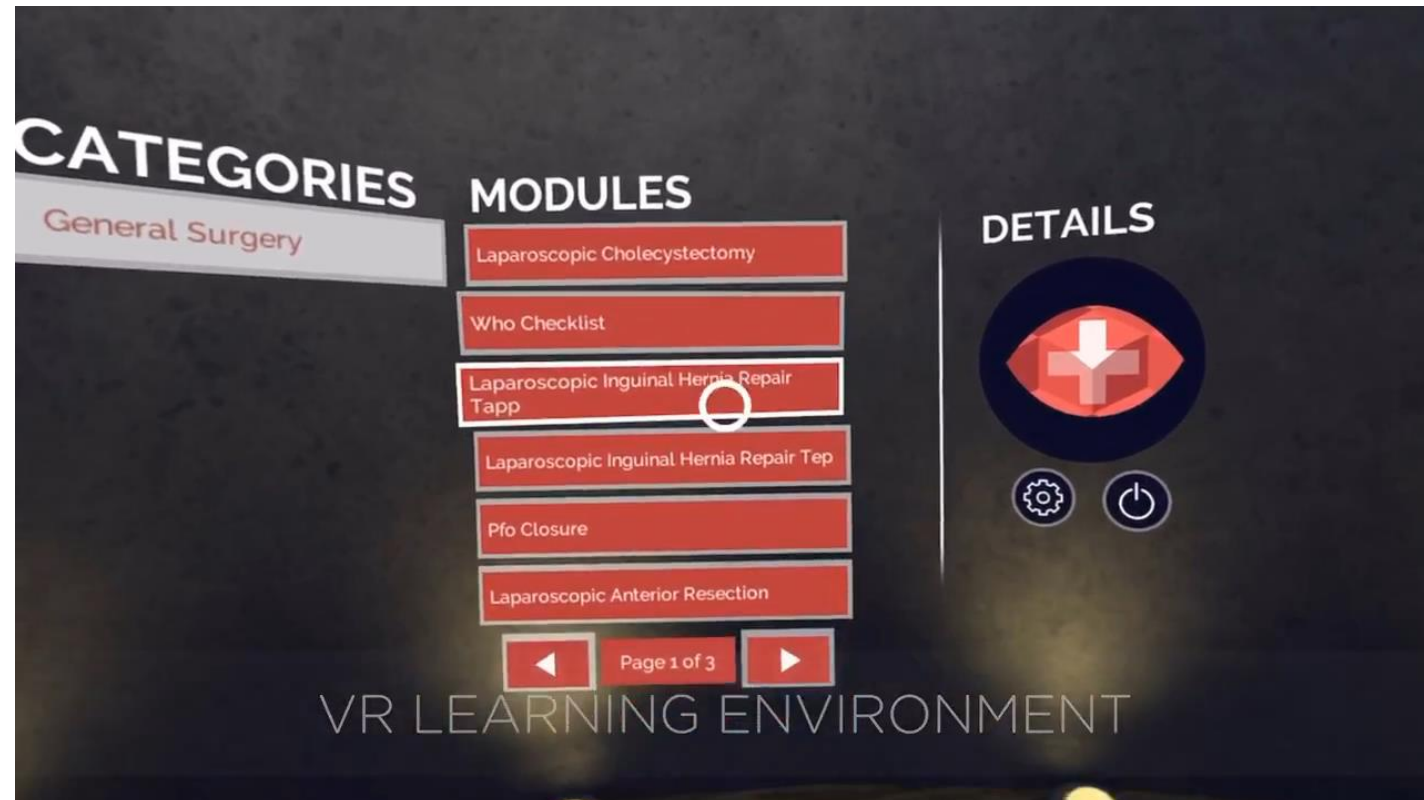
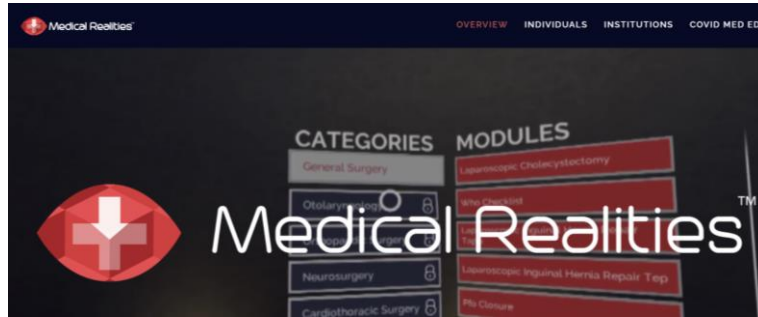


Simulation Model



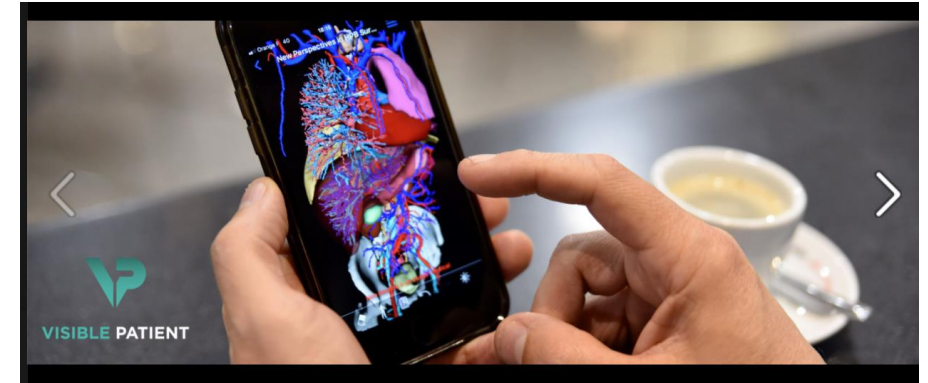
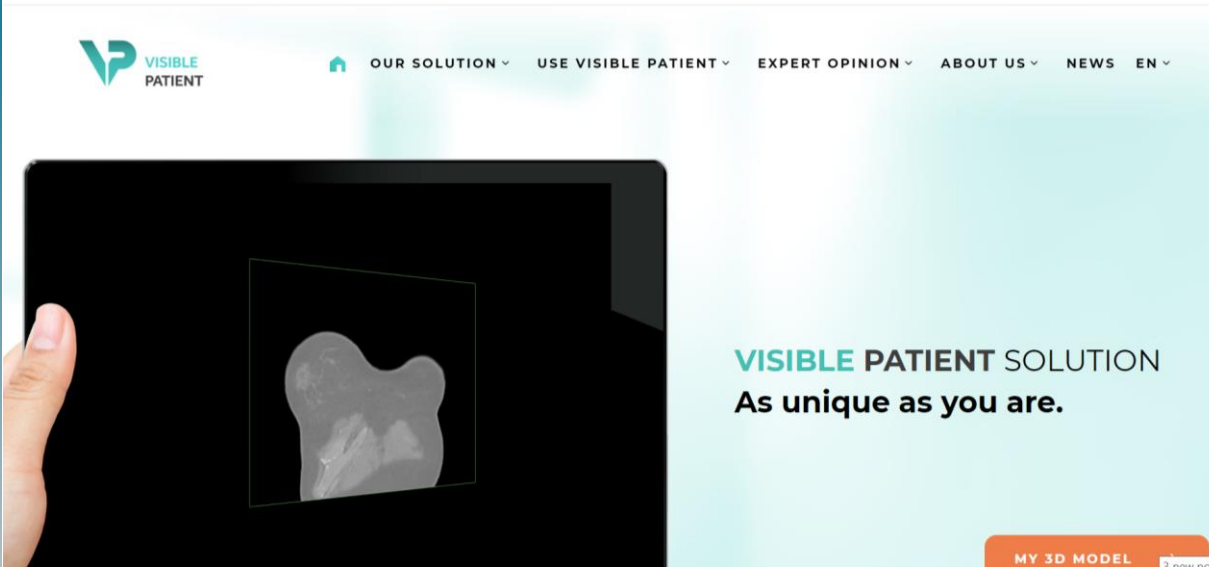
These models will be studied in a validation study to determine if they are truly equivalent.

VR Surgical GAMES MEDICAL REALITIES



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' 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



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



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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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