Approaches and Challenges to Virtual and Augmented Reality in Health Care and Rehabilitation

a short course proposal

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SA '20 Courses, December 04-13, 2020, Virtual Event, Republic of Korea
ACM 978-1-4503-8112-3/20/11.
10.1145/3415263.3419174

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Health and Well-being

Persuasive Computing

Behavior Change Technologies

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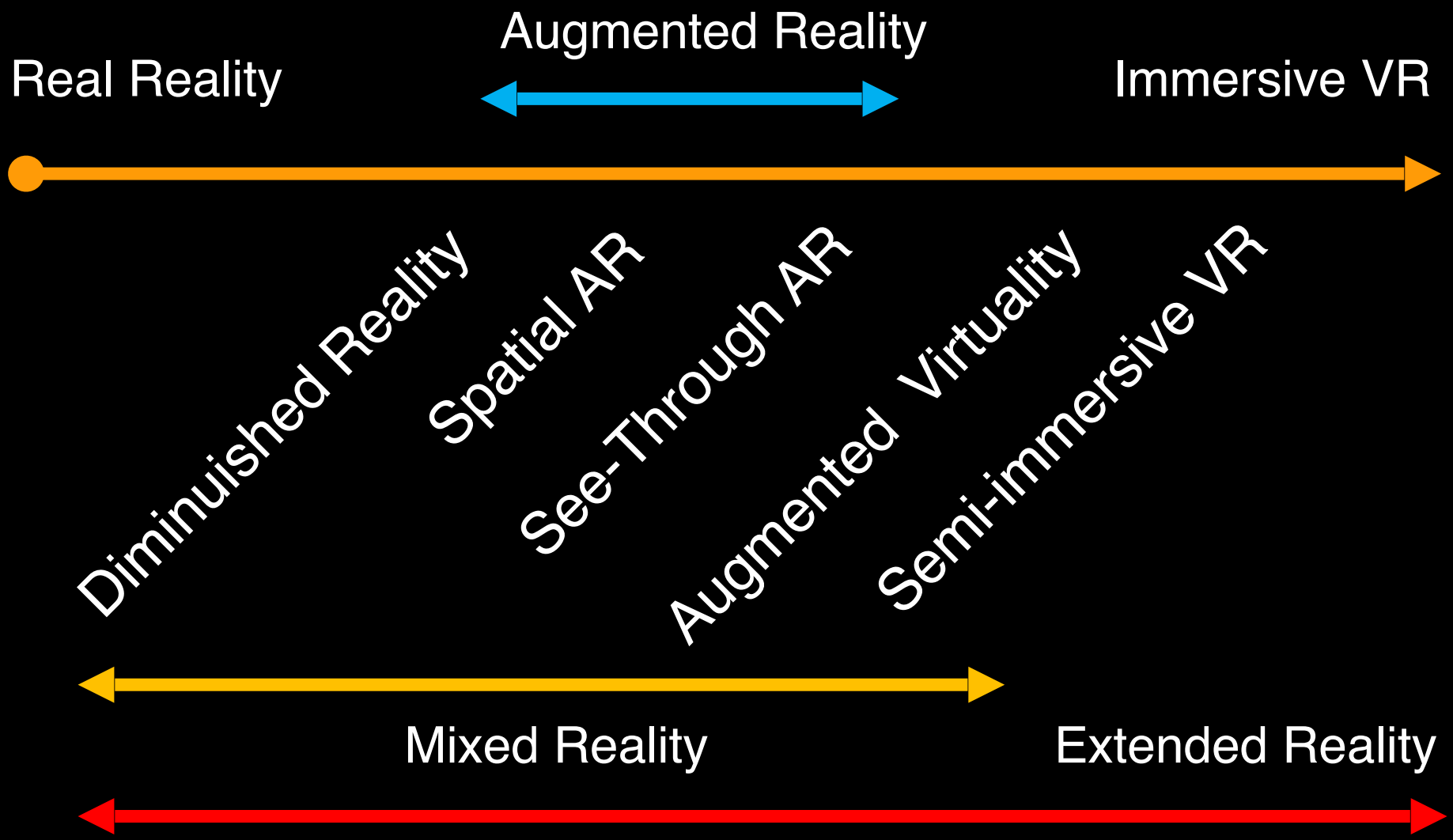
Introduction and Motivation


Medical UI/UX

Reality–Virtuality Continuum



Challenges

Building a network of healthcare professionals

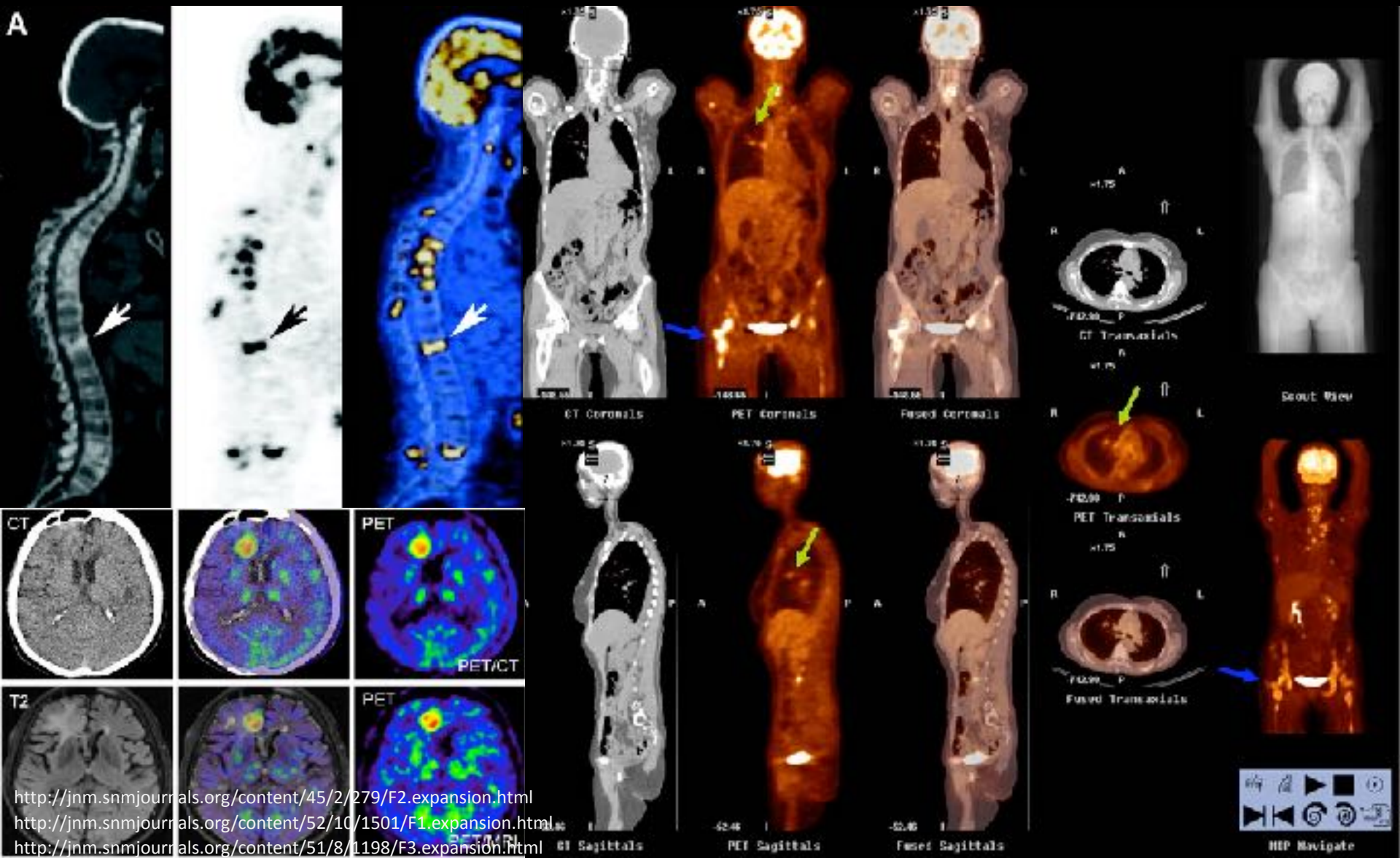
Identifying current practices

Linguistic Barrier

Big Picture but no Specs

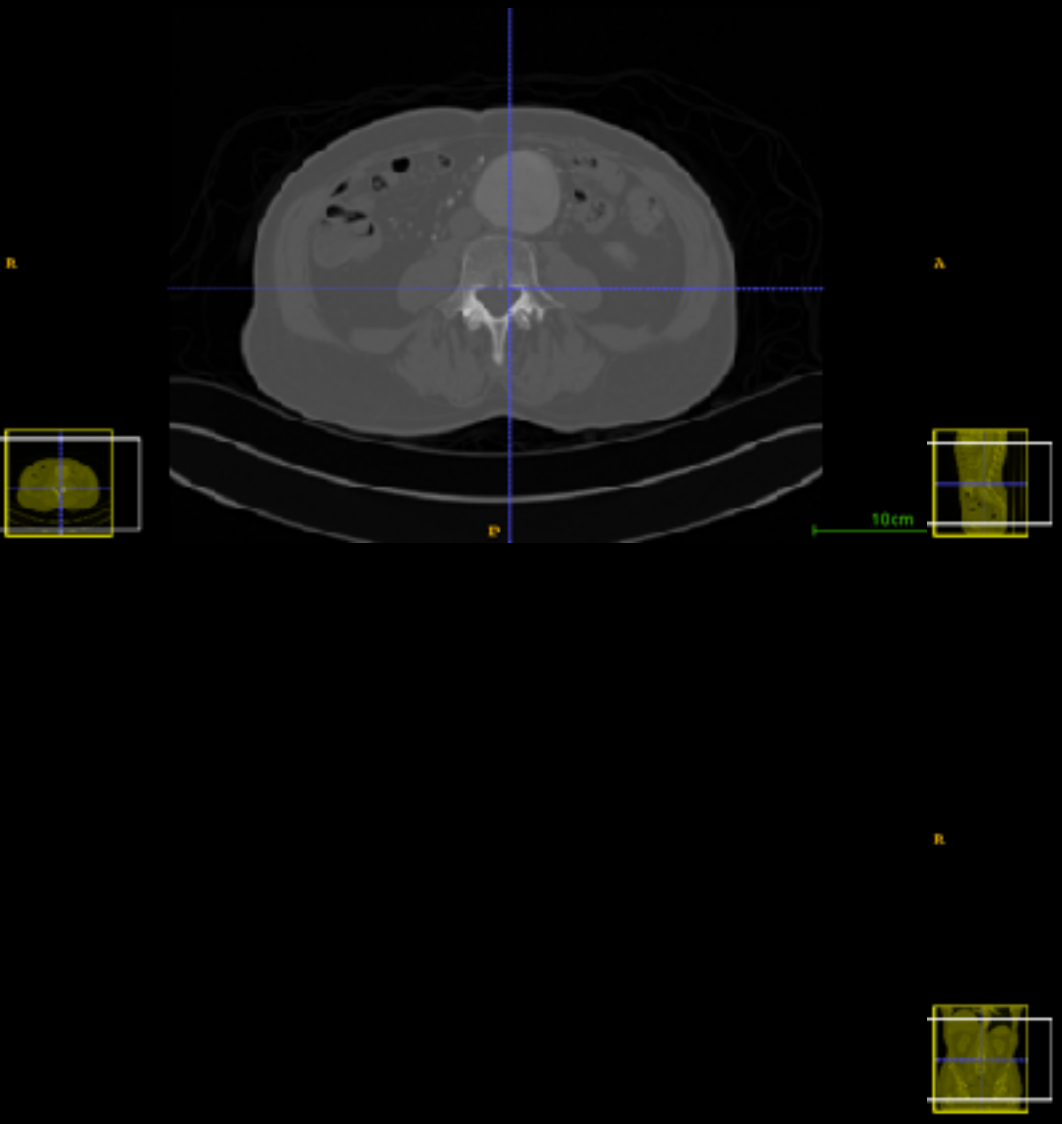
“Automagic worshippers”

Motivation



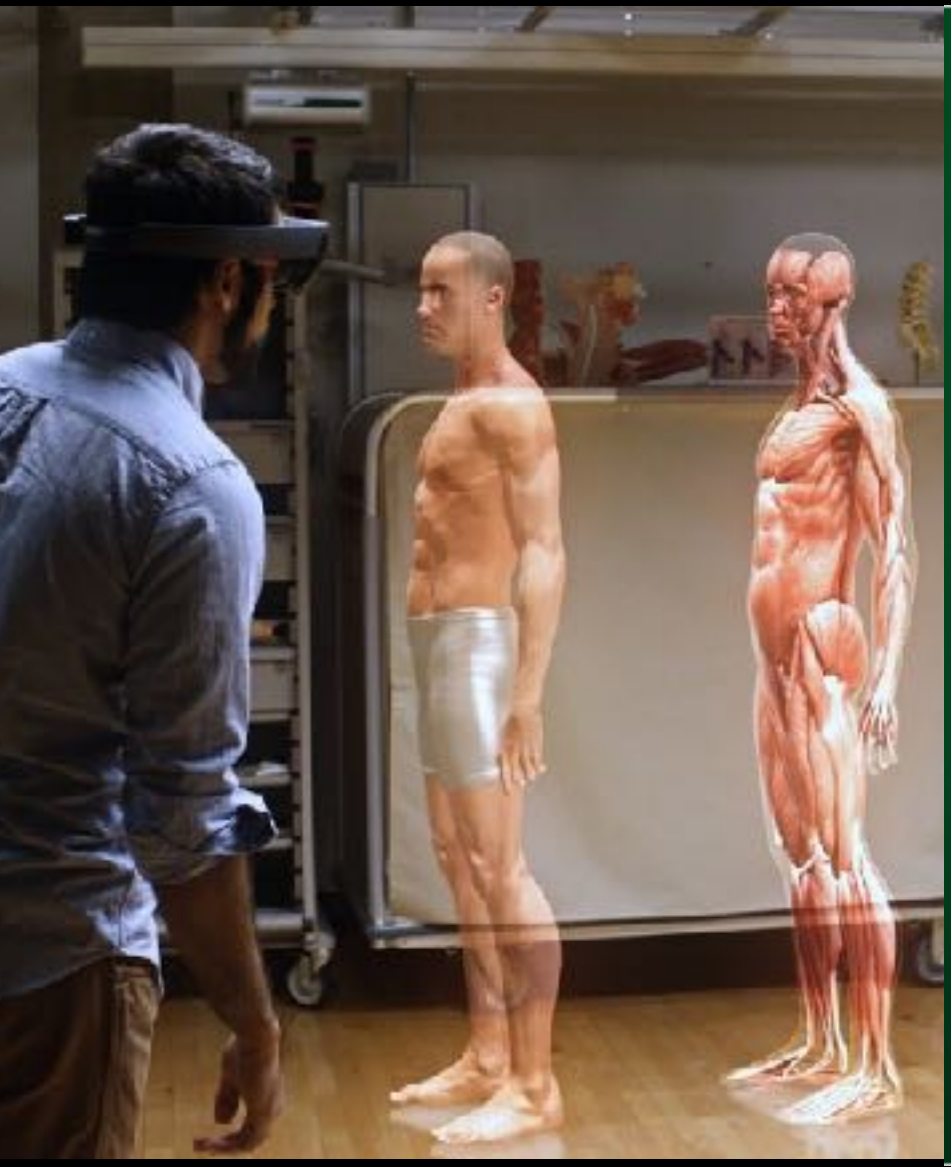
http://jnm.snmjournals.org/content/45/2/279/F2.expansion.html
http://jnm.snmjournals.org/content/52/10/1501/F1.expansion.html
http://jnm.snmjournals.org/content/51/8/1198/F3.expansion.html

Motivation



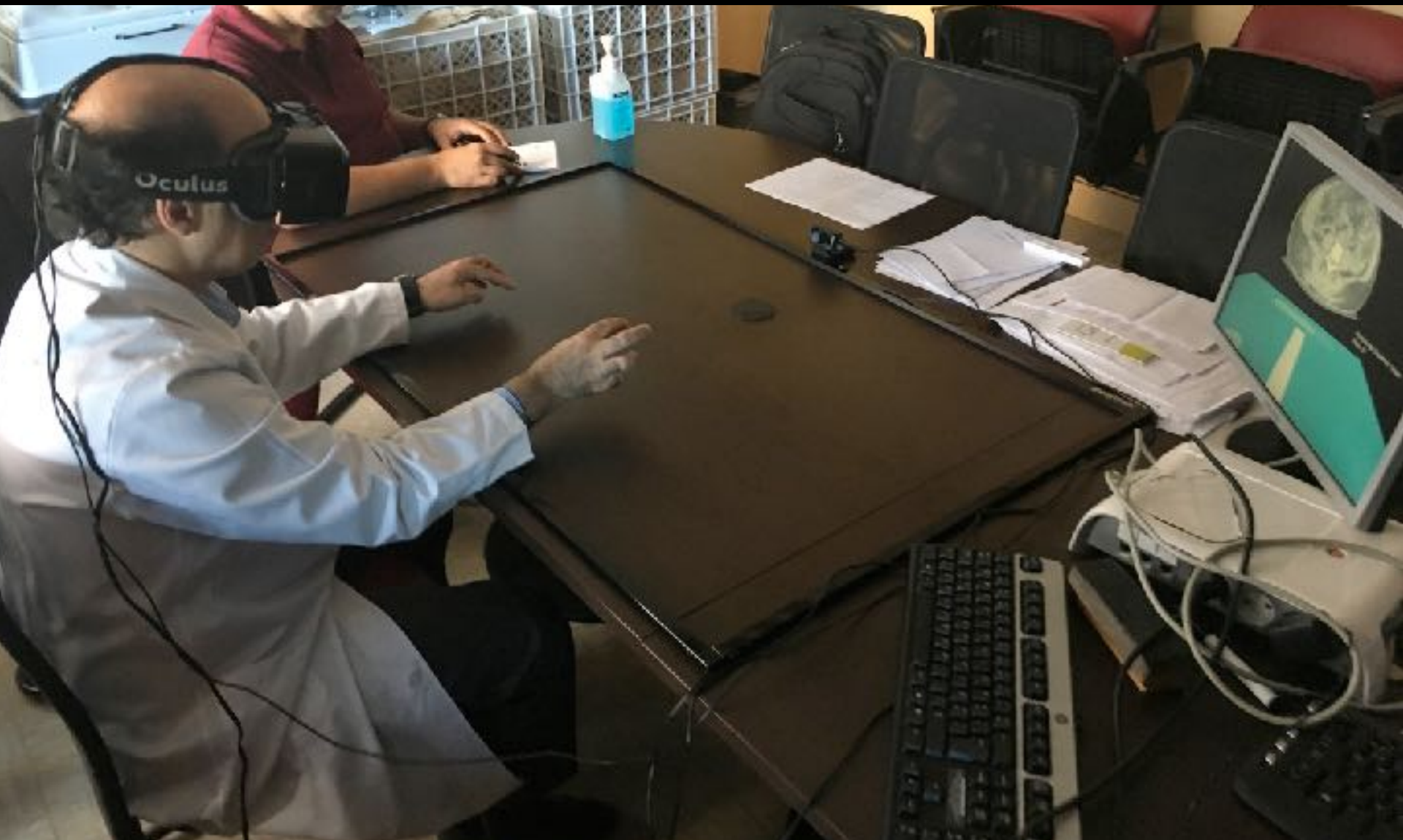
Motivation

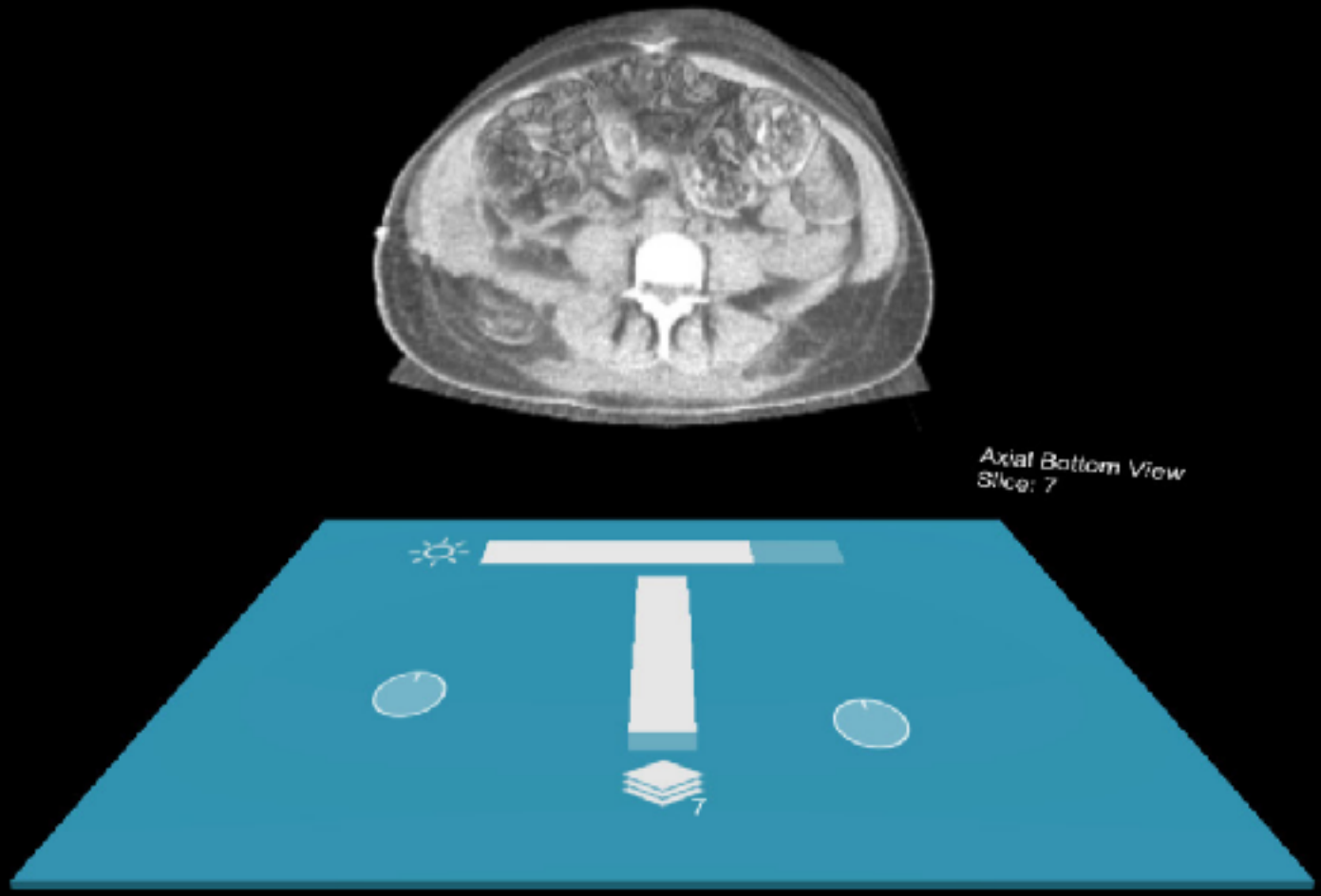
Extend the Reality: Learning



and Collaboration

Scenario: Radiodiagnostics

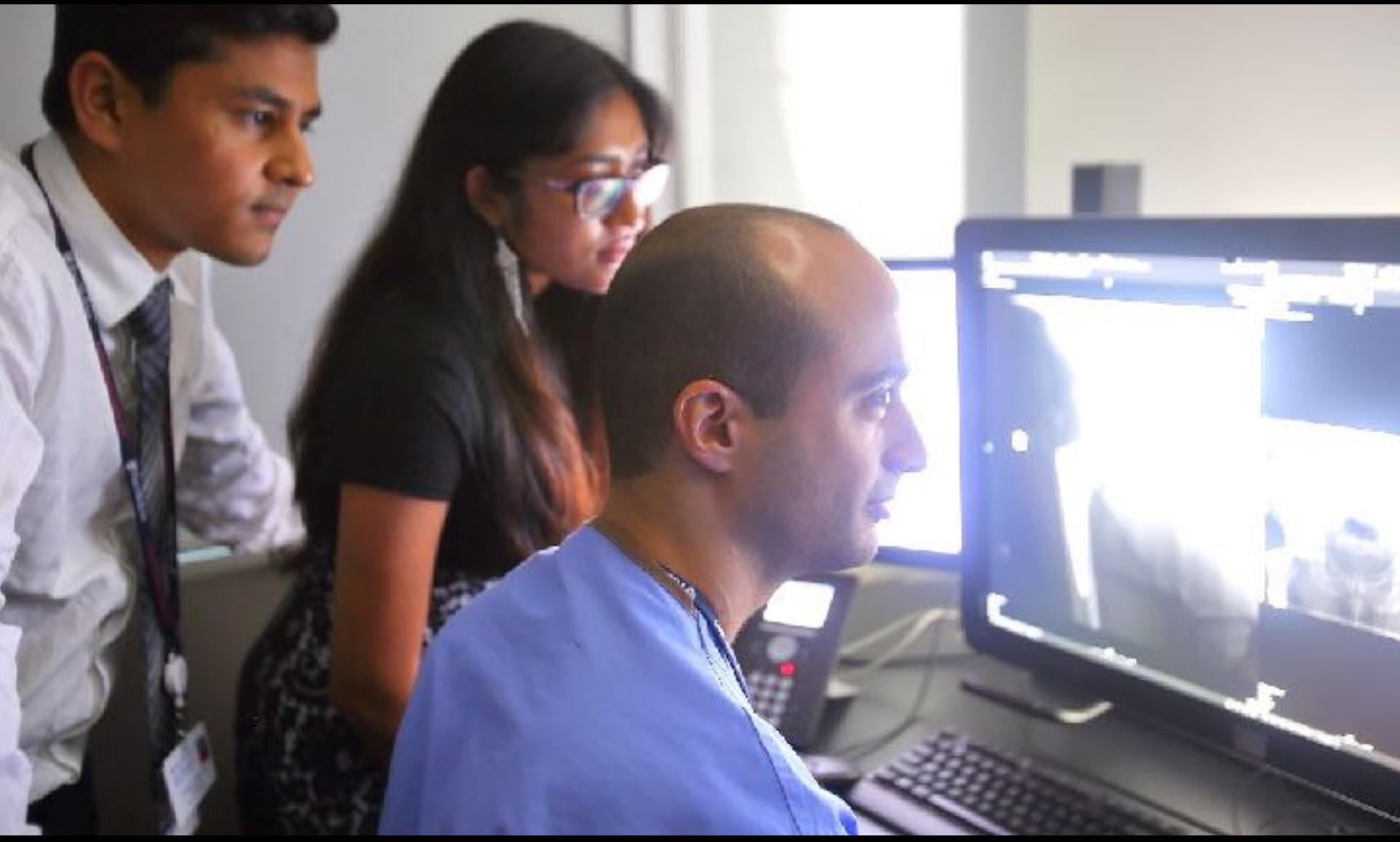




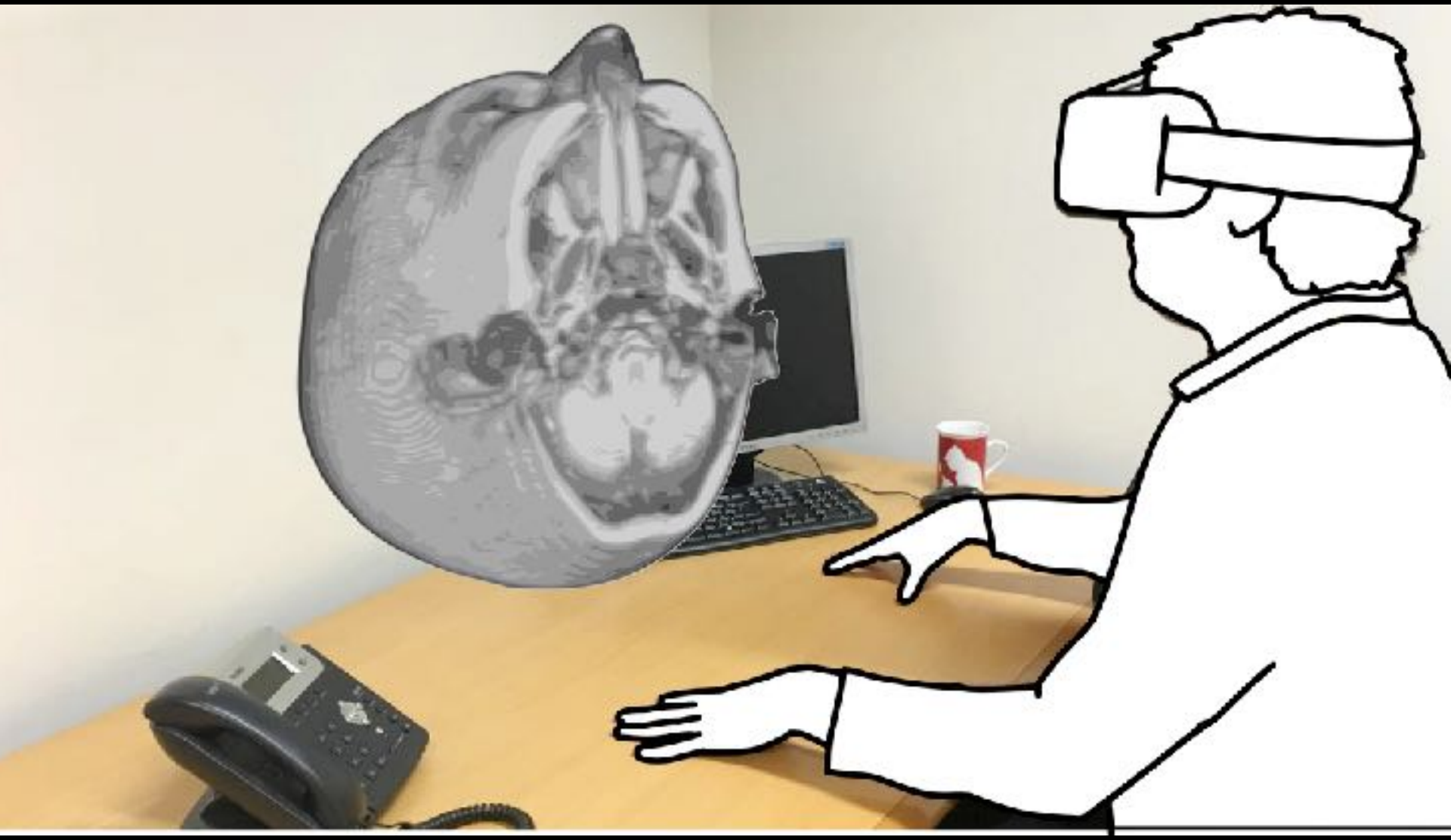
VRRRRoom: Virtual Reality for Radiologists in the Reading Room CHI 2017

VR for Radiologists in the Reading ROOM

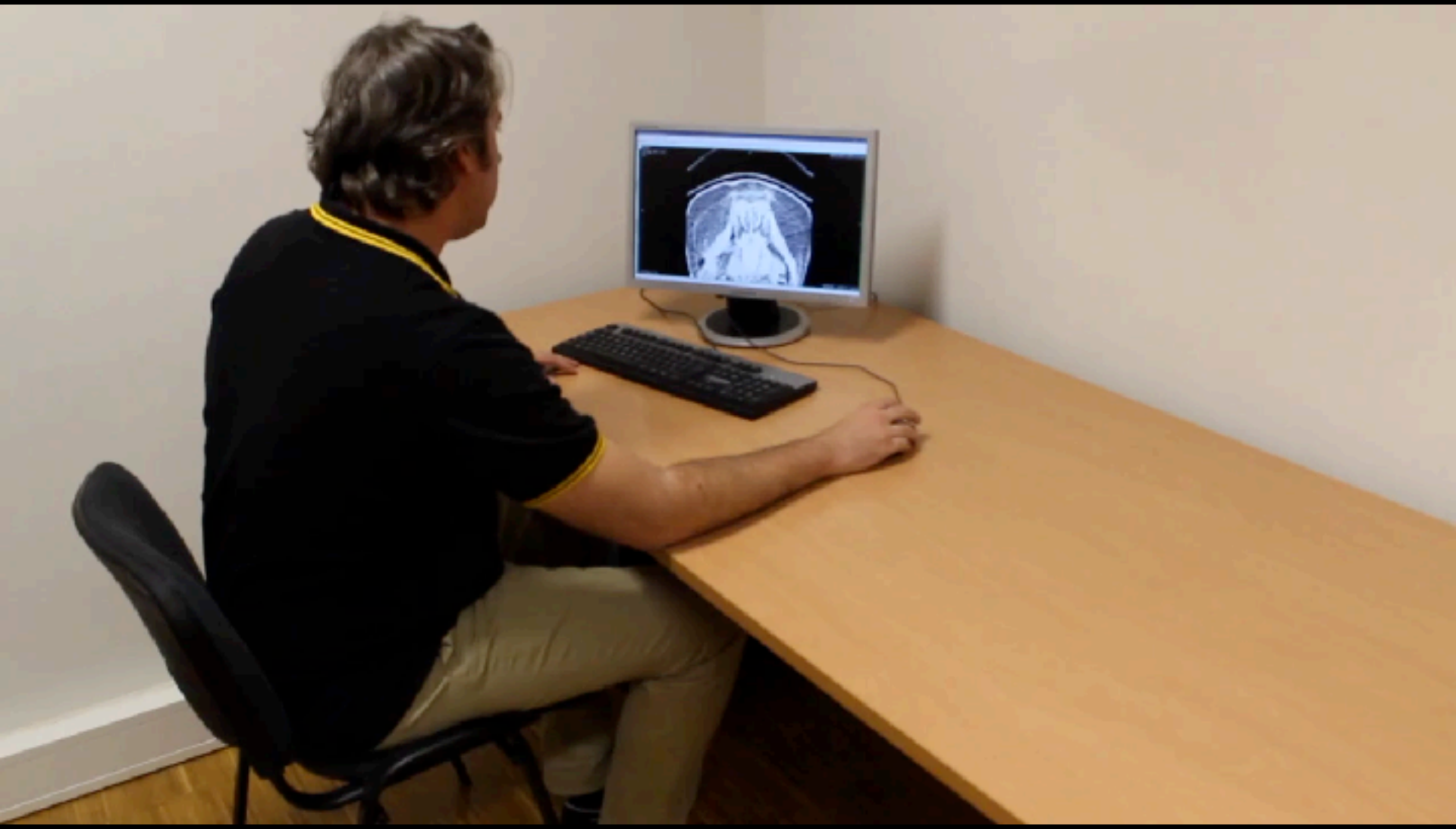
VR for Radiologists in the Reading Room



VR for Radiologists in the Reading Room

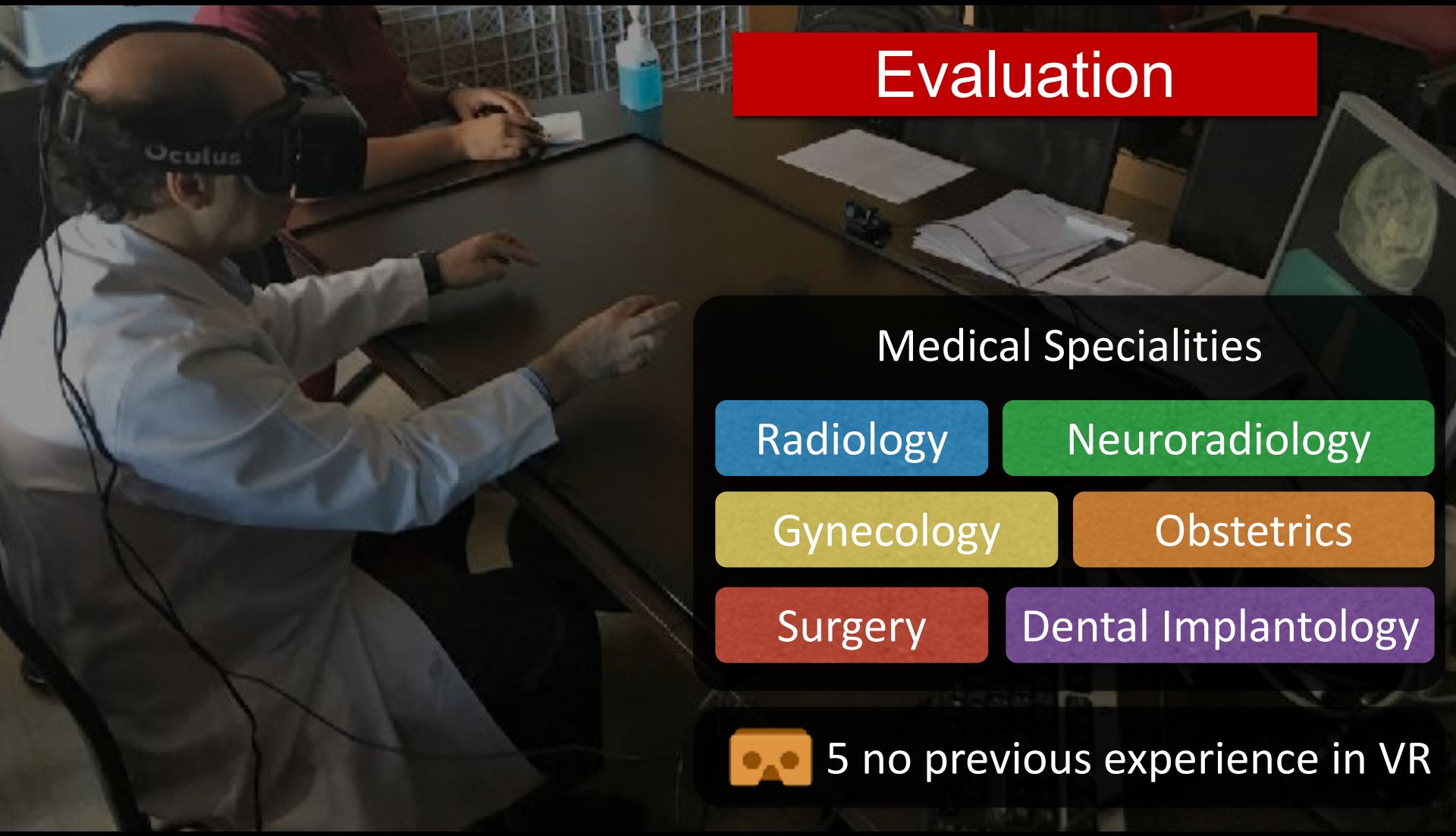


VR for Radiologists in the Reading Room



https://www.youtube.com/watch?v=bsNwV4BhJOw

VR 4 Radiologists in the Reading ROOM



Evaluation

Medical Specialities

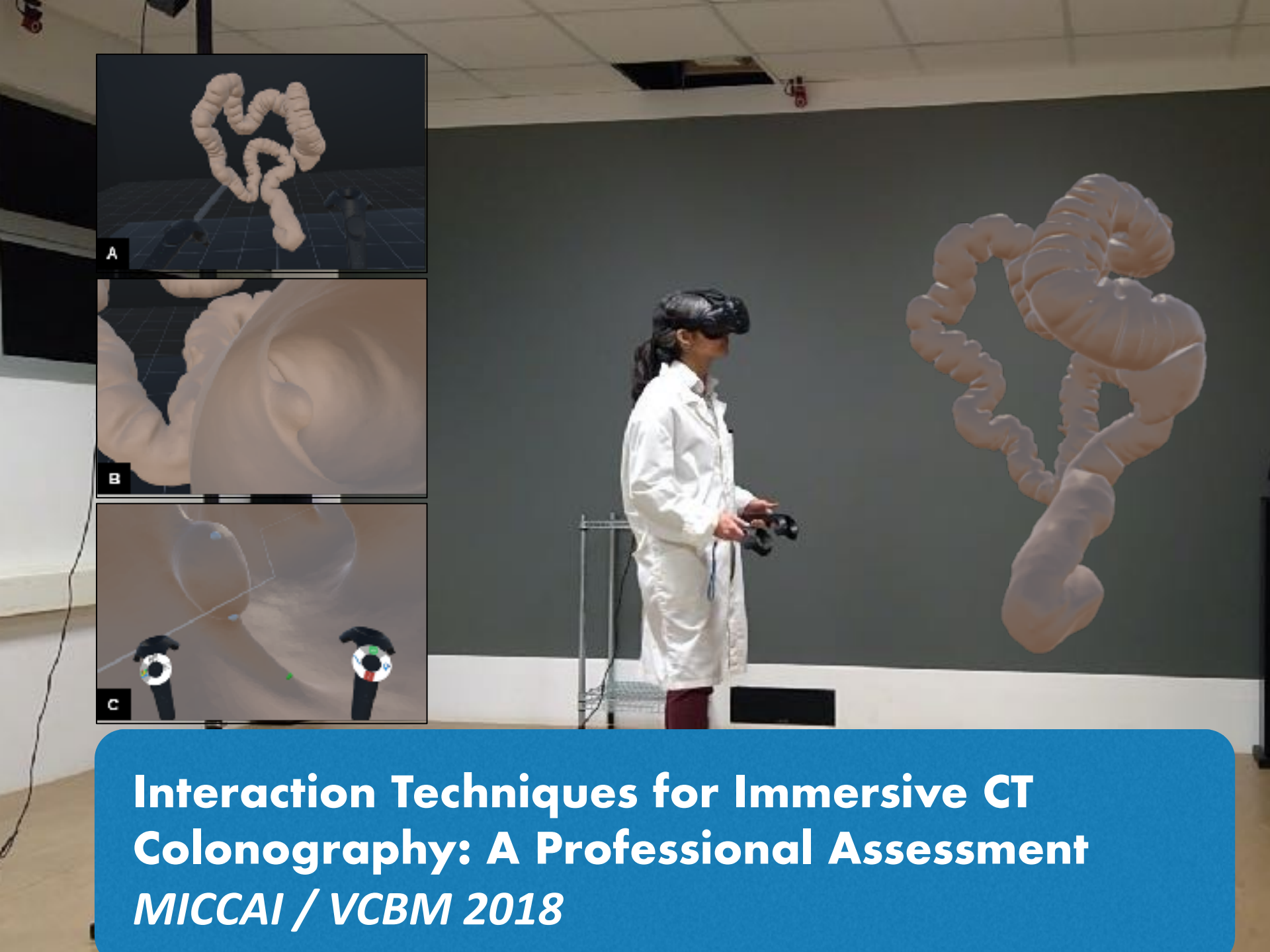
- Radiology
- Neuroradiology
- Gynecology
- Obstetrics
- Surgery
- Dental Implantology

5 no previous experience in VR

Virtual Colonoscopy


Problem

Problematic



Interaction Techniques for Immersive CT Colonography: A Professional Assessment

MICCAI / VCBM 2018


https://youtu.be/_9EMhjI3kYw

Professional Assessment
5M+2F Doctors

Diagnostic: Minutes << HOURS!

Evaluation

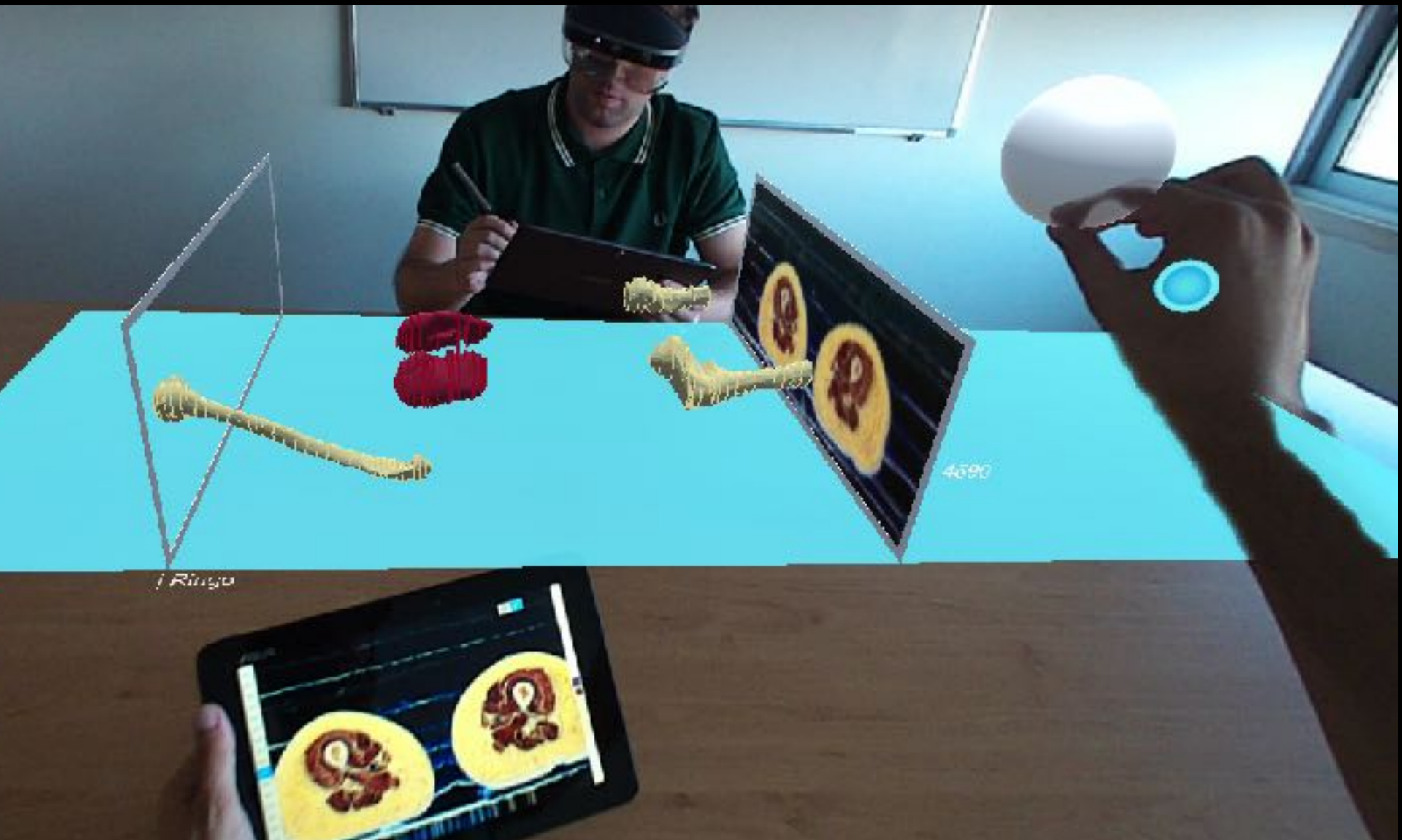
+ immersion
+ freedom of movement
+ World In Miniature navigation

- limited camera control
- Improvements needed

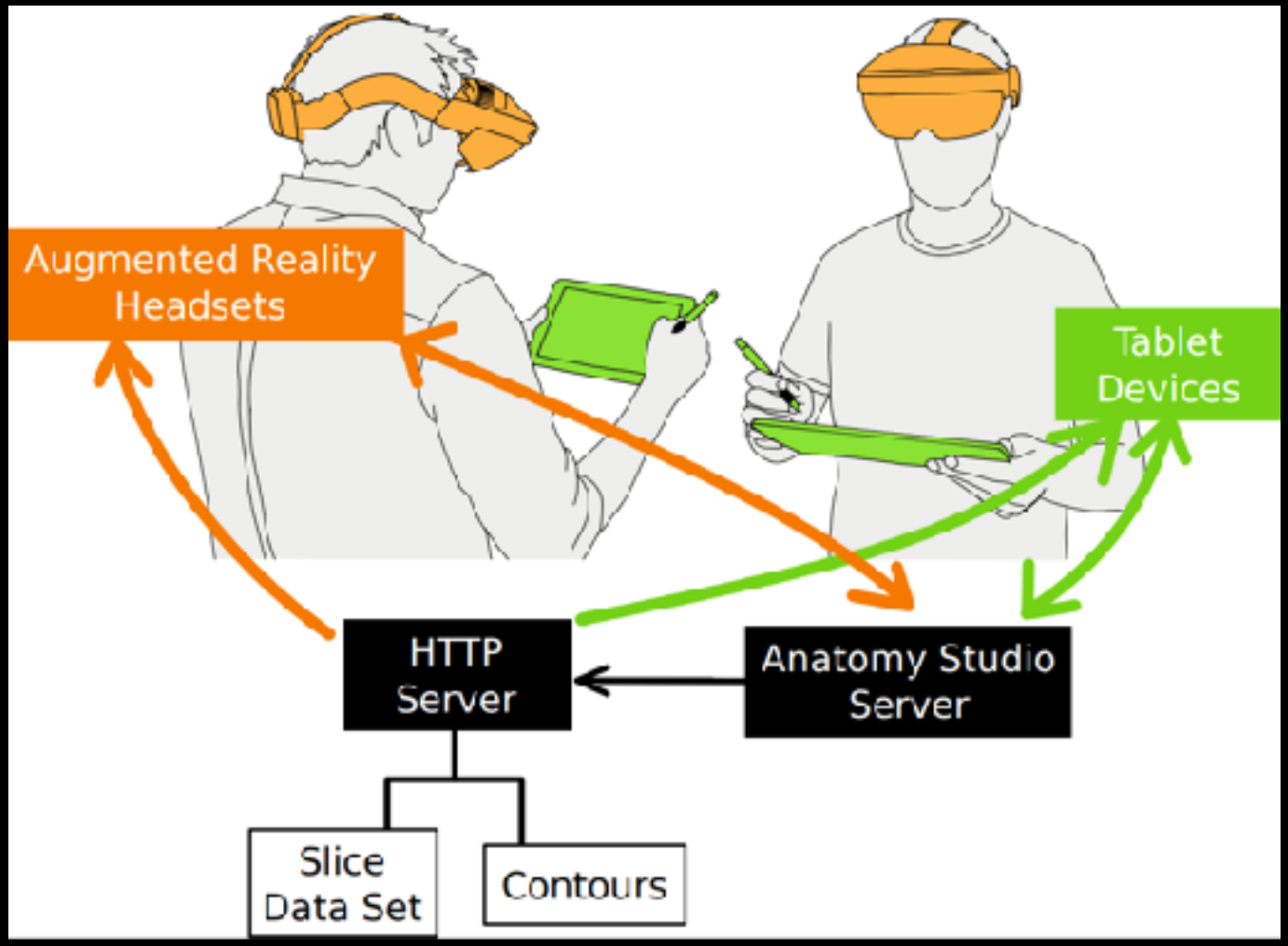
Augmented Dissection Table

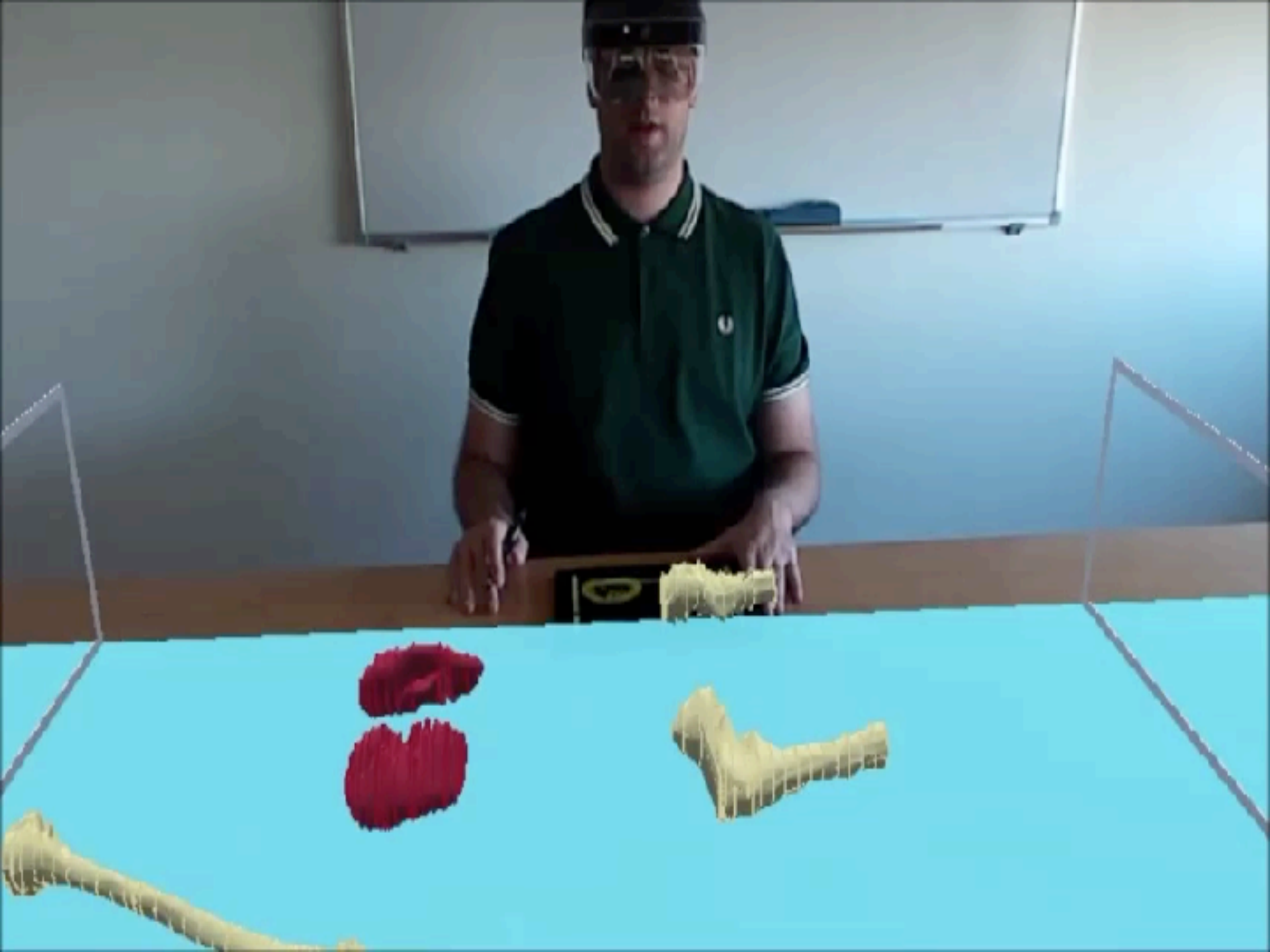
Table for two … plus one

Anatomy Studio: Augmented Virtual Dissection Sessions



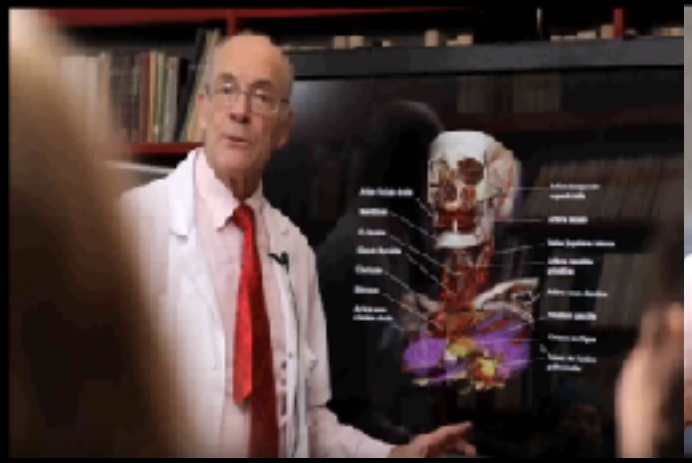
Anatomy Studio: Augmented Virtual Dissection Sessions





Anatomy Studio: Augmented Virtual Dissection Sessions

Unesco Chair Of Digital Anatomy


Université Paris Descartes

Unité de recherche en Développement, Imagerie et Anatomie - Prof. Vincent Delmas et Dr. J.F Uhl

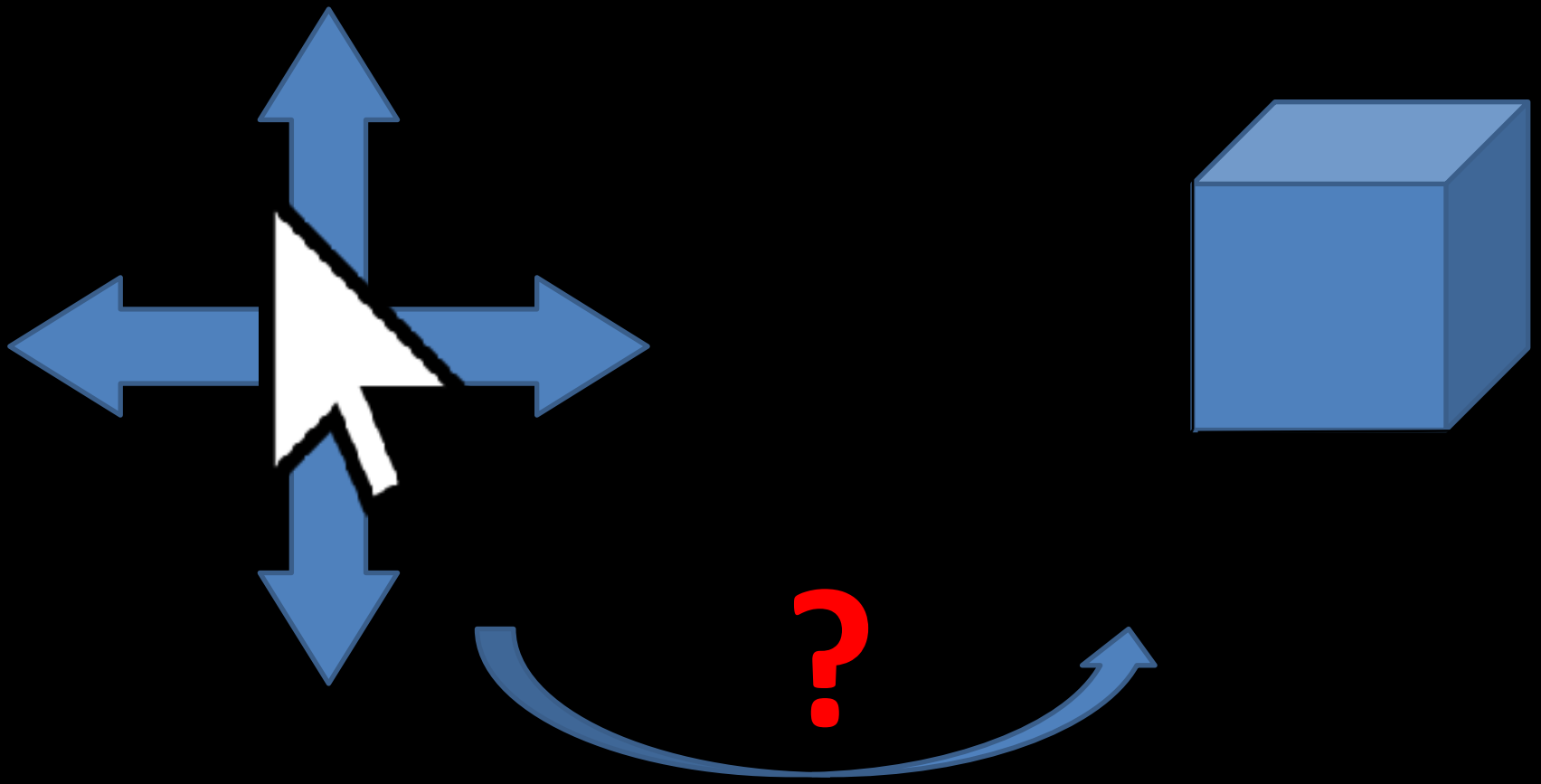


VR in the Operations Room

Contactless Surgical Navigation

Germ-free interfaces

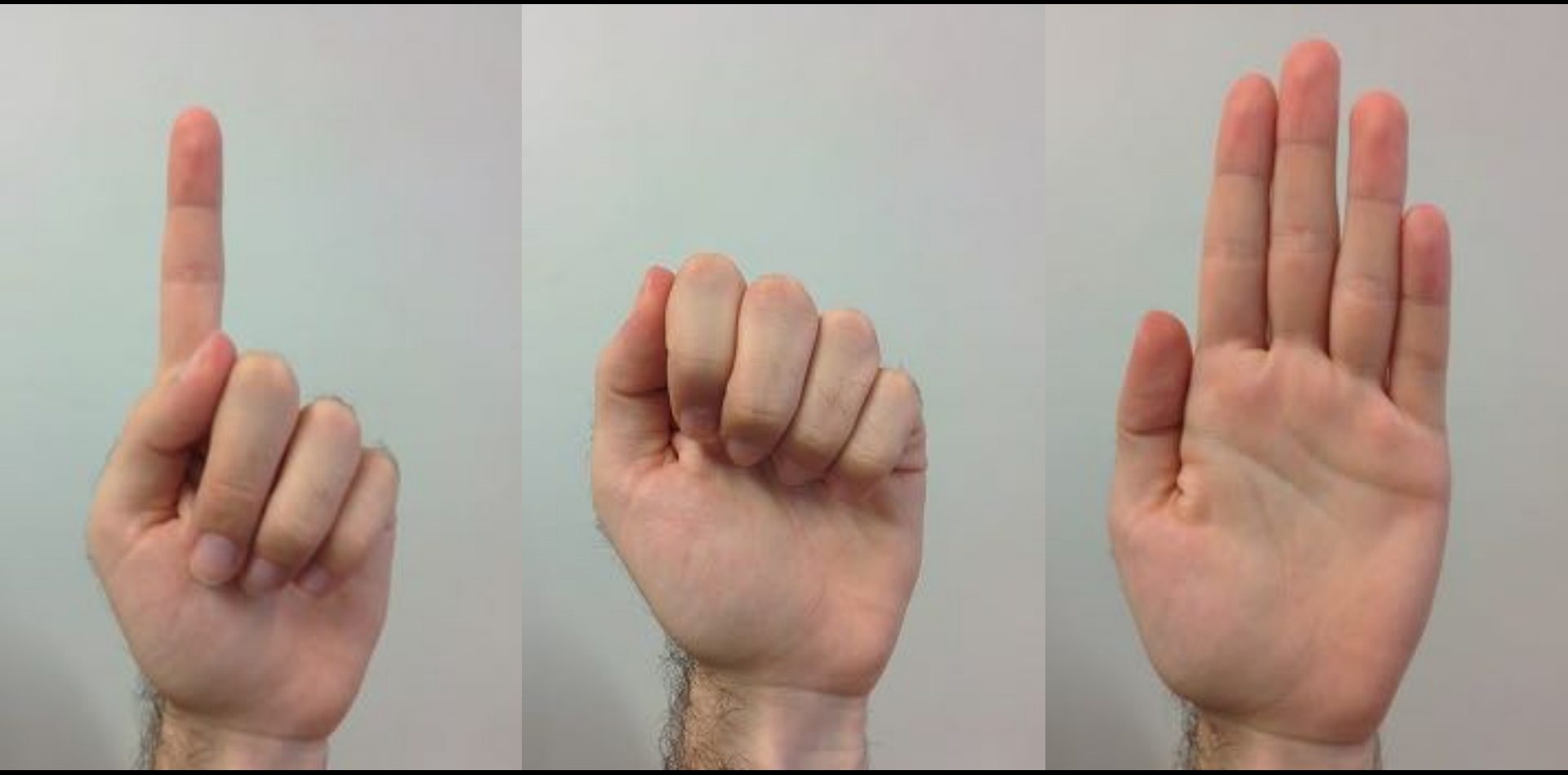
Conventional Systems: Dimensional Gap



VOXEL Explorer: Asepsis

Source: O'Hara et al., 2014

VOXEL Explorer: Simple Gestures



VOXEL Explorer: Track your Body

VOXEL Explorer: Gameboy Metaphor


FEETICHES proposes a set of hand and feet interaction techniques for touchless medical image manipulation while the user is standing

Augmented Surgery

More than meets the scalpel

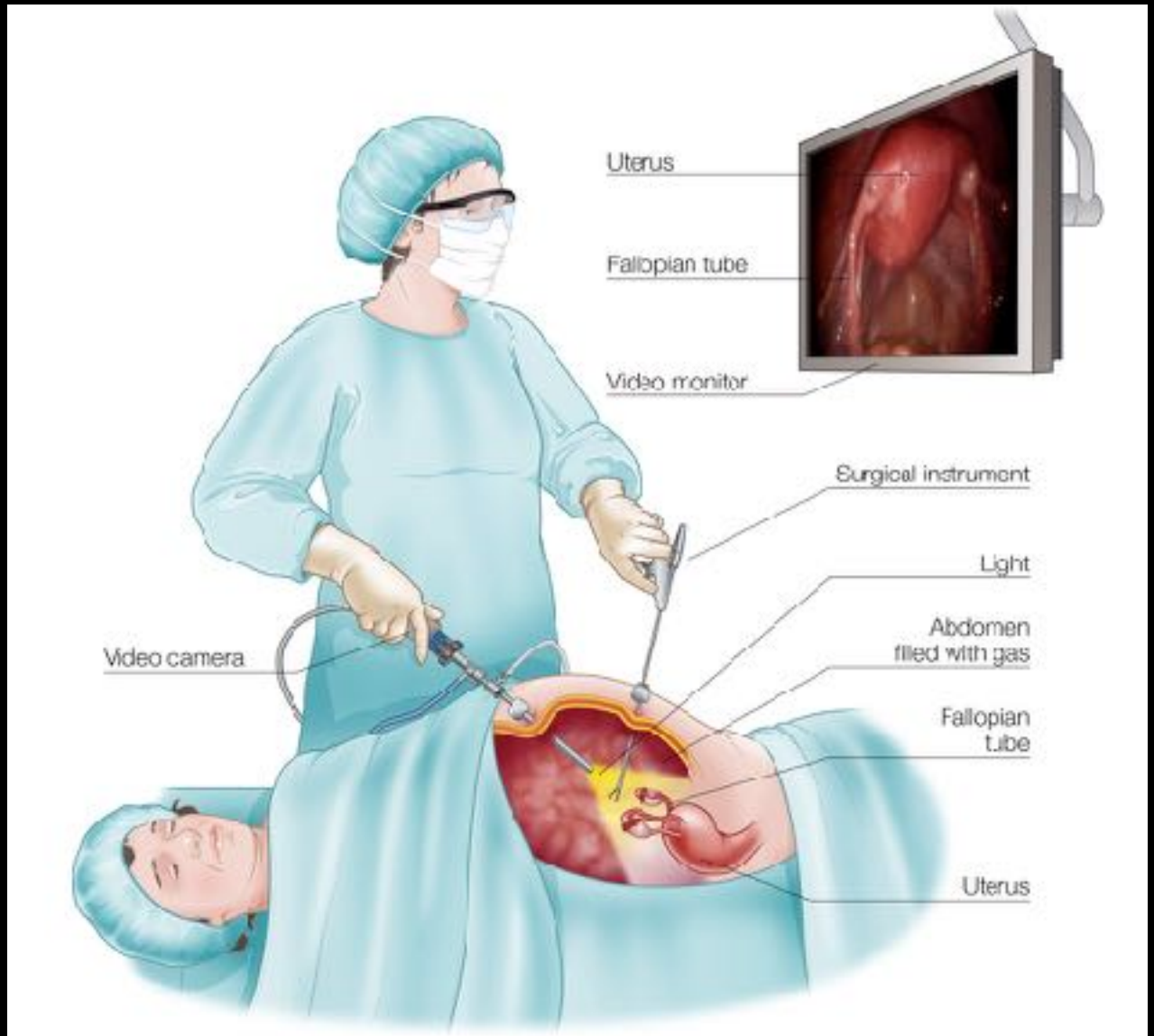
The Promise of an "*Augmented Reality*"

Motivation

Laparoscopic HUD

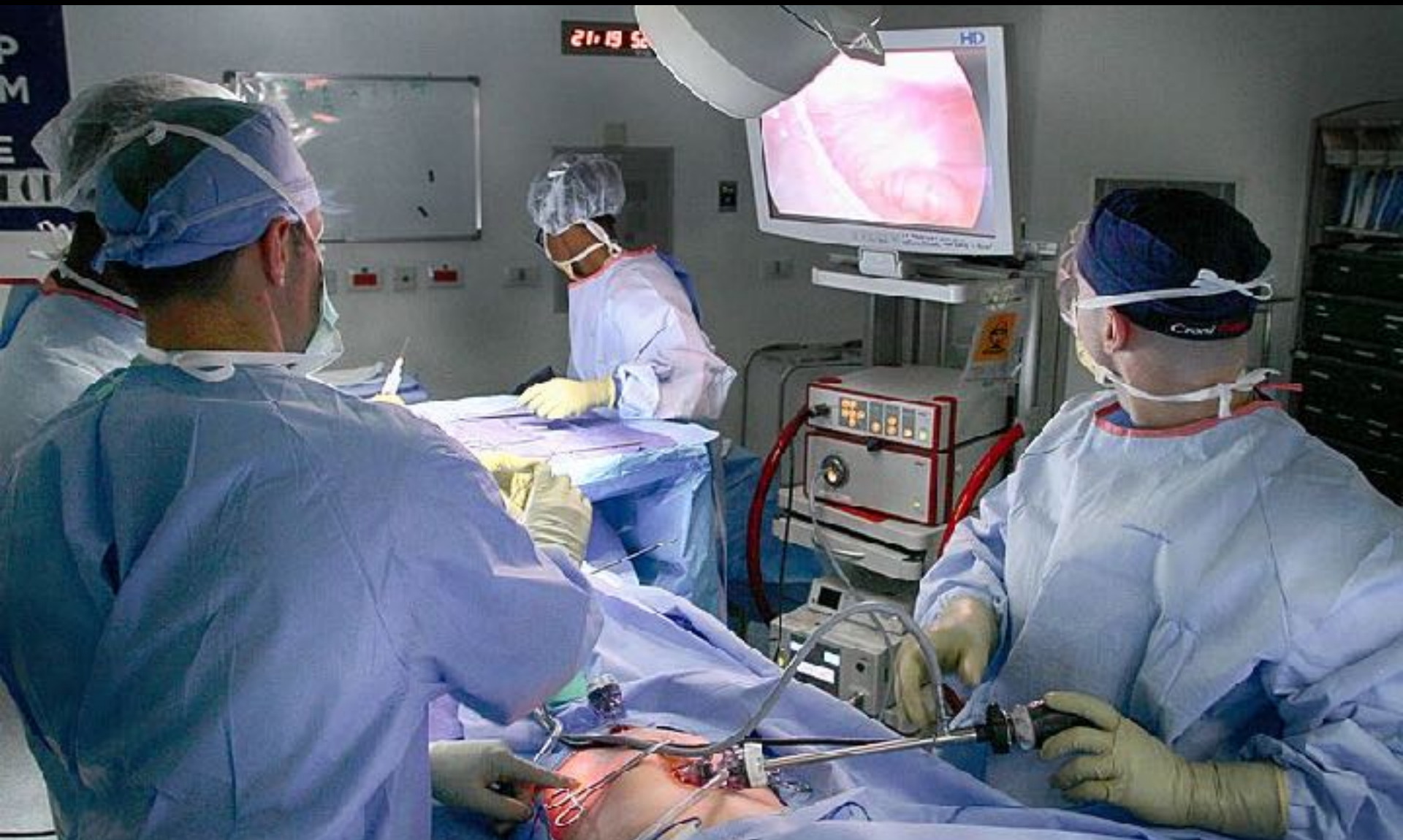
Augmented Laparoscopic Navigation

Motivation

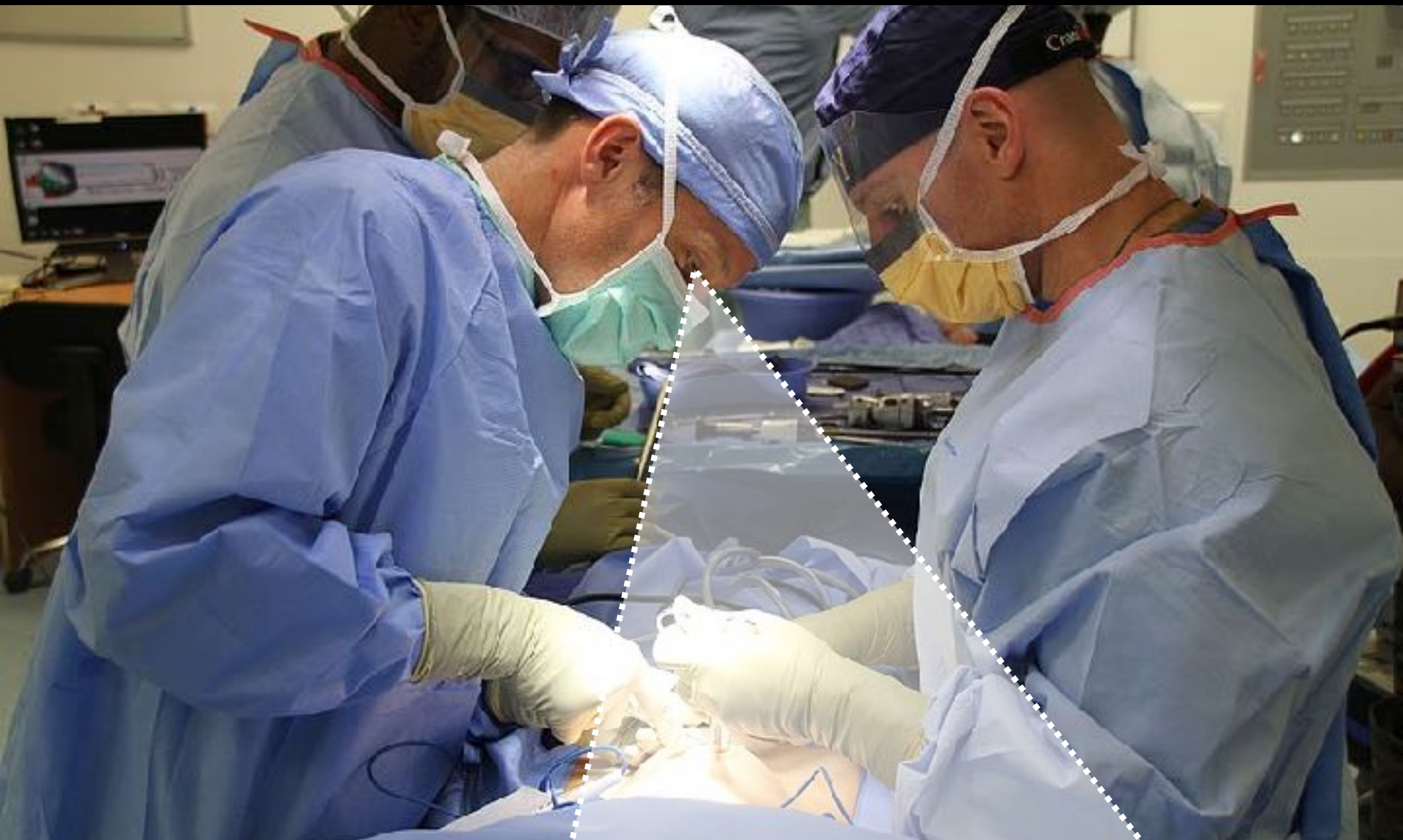

Uterus
Fallopian tube
Video monitor
Surgical instrument
Light
Abdomen filled with gas
Video camera
Fallopian tube
Uterus

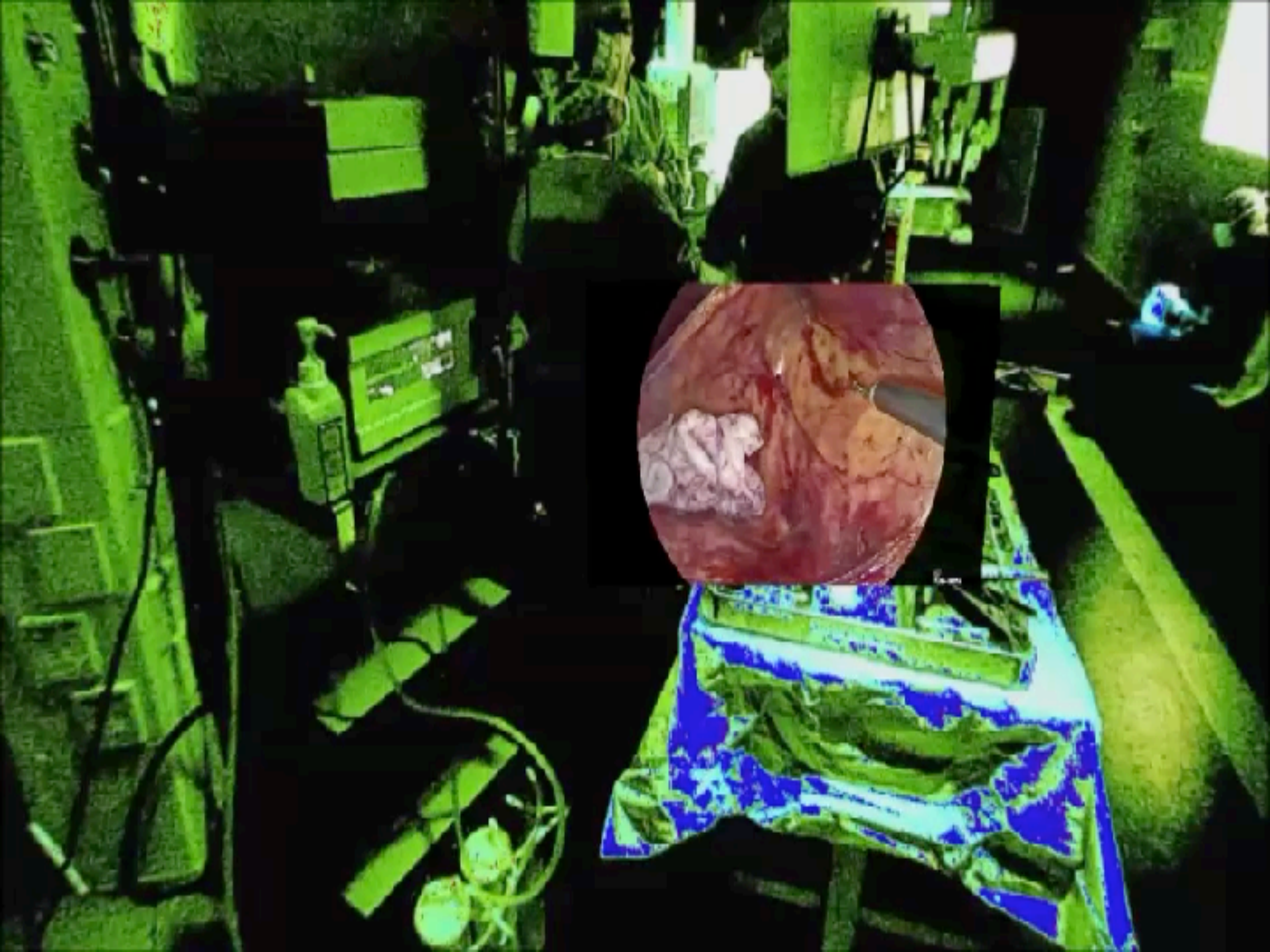
Motivation

Motivation



Laparoscopic Head Mounted Display





Interactive Rehabilitation

Easing the patient's patience

Motivation

Motivation



REPETITION – FEEDBACK – MOTIVATION

Motivation

COST

WEARABLES

Motivation

COMPENSATORY MOVEMENTS

COLLABORATION

Physio@Home

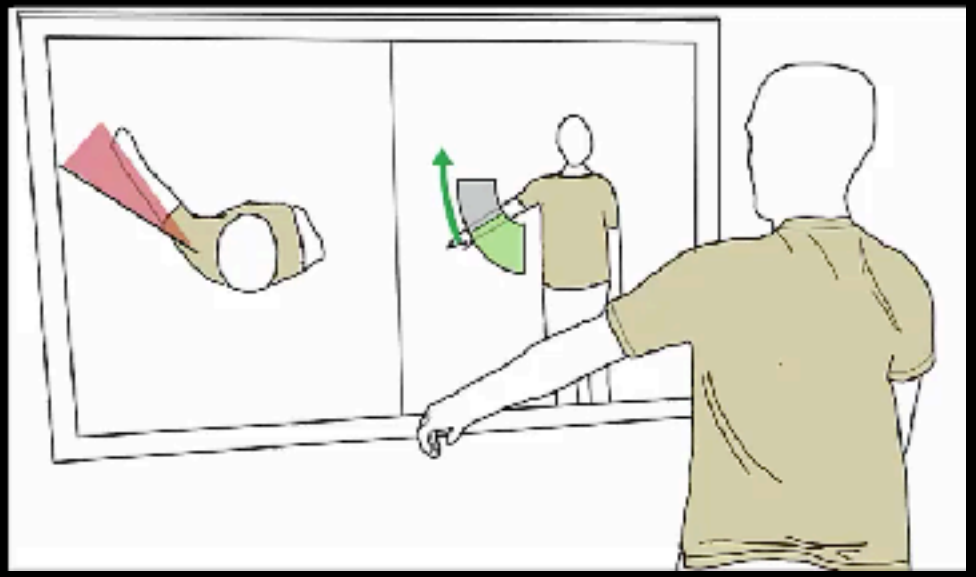
Exploring visual guidance and feedback techniques for physiotherapy exercises

Richard Tang[1], Xing-Dong Yang[1], Scott Bateman[2], Joaquim Jorge[3], Anthony Tang[1]

[1]University of Calgary

[2]University of Prince Edward Island

[3]IST/INESC-ID/U Lisboa



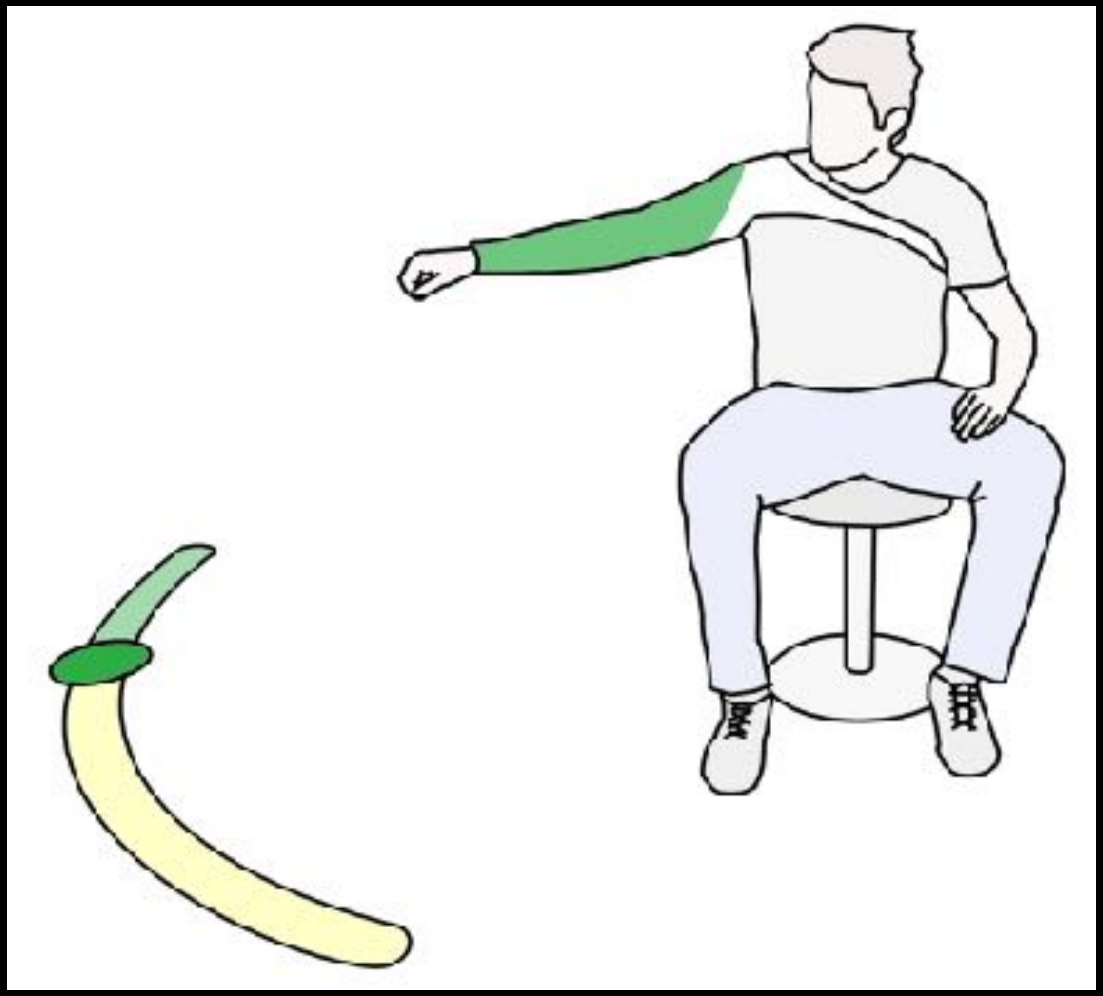
SleeveAR: Augmented Reality for Rehabilitation using Realtime Feedback

João Vieira, Maurício Sousa, Artur Arsénio and Joaquim Jorge

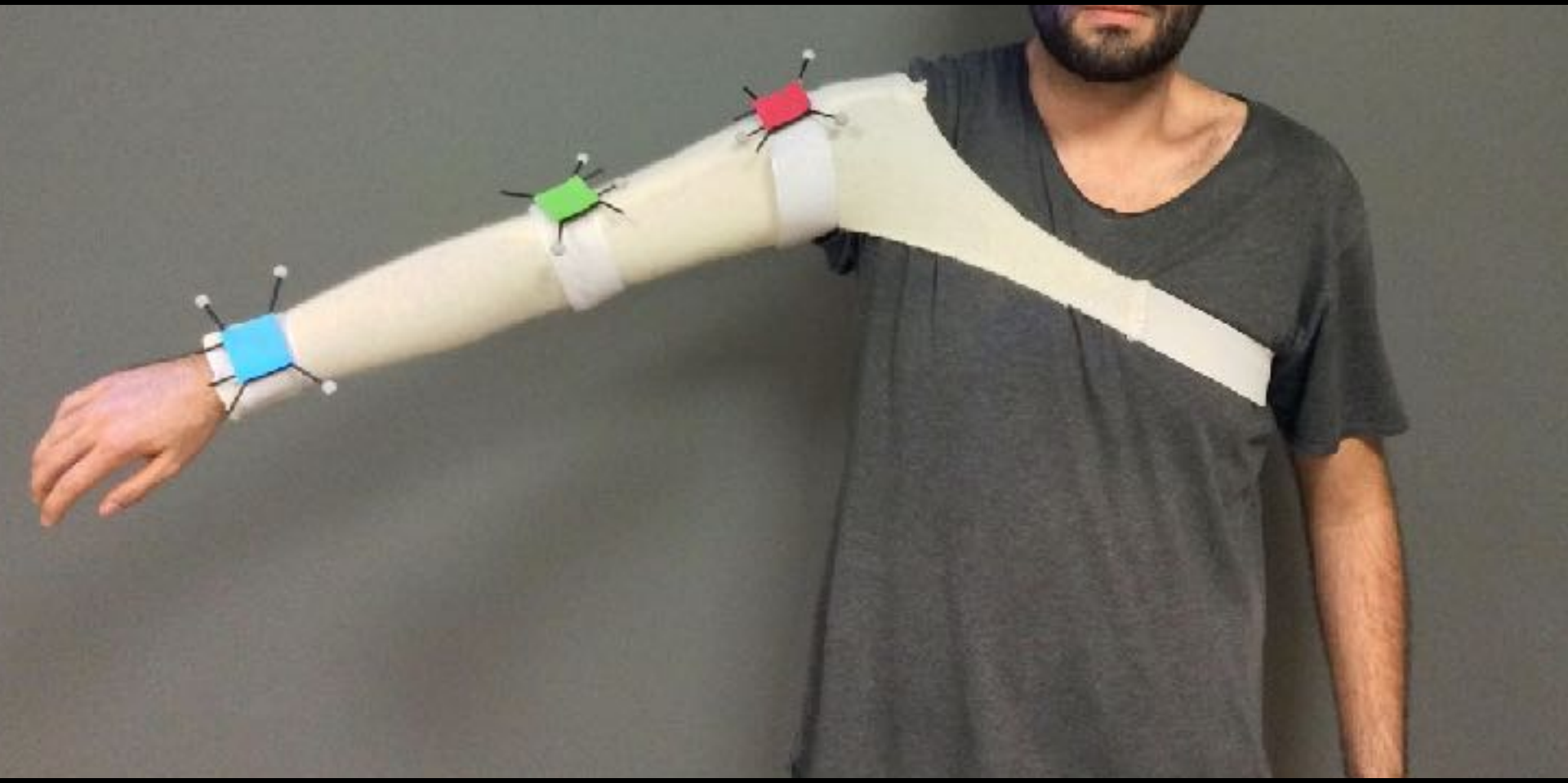
Motivation

Augmented Reality

SleeveAR



Sleeve

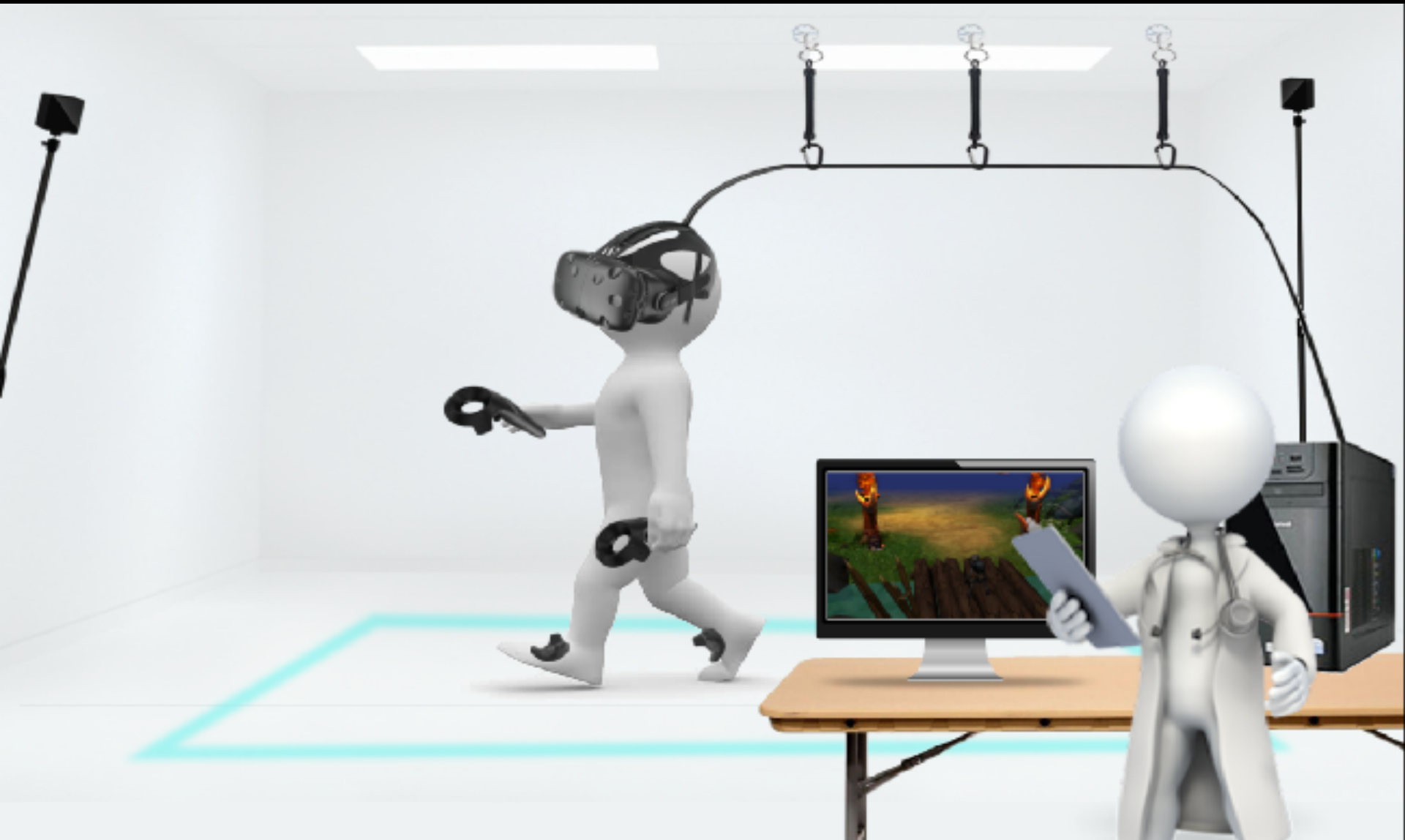


Process

Locomotiver

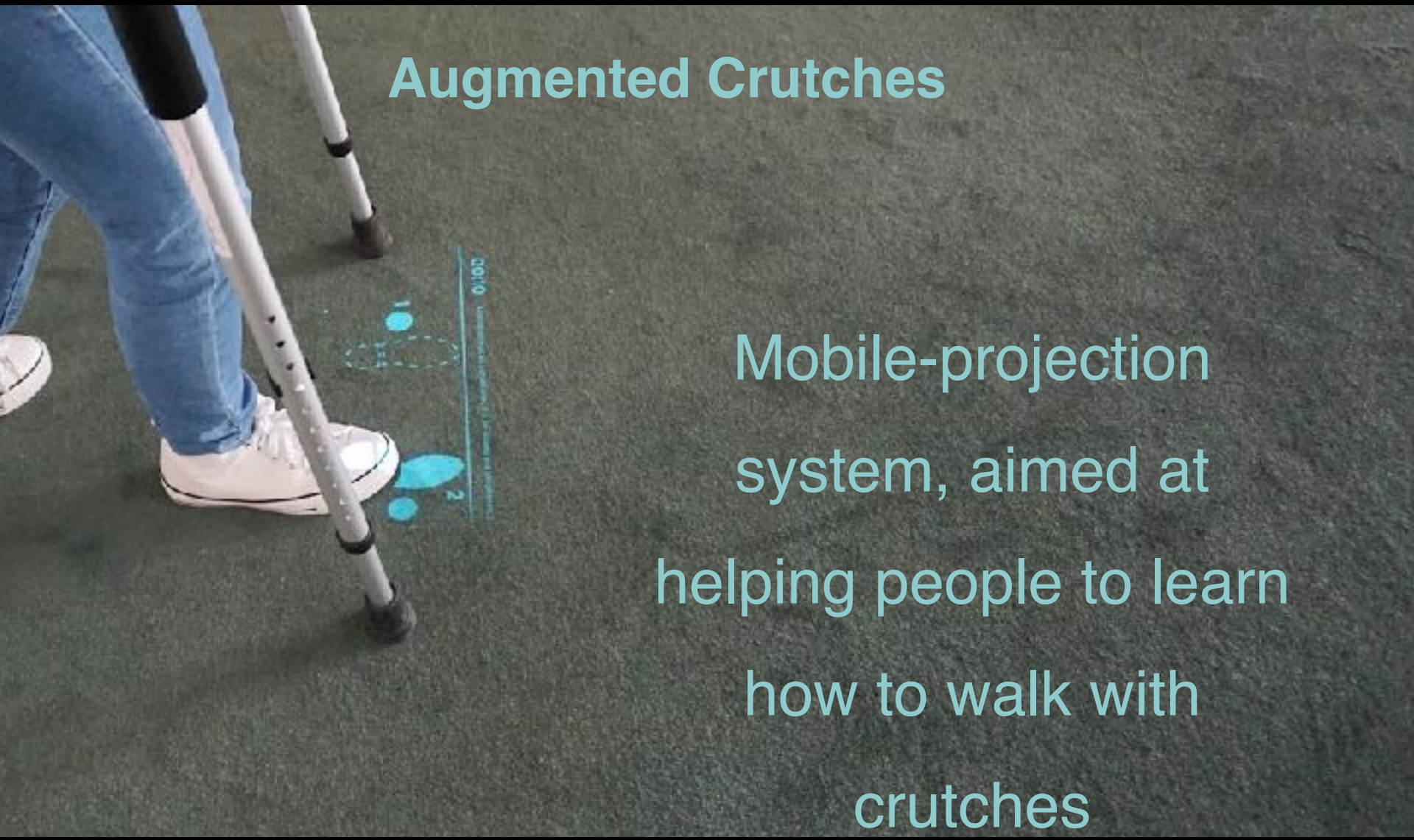
Exergames for Locomotion Rehabilitation in VR

VR for Locomotion




Locomotiver
Welcome to Locomotiver
Metrics
[Ctrl] - Lock/Unlock
[Mouse] - Move around
[Mouse Scroll] - Zoom In/Out
New Exercise

Augmented Crutches


Augmented Crutches
Mobile-projection system, aimed at helping people to learn how to walk with crutches

1

Personal Experience

2 Research

1

Personal Experience

2

Physical Therapist

How it works

1. Answer questionnaire

2. Connect to projector

3. Walk with projected visual cues

If you want to know more

1. Beatriz Peres, Pedro F. Campos, Aida Azadegan, ***A Persuasive Approach in Using Visual Cues to Facilitate Mobility Using Forearm Crutches***. BCSS@PERSUASIVE 2019

2. Beatriz Peres, Pedro F. Campos, Aida Azadegan , ***Digitally Augmenting the Physical Ground Space with Timed Visual Cues for Crutch-Assisted Walking***. CHI Extended Abstracts 2019

3. Beatriz Peres, Pedro F. Campos, Aida Azadegan , ***A Digitally-Augmented Ground Space with Timed Visual Cues for Facilitating Forearm Crutches' Mobility***, Full paper , Interact 2019

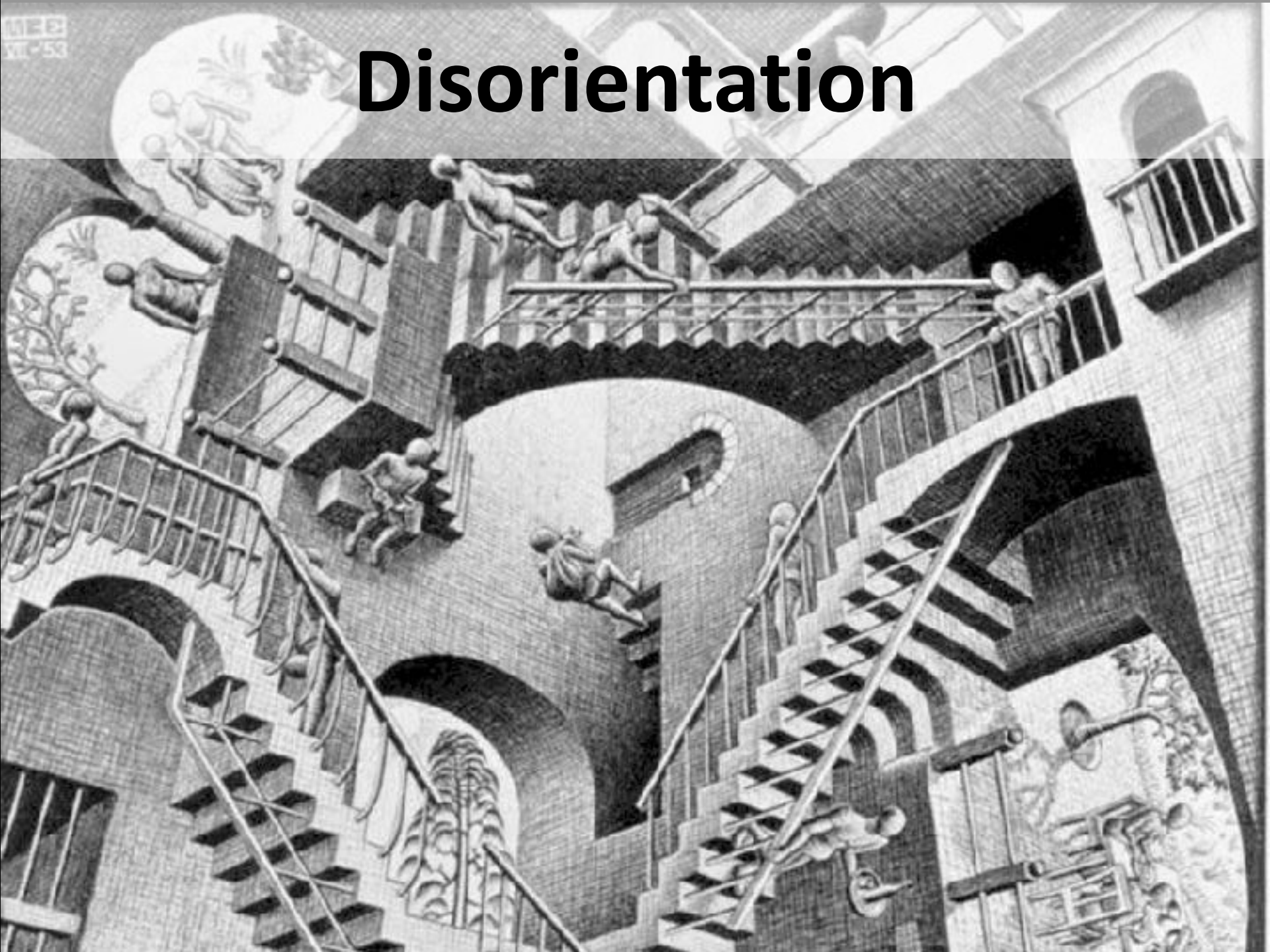
.


CHALLENGES
AHEAD

Nonstandard Equipment

Funny User Interfaces

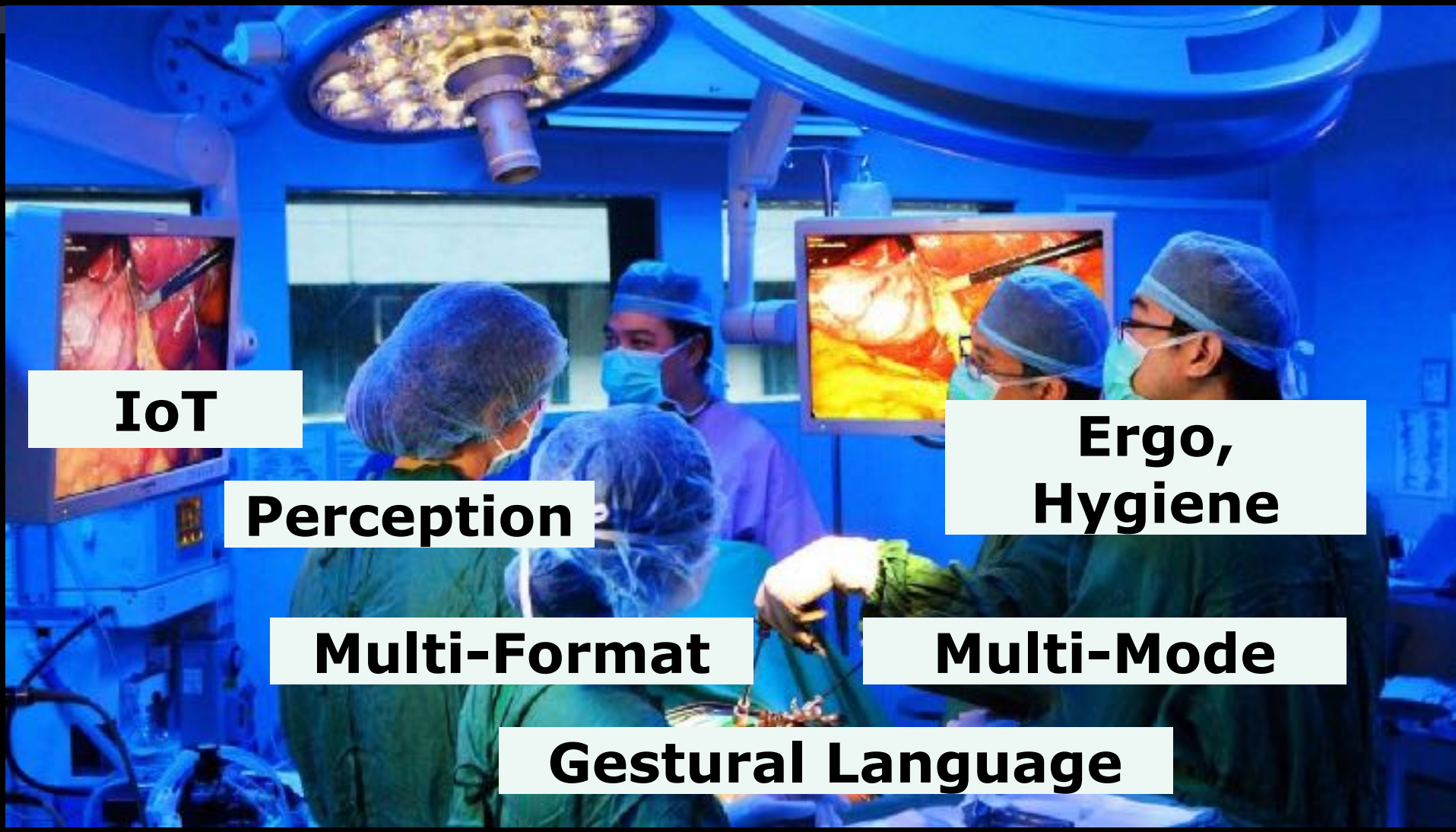
Disorientation

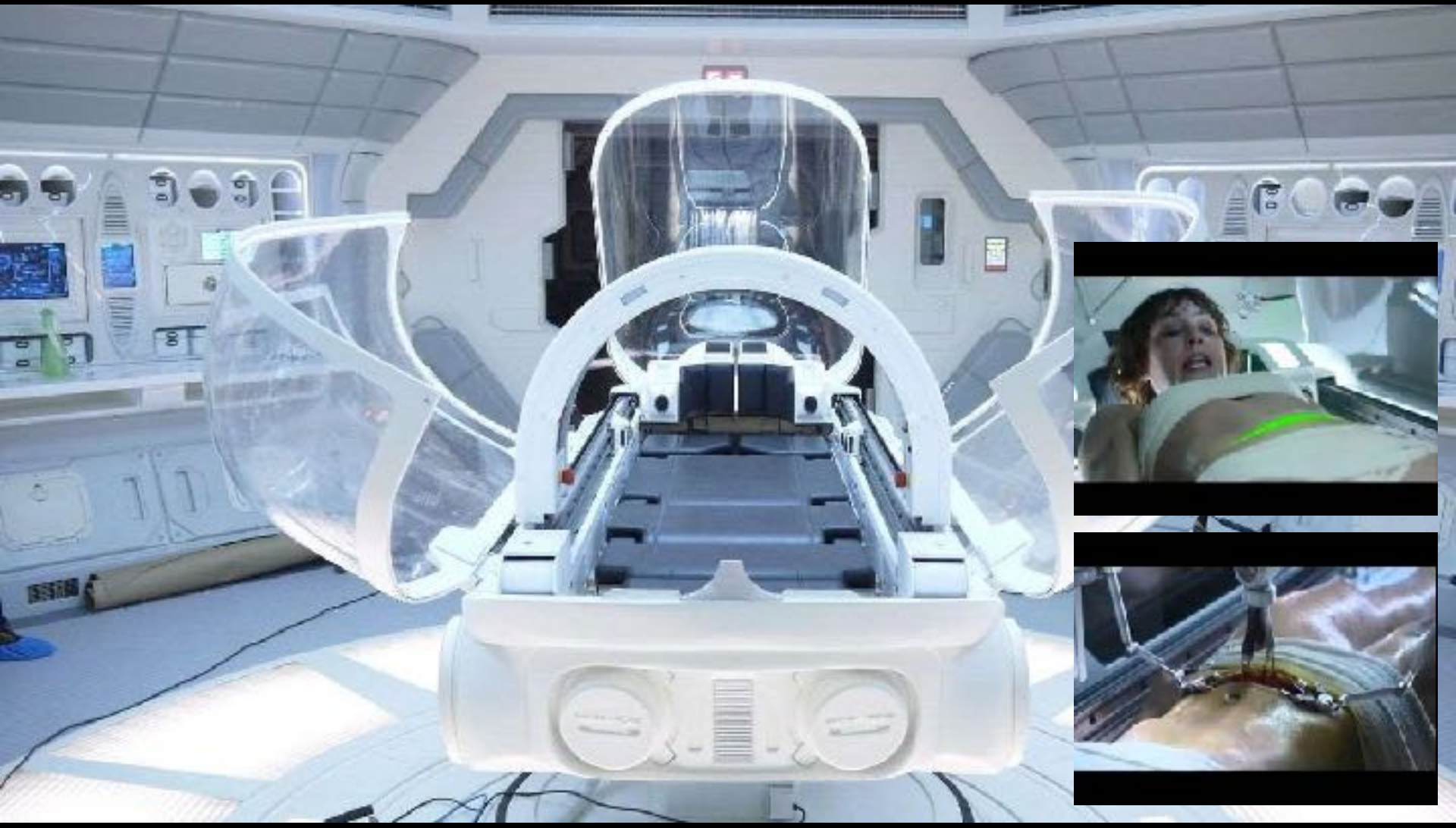


Fatigue


Nausea


Bright Future Ahead


IoT
Perception
Ergo,
Hygiene
Multi-Format
Multi-Mode
Gestural Language



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it-medex

Interactive Tablets for Collaborative Scenarios Related to 3D Medical Image Exploration

Scan me

jorgej@acm.org

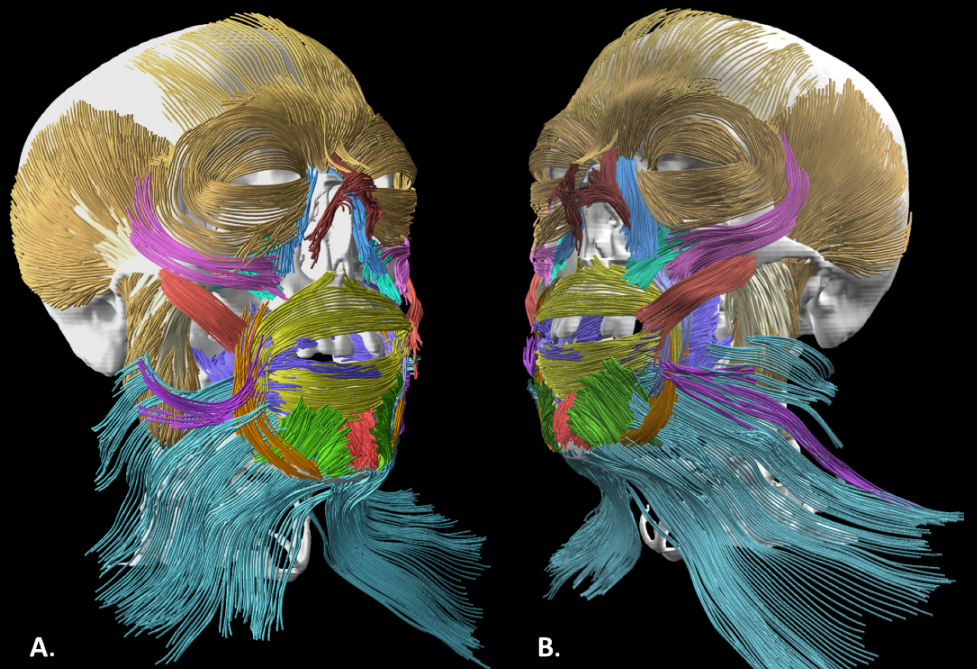
http://it-medex.inesc-id.pt/home

Don’t miss out our upcoming

Digital Anatomy book

Applications of Virtual, Mixed and Augmented Reality

Changing Classrooms require novel technology-based approaches. It has been shown that Virtual Reality can improve both retention and learning outcomes. Published by Springer-Verlag, this textbook provides a valuable tool to foster dialogue between anatomists, surgeons, radiologists, clinicians as well as computer scientists, course designers and industry practitioners.



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CAVE COLON	Pedro Borges, Daniel Medeiros, Soraia Paulo
Voxel TIPs	Rita Mendes, Pedro Parreira, Soraia Paulo
Anatomy Studio	Maurício Sousa, Daniel Mendes, Rafael dos Anjos, Soraia Paulo
Voxel Explorer	Pedro Parreira, Soraia Paulo
TOOTHFAIRY	Filipe Relvas, Soraia Paulo
Laparoscopic HUD	Miguel Belo, Soraia Paulo
ImplantAR	Tiago Jerónimo
Plausible Box Figures	Nuno Matias
Imperceptible Breathing	Filipe Marques

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Soraia Figueiredo Paulo

Beatriz Peres

Bibliography

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Anatomy Studio: a Tool for Virtual Dissection Through Augmented 3D Reconstruction, Ezequiel R. Zorzal, Maurício Sousa, Daniel Mendes, Rafael Kuffner dos Anjos, Daniel Medeiros, Soraia Figueiredo Paulo, Pedro Rodrigues, José João Mendes, Vincent Delmas, Jean-Francois Uhl, José Mogorrón, Joaquim Armando Jorge, Daniel Simões Lopes, Computers & Graphics, DOI: 10.1016/j.cag.2019.09.006, 2019

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