

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

a short course

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Research Interests:
Calligraphic Interaction,
Multimodal Interfaces,
Graphical Modeling

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Research Interests:
Virtual Reality
Health and Well-being
Persuasive Computing
Behavior Change Technologies
Multimodal Interaction

PI, SUAVE project: Nudging users
towards healthier lifestyles
PI, Augmented Crutches: AR for
helping patients to learn how to
walk with crutches
PI, SENSE:SEAT, Inducing
Improved Mood and Cognition
through Multisensorial Priming



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Heads Biomedical Research Line

PI of project IT-MEDEX

Research Interests:

Computational Geometry,
Interactive Computer Graphics,
Computer-Aided Healthcare,
Interactive Visualization

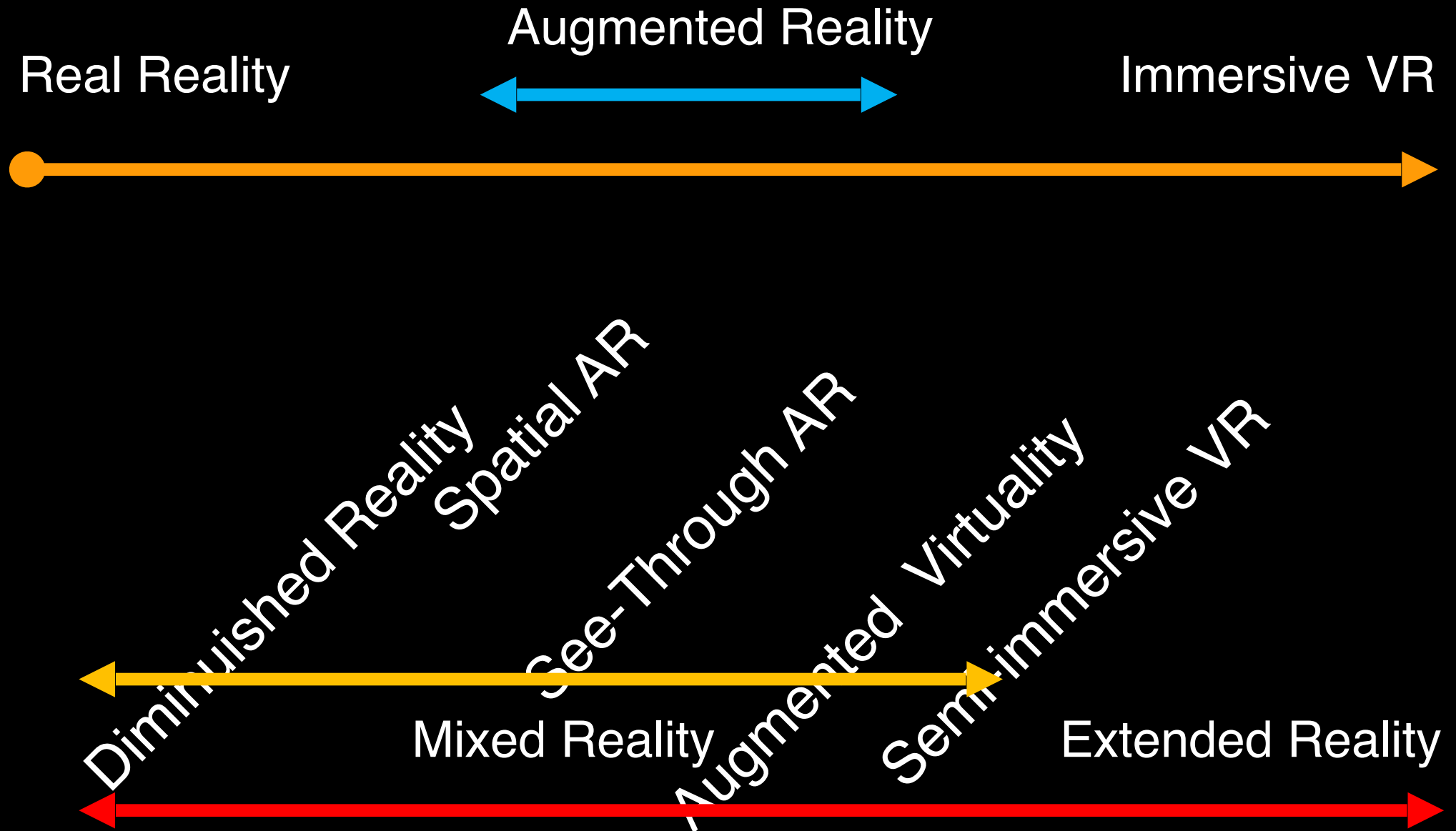
[http://web.ist.utl.pt/
daniel.s.lopes](http://web.ist.utl.pt/daniel.s.lopes)

Introduction and Motivation



Medical UI/UX

Reality–Virtuality Continuum



Challenges

Building a network of healthcare professionals

Identifying current practices

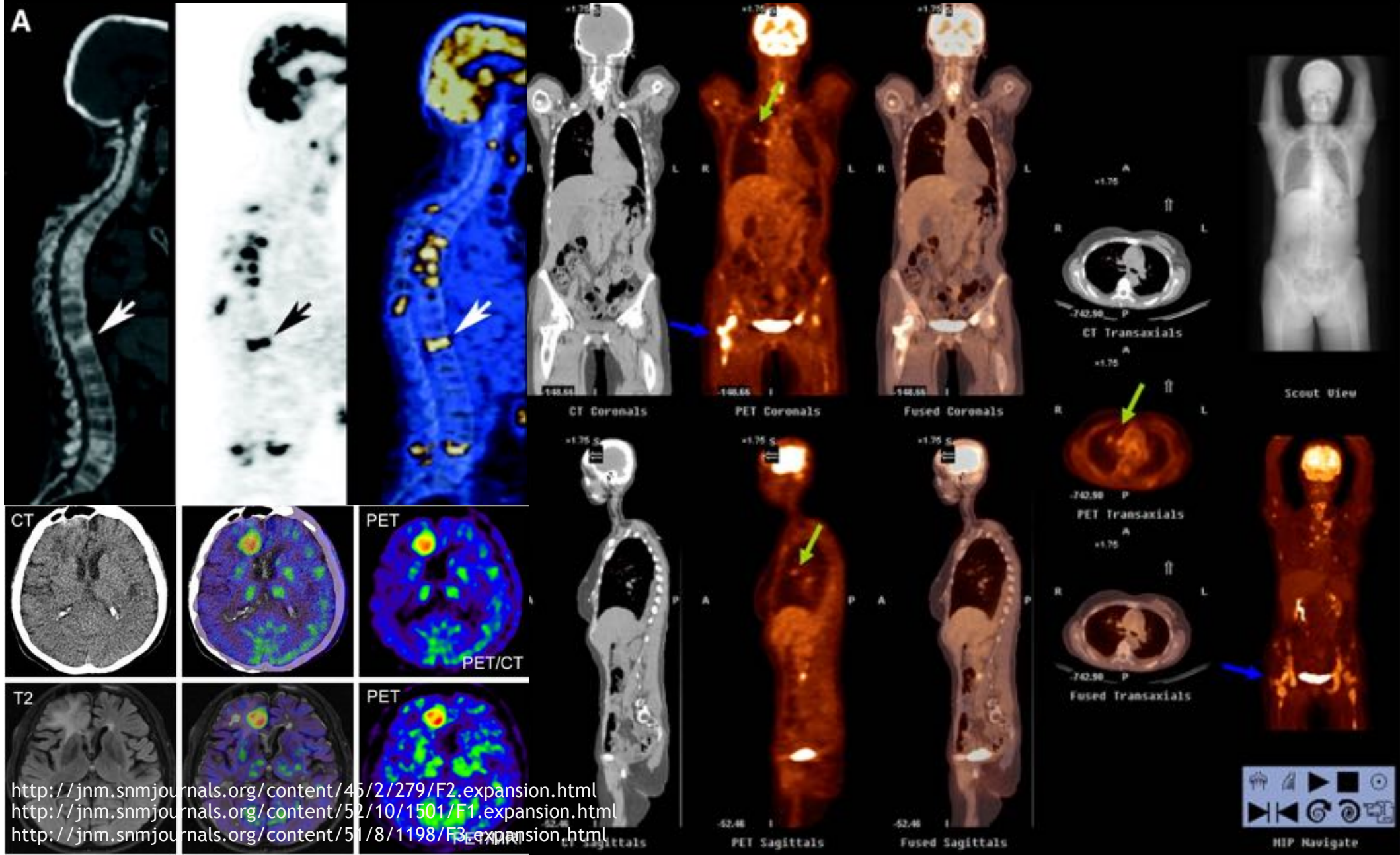
Linguistic Barrier

Big Picture but no Specs

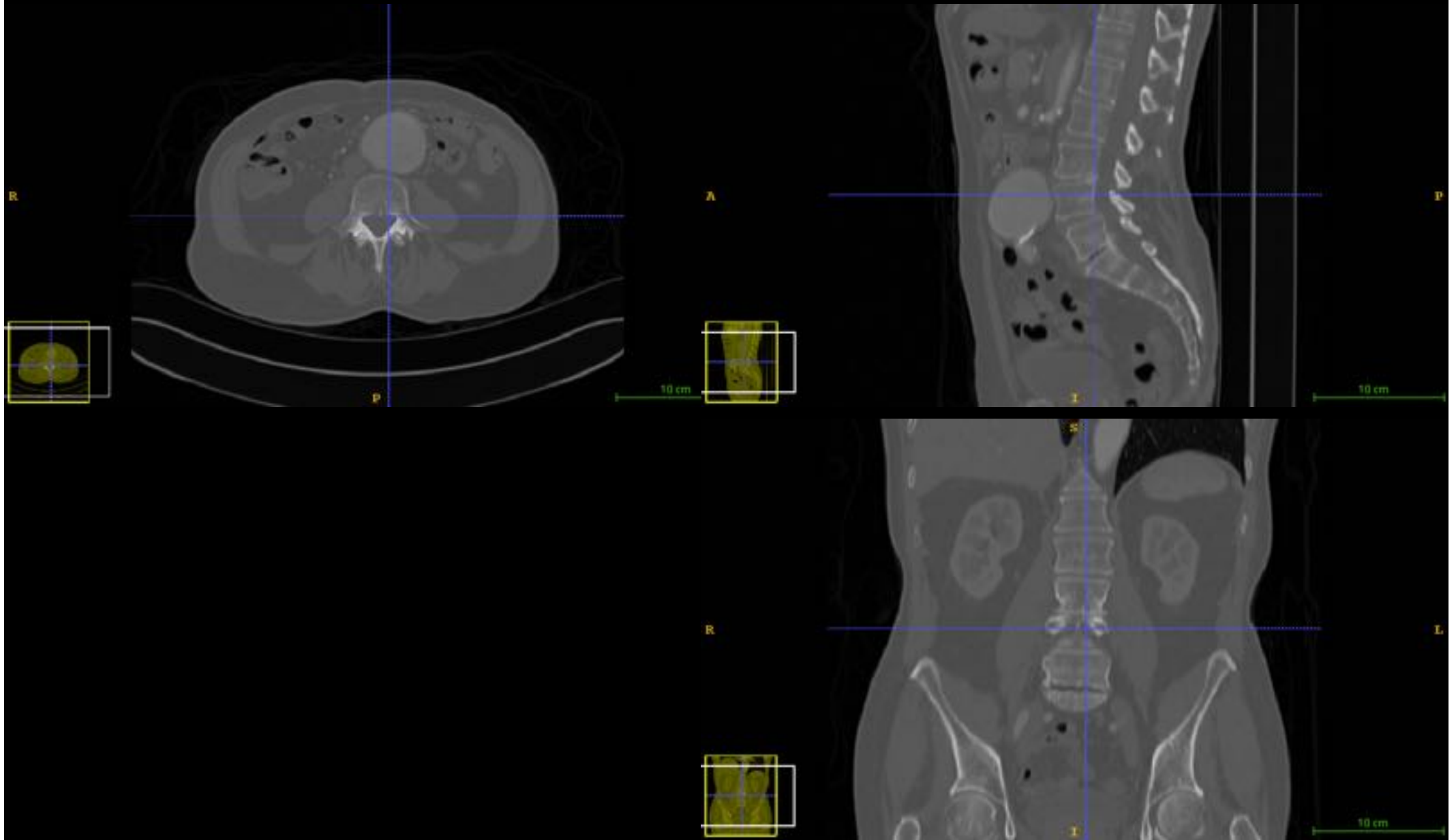
“Automagic worshippers”



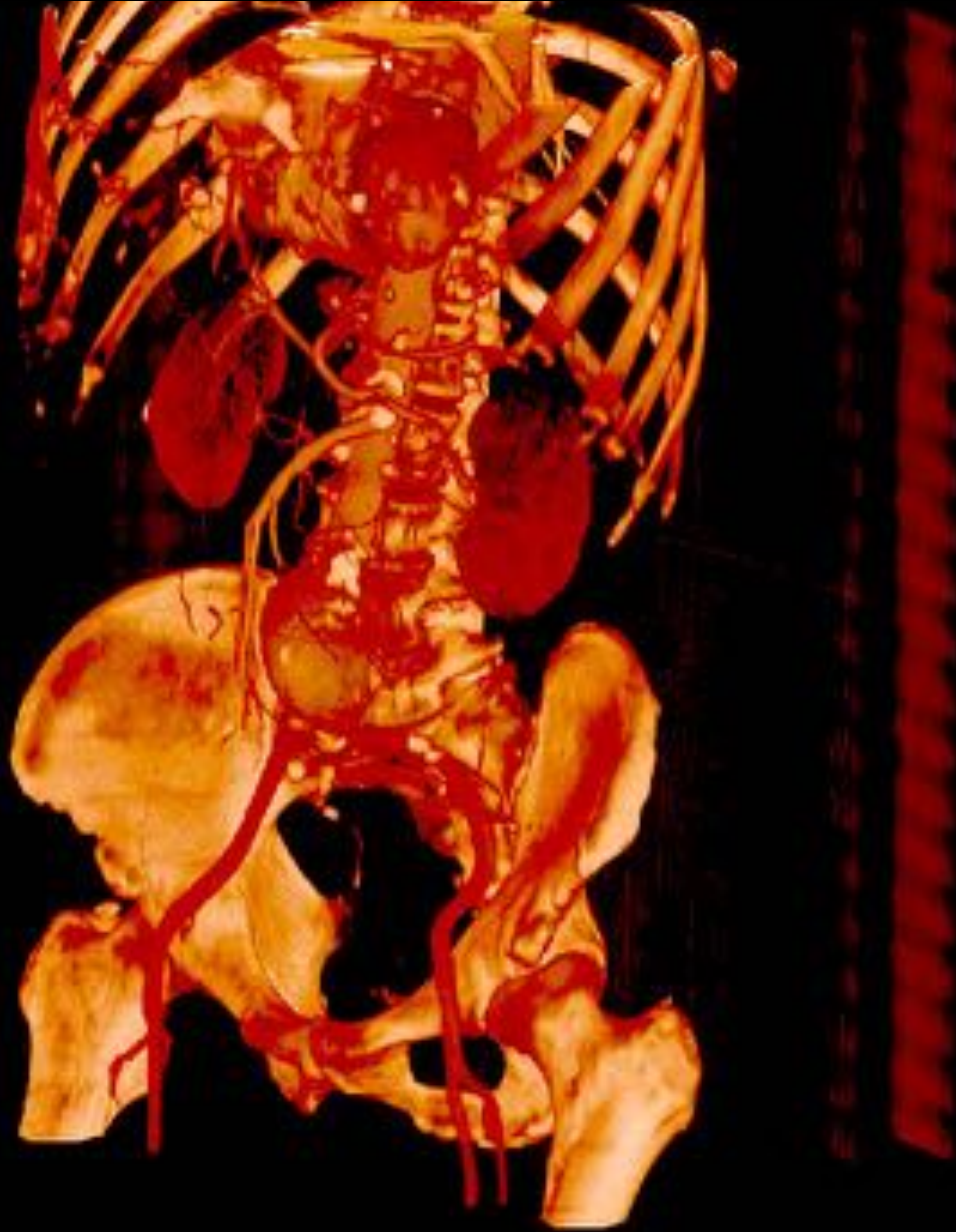
Motivation



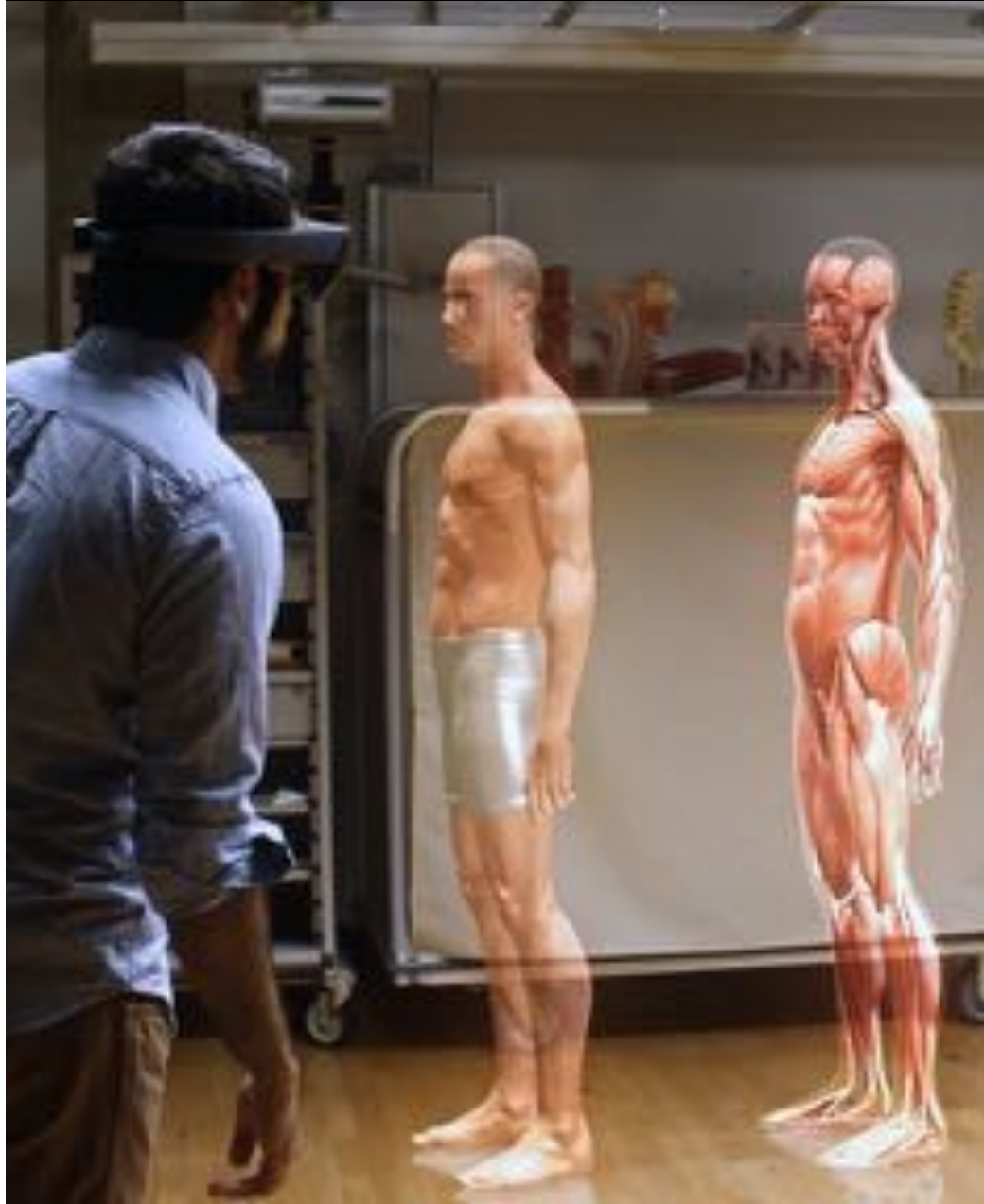
Motivation



Motivation



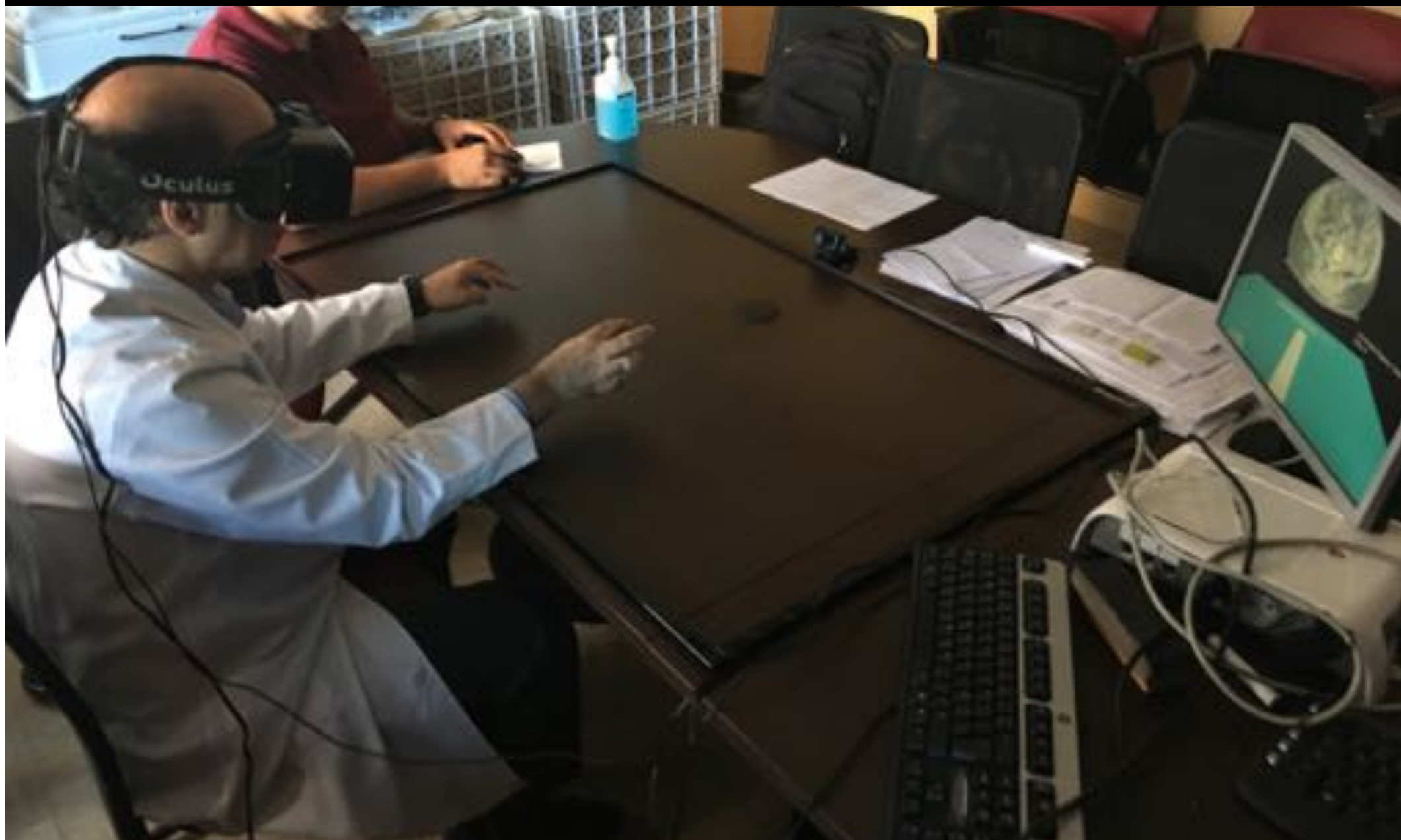
Extend the Reality: Learning

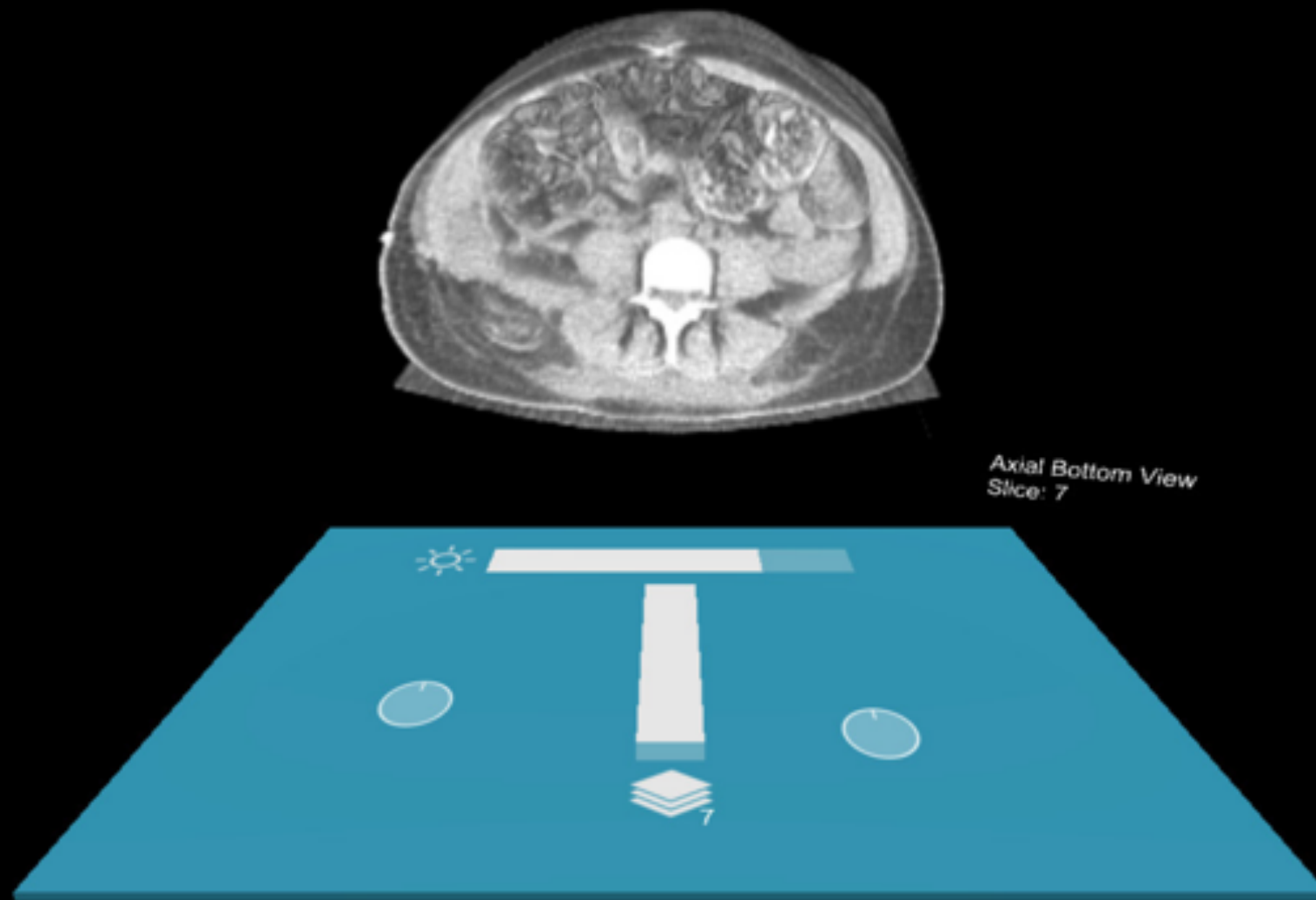


and Collaboration



Scenario: Radiodiagnostics





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

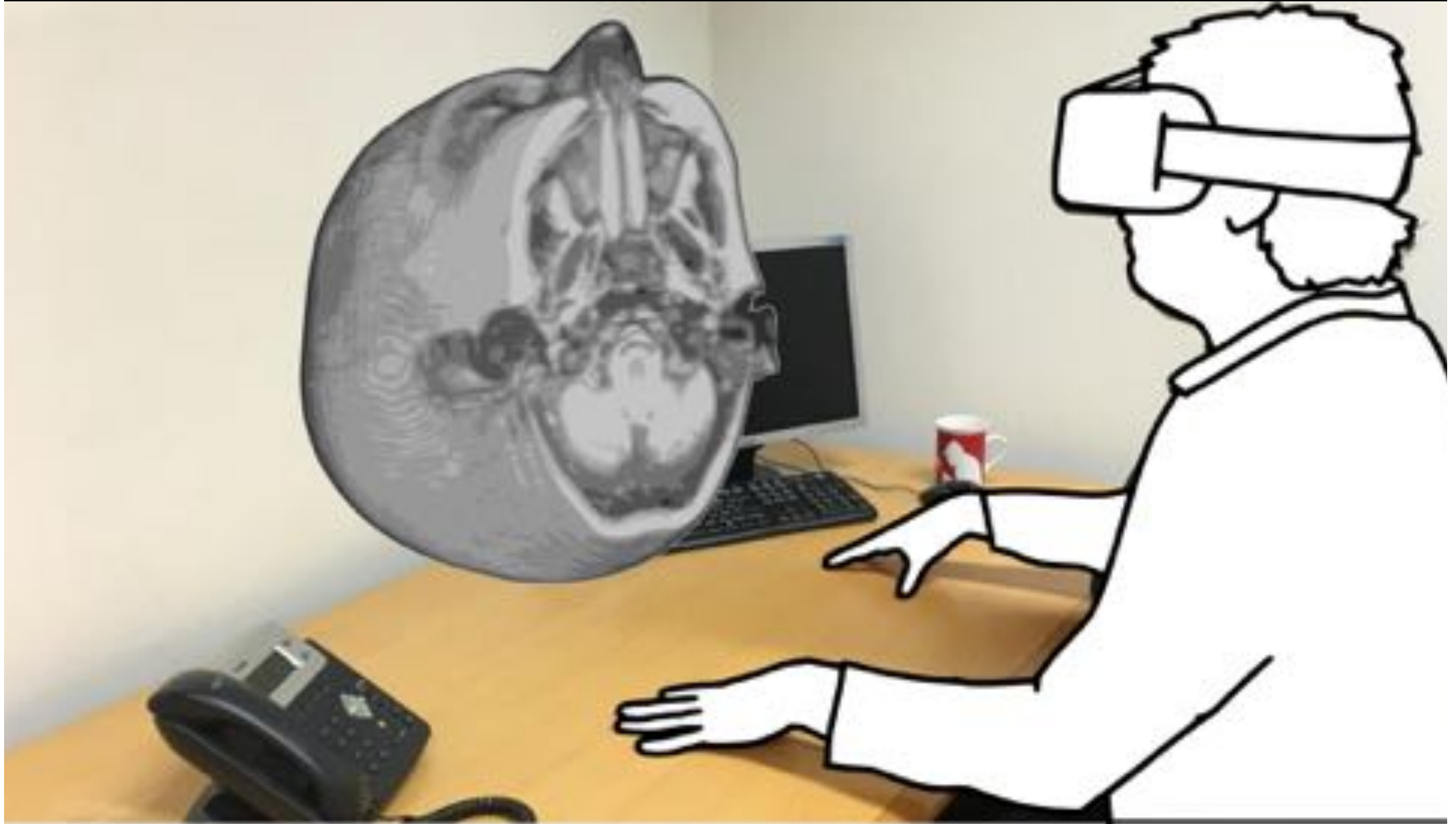
VR for Radiologists in the Reading ROOM



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=bsNwV4BhIOw](https://www.youtube.com/watch?v=bsNwV4BhIOw)

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

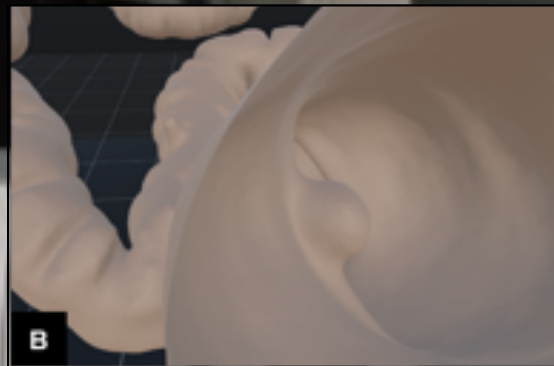
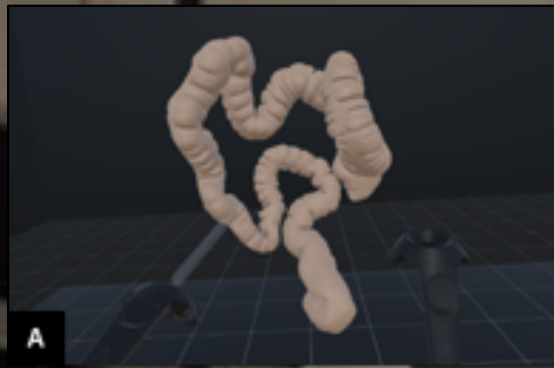


**Proble
m**



Problematic





Interaction Techniques for Immersive CT Colonography: A Professional Assessment *MICCAI / VCBM 2018*

https://youtu.be/_9EMhjl3kYw

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

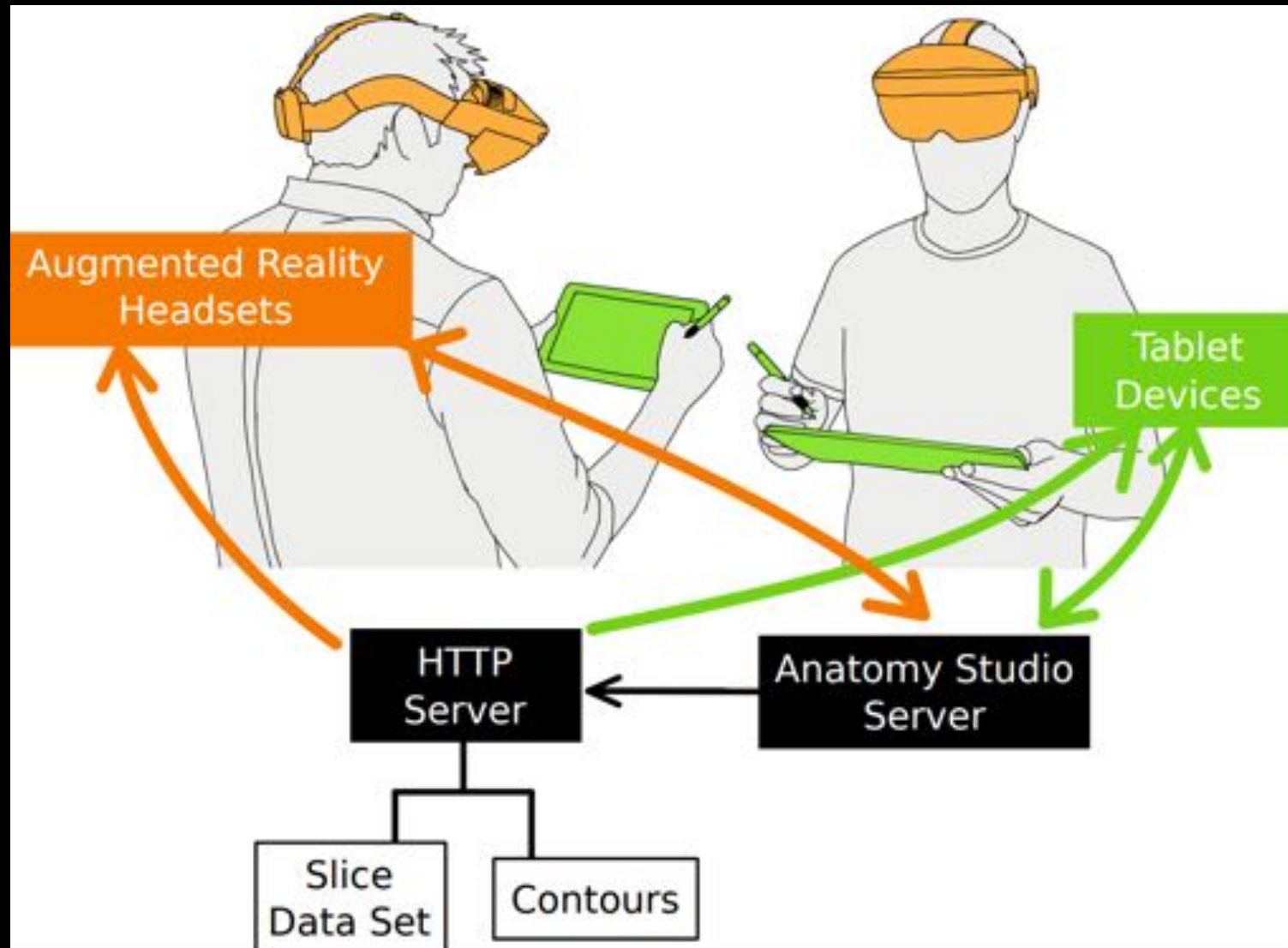
Table for two ... plus one

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.
I F I h l

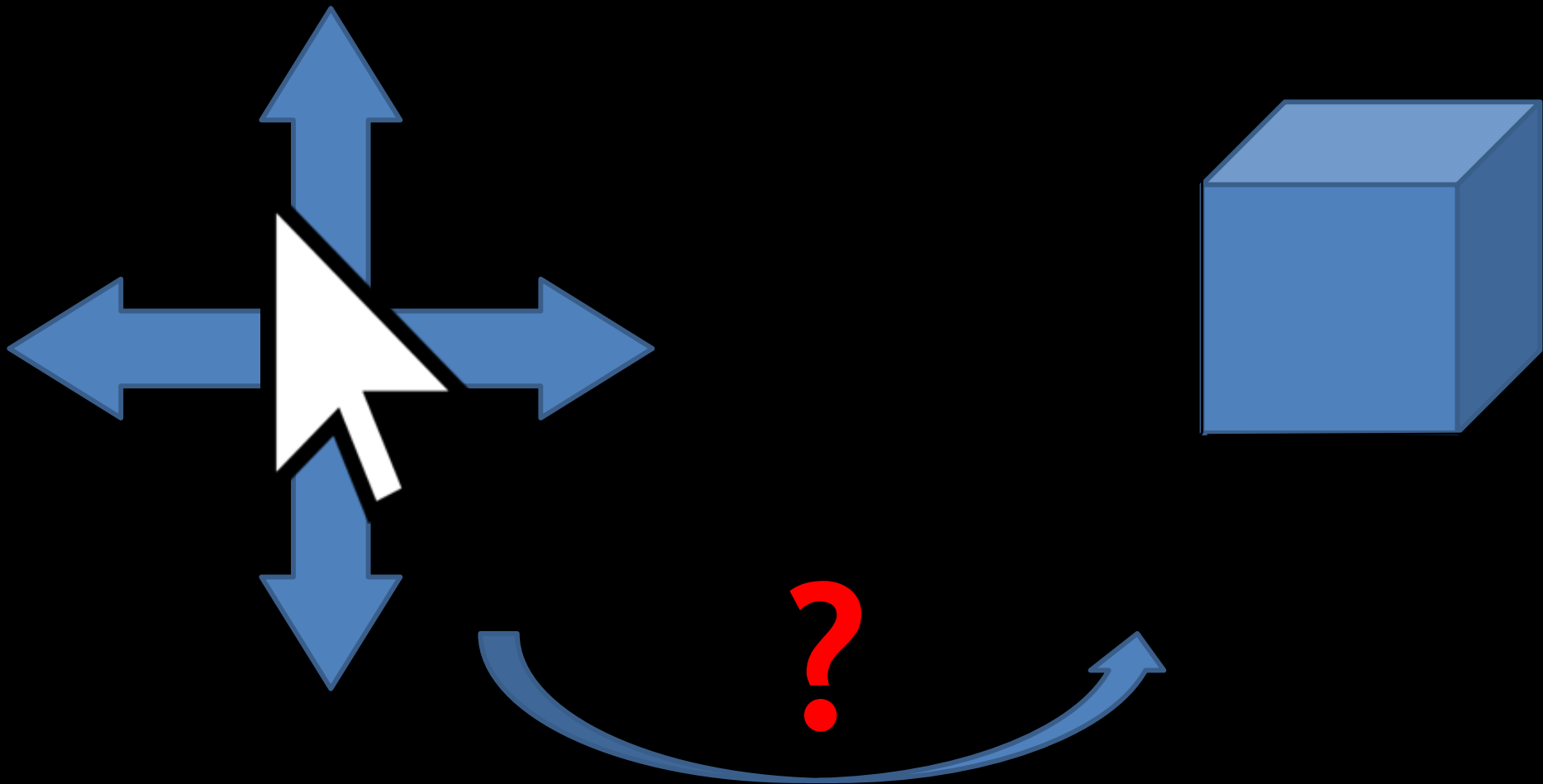


VR in the Operations Room

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*”



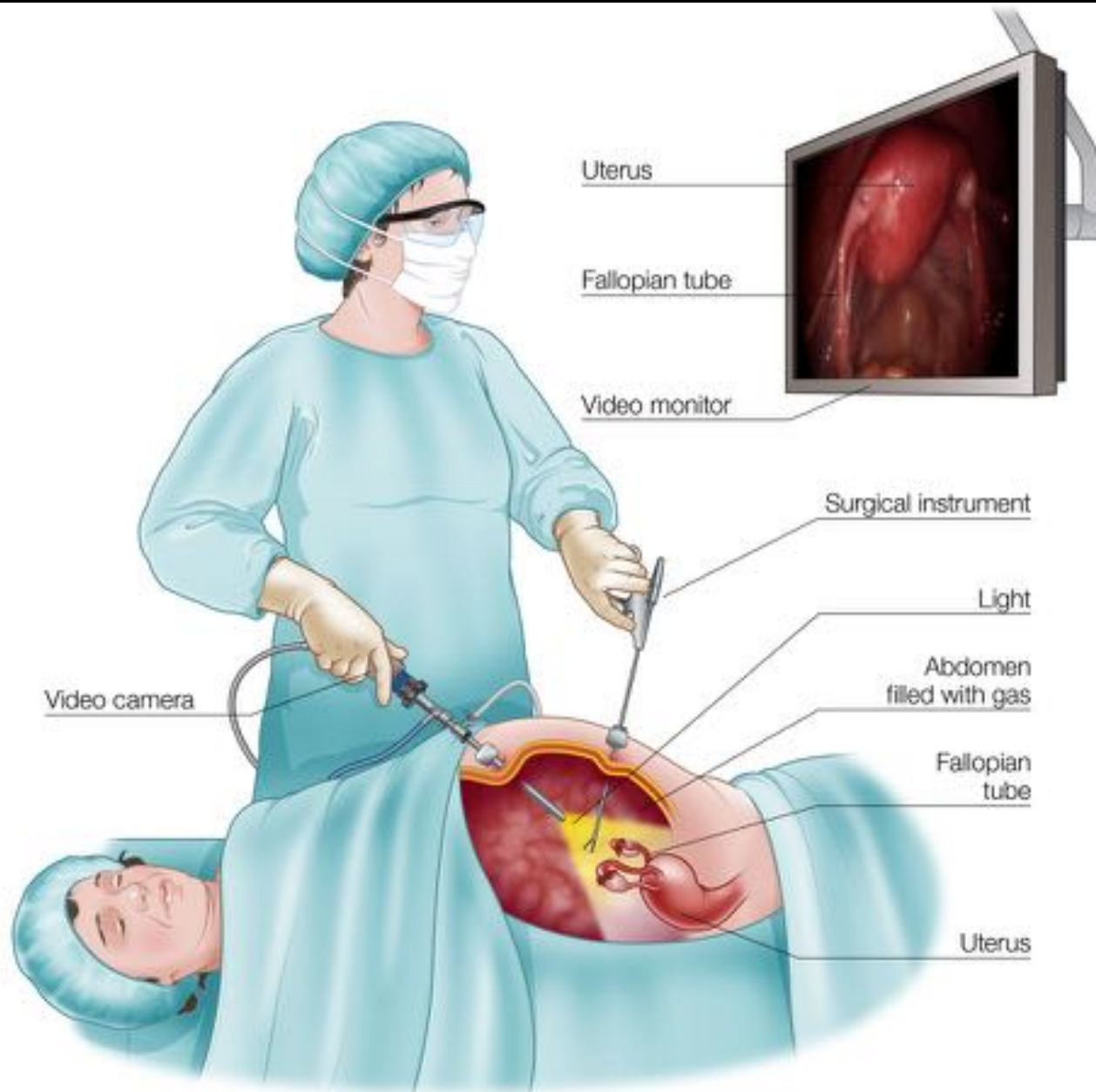
Motivation



Laparoscopic HUD

Augmented Laparoscopic
Navigation

Motivation



Motivation

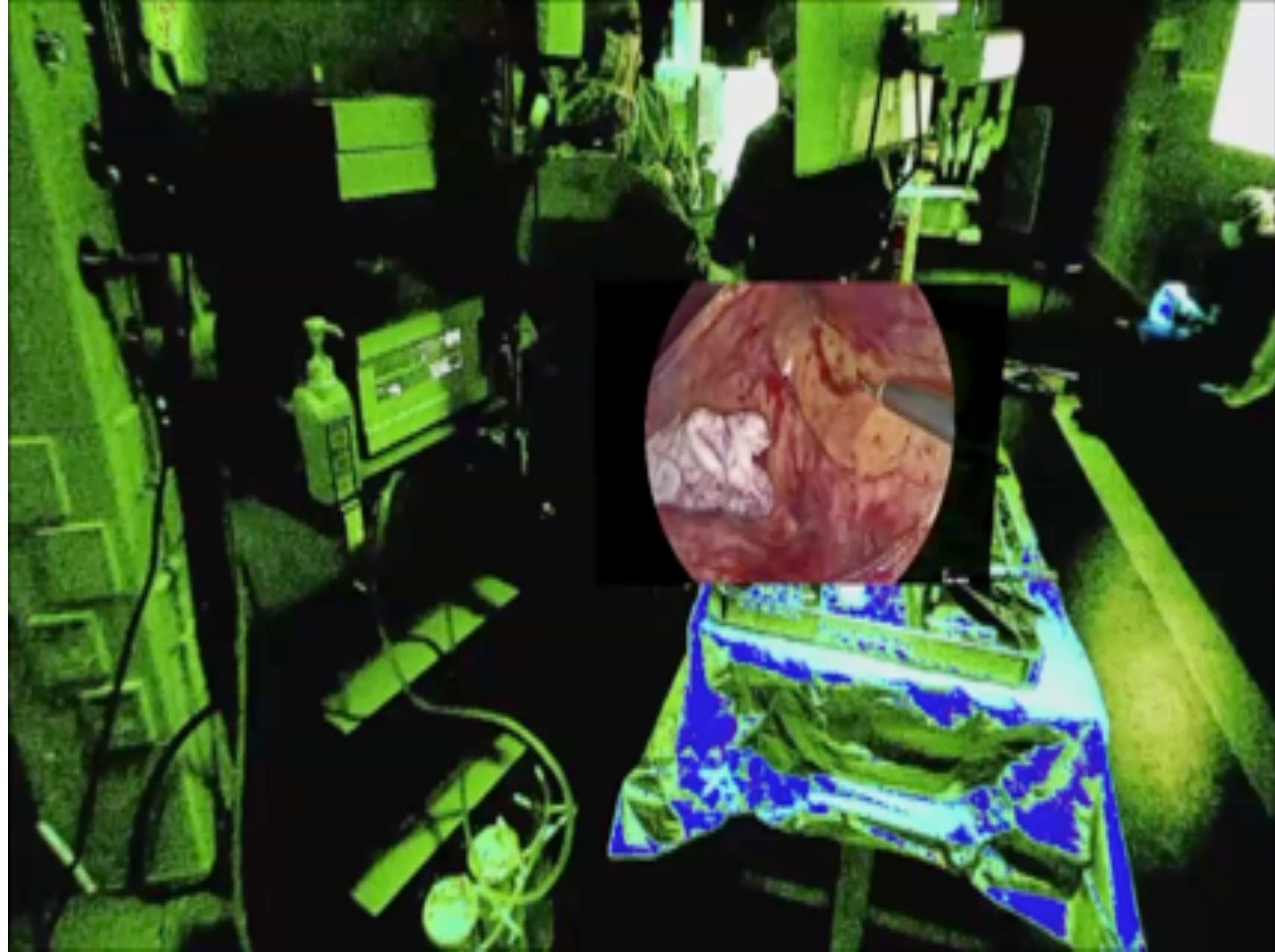


Motivation



Laparoscopic Head Mounted Display





Interactive Rehabilitation

Easing the patient's patience

Motivation



Motivation



REPETITION – FEEDBACK – MOTIVATION

Motivation



COST

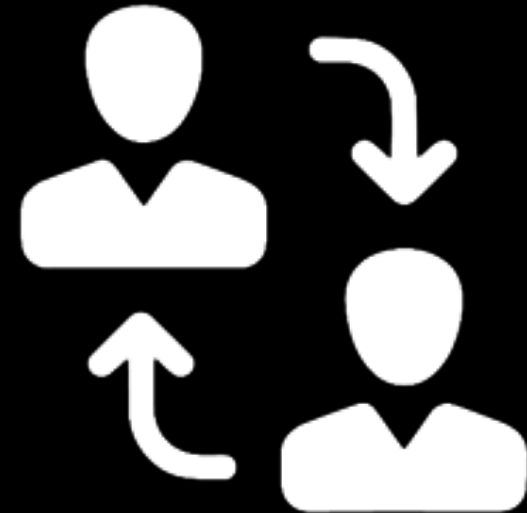


WEARABLES

Motivation



COMPENSATORY
MOVEMENTS



COLLABORATION

Physio@Home

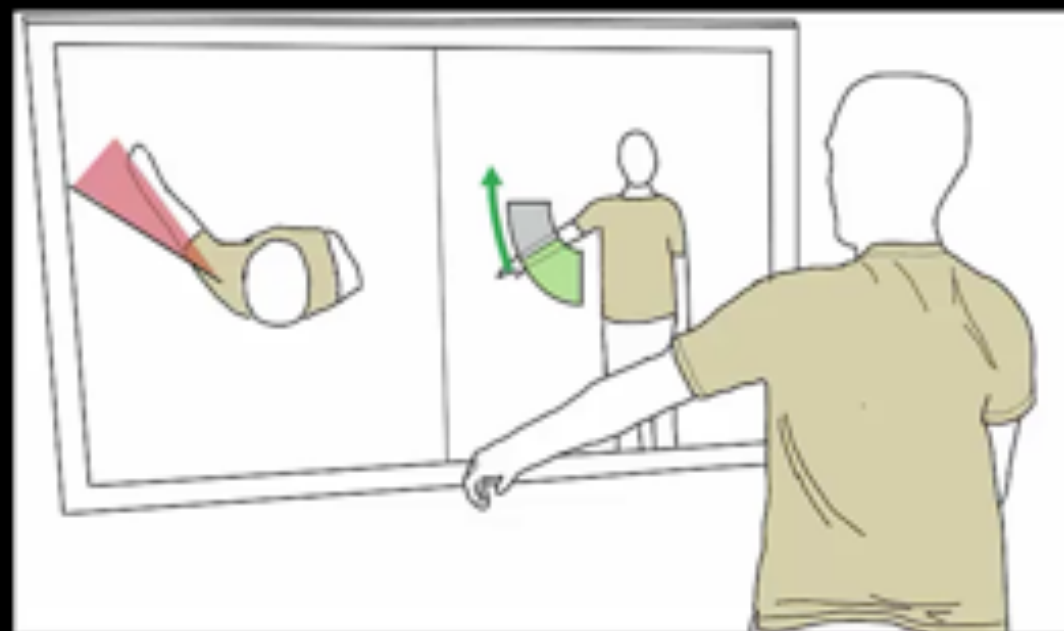
Exploring visual guidance and feedback techniques for
physiotherapy exercises

Richard Tang¹, Xing-Dong Yang¹, Scott Bateman², Joaquim Jorge³, Anthony Tang¹

¹University of Calgary

²University of Prince Edward Island

³IST/INESC-ID/U Lisboa



SleeveAR: Augmented Reality for Rehabilitation using Realtime Feedback

João Vieira, Maurício Sousa, Artur Arsénio and Joaquim Jorge

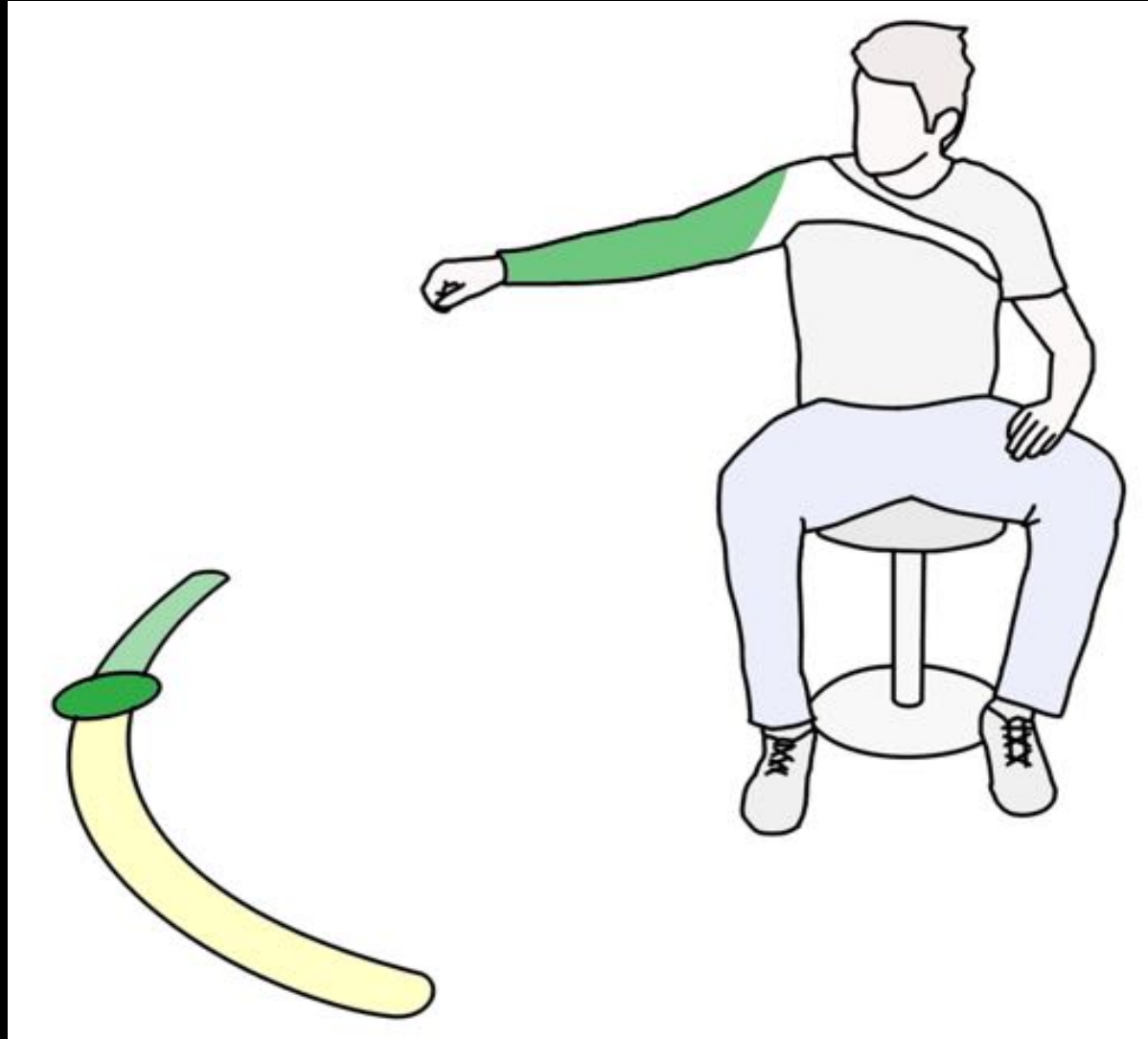
Motivation



Augmented Reality



SleeveAR



Sleeve



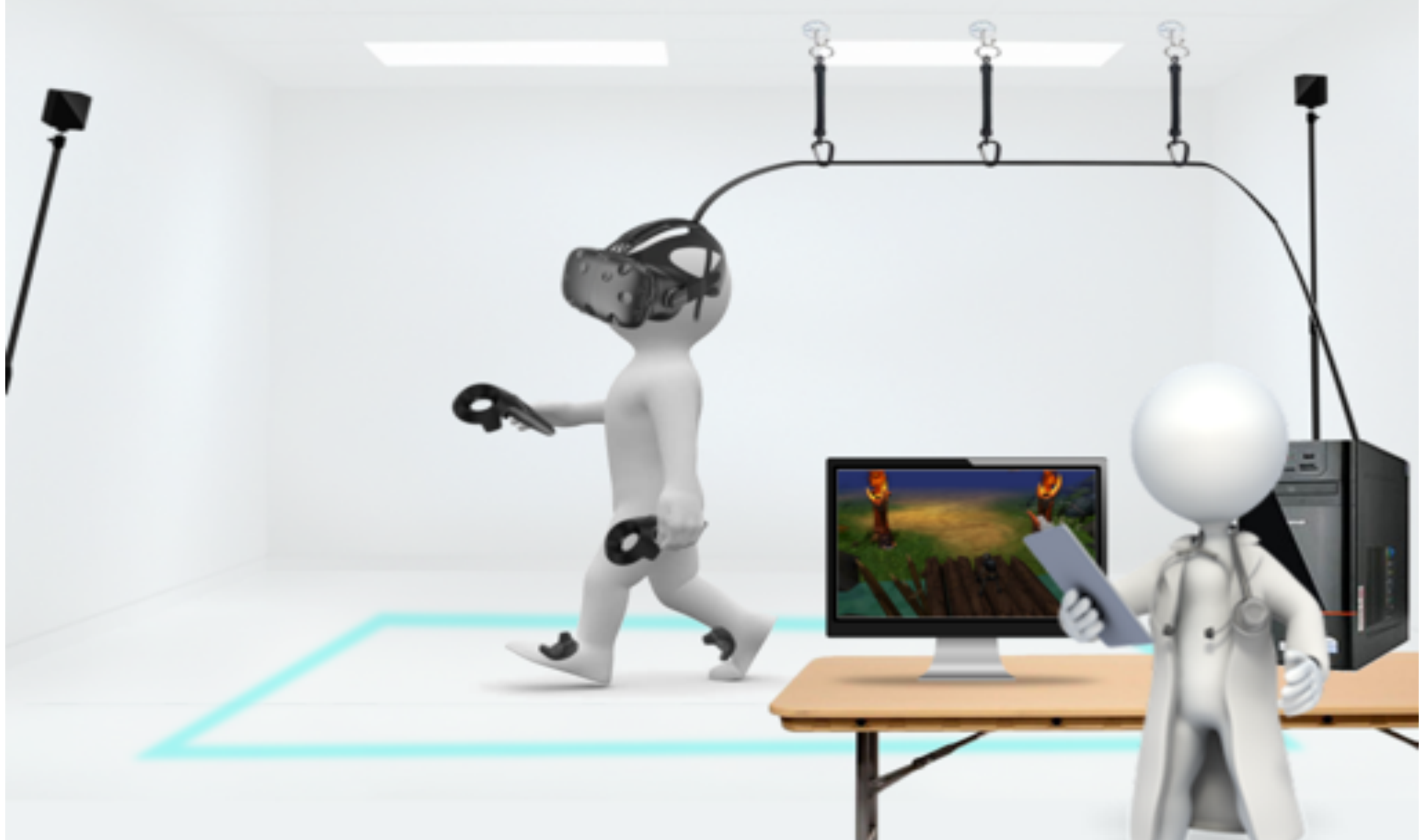
Process



Locomotiver

Exergames for
Locomotion Rehabilitation
in VR

VR for Locomotion

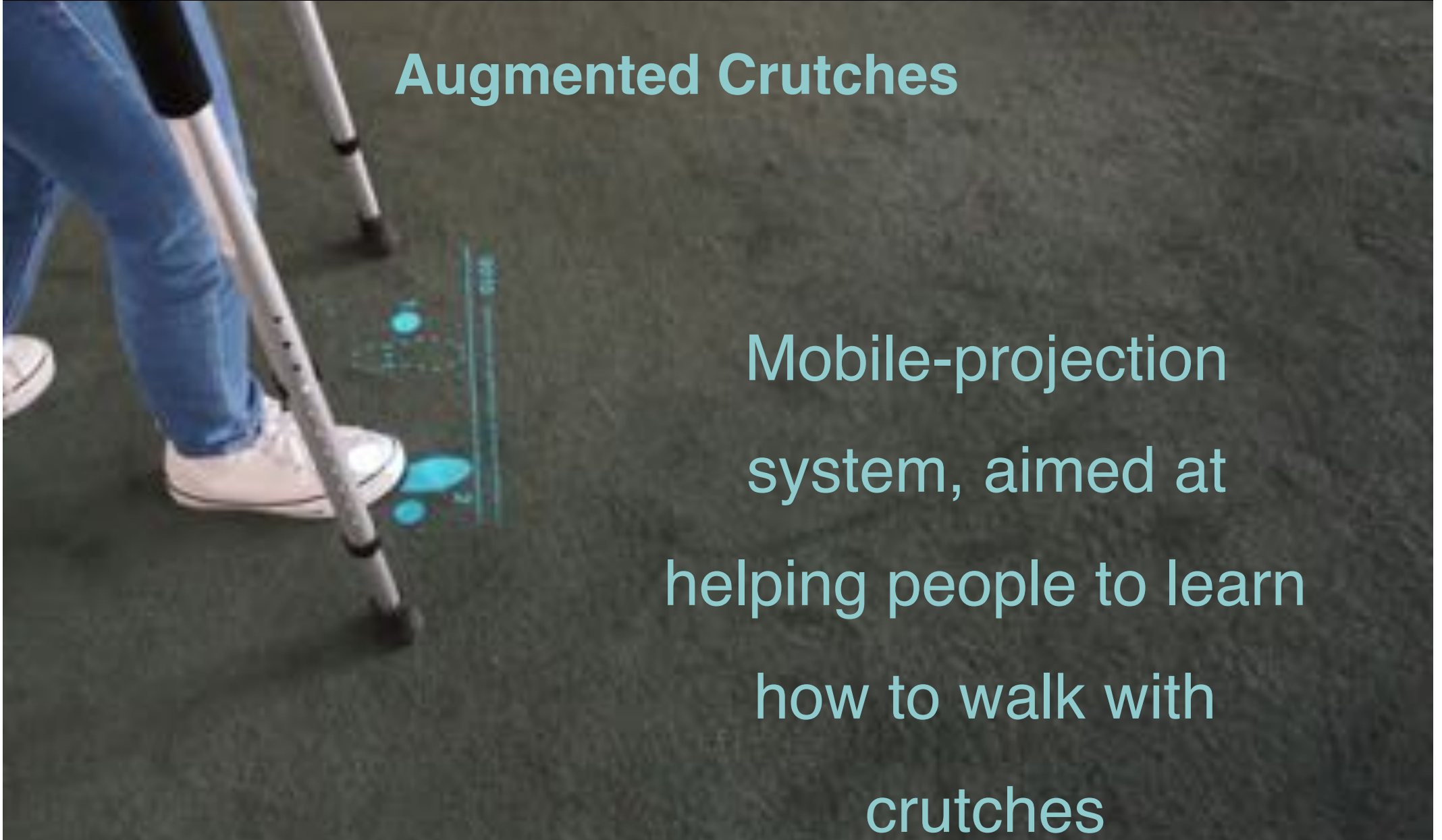


locomotiver

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



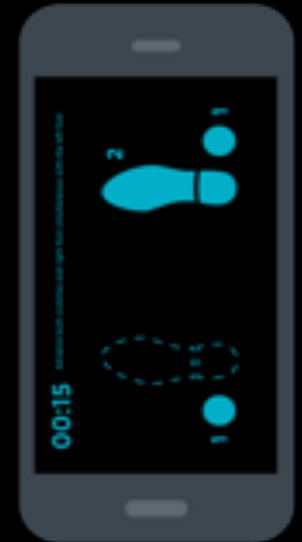
2

Connect to
projector





Walk with
projected visual
cues





A photograph showing a person's lower legs and feet wearing blue jeans and white sneakers. They are using a silver forearm crutch. On the dark grey carpeted floor, there are several glowing blue digital visual cues, including a vertical line and some circular patterns, which are part of a mobility assistance system.

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**

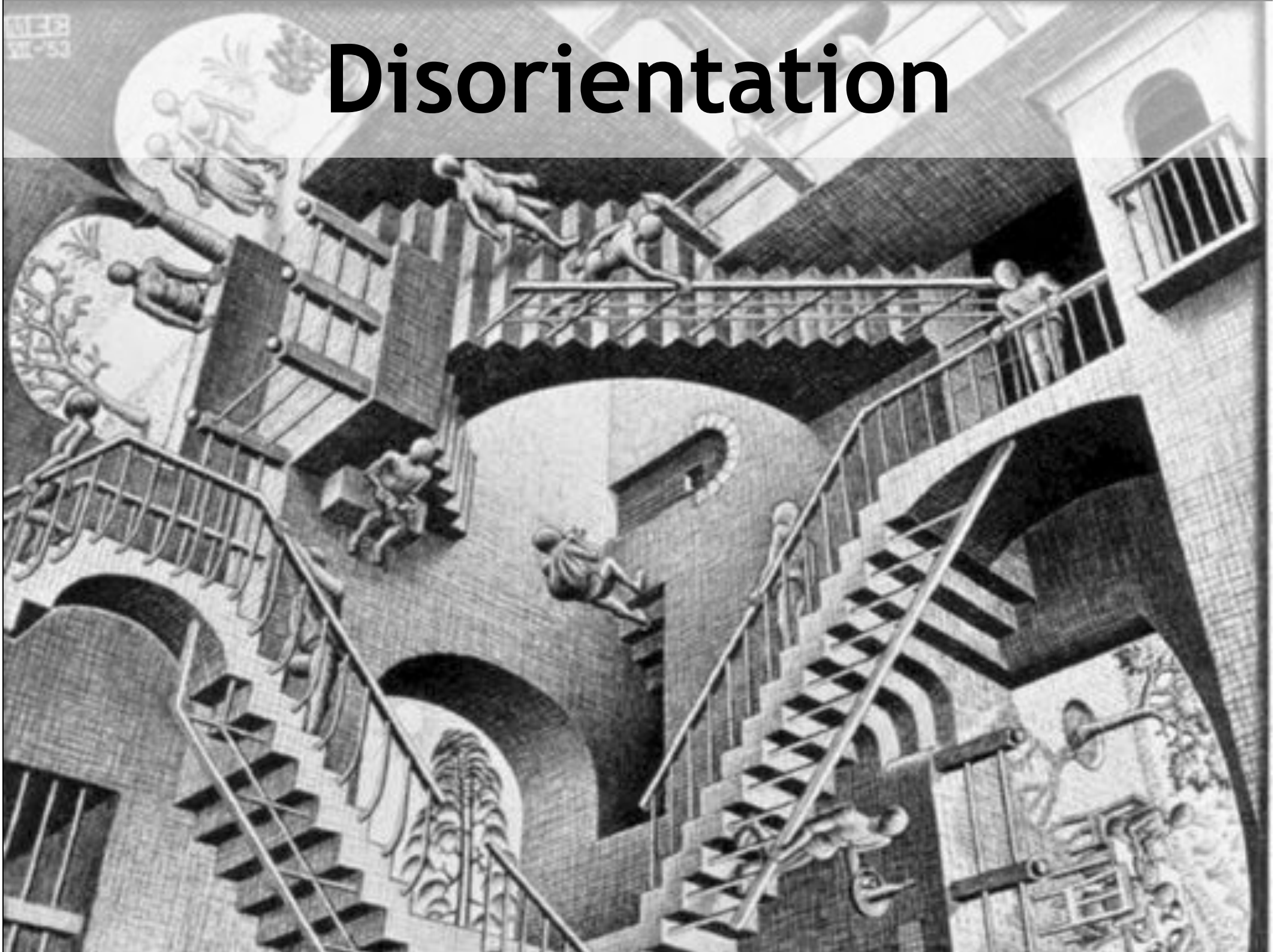
Nonstandard Equipment



Funny User Interfaces



Disorientation



Fatigue

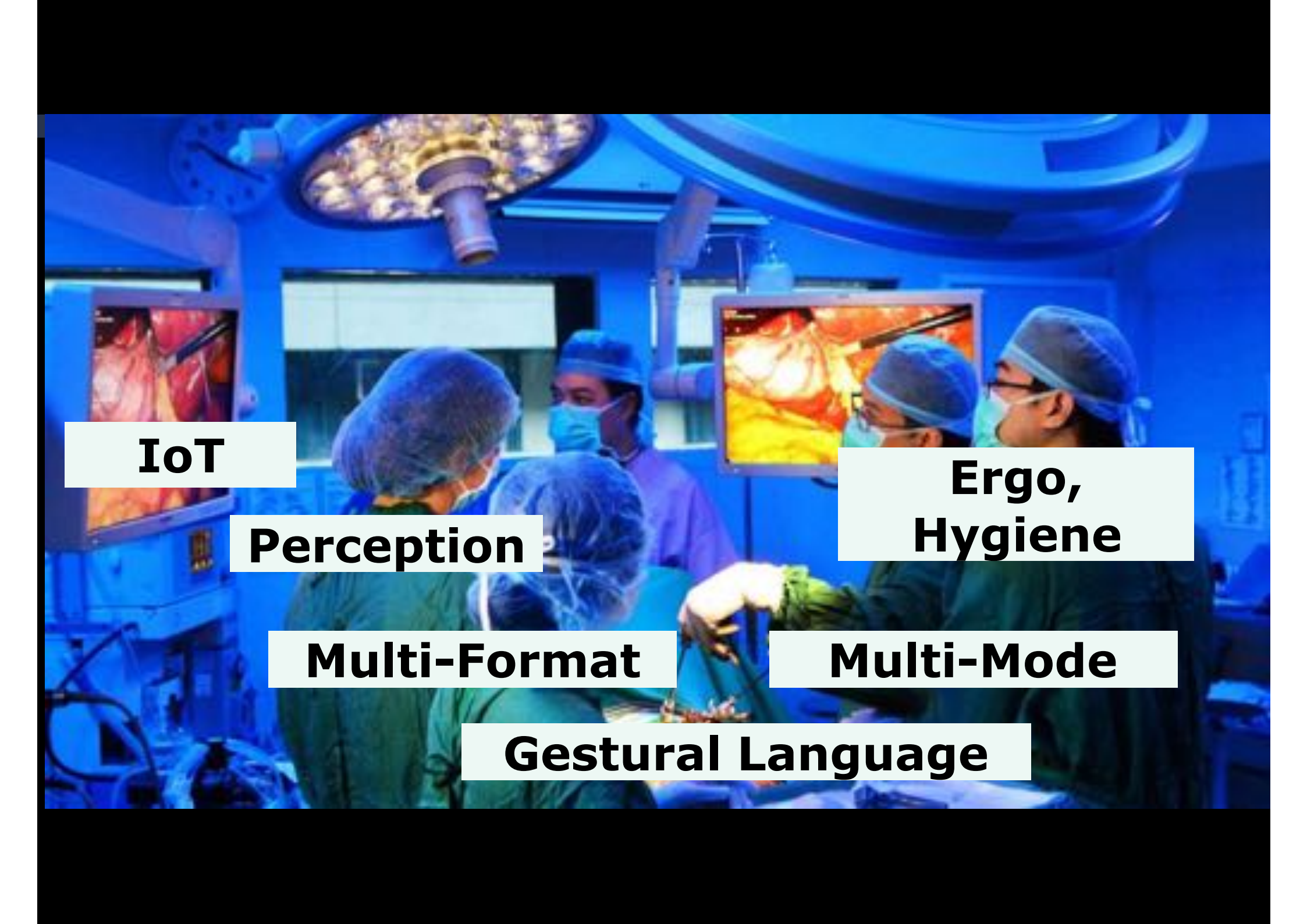


A woman with dark hair in a braid, wearing a red and blue plaid shirt and a white VR headset, is sitting on a bed. She has a distressed expression, with her hand covering her mouth. A hand from the left is holding a brown paper bag, offering it to her. The background shows a room with several framed pictures on the wall and a bed with grey bedding. The word "Nausea" is written in large yellow letters across the center of the image.

Nausea

Bright Future Ahead



A photograph of a surgical team in an operating room, illuminated by blue light. Several surgeons in scrubs and masks are gathered around a patient. Two large monitors on the left and right display surgical video feeds. Overlaid on the image are several white text boxes with black text, representing different aspects of human-computer interaction in this context. The labels include 'IoT', 'Ergo, Hygiene', 'Perception', 'Multi-Format', 'Multi-Mode', and 'Gestural Language'.

IoT

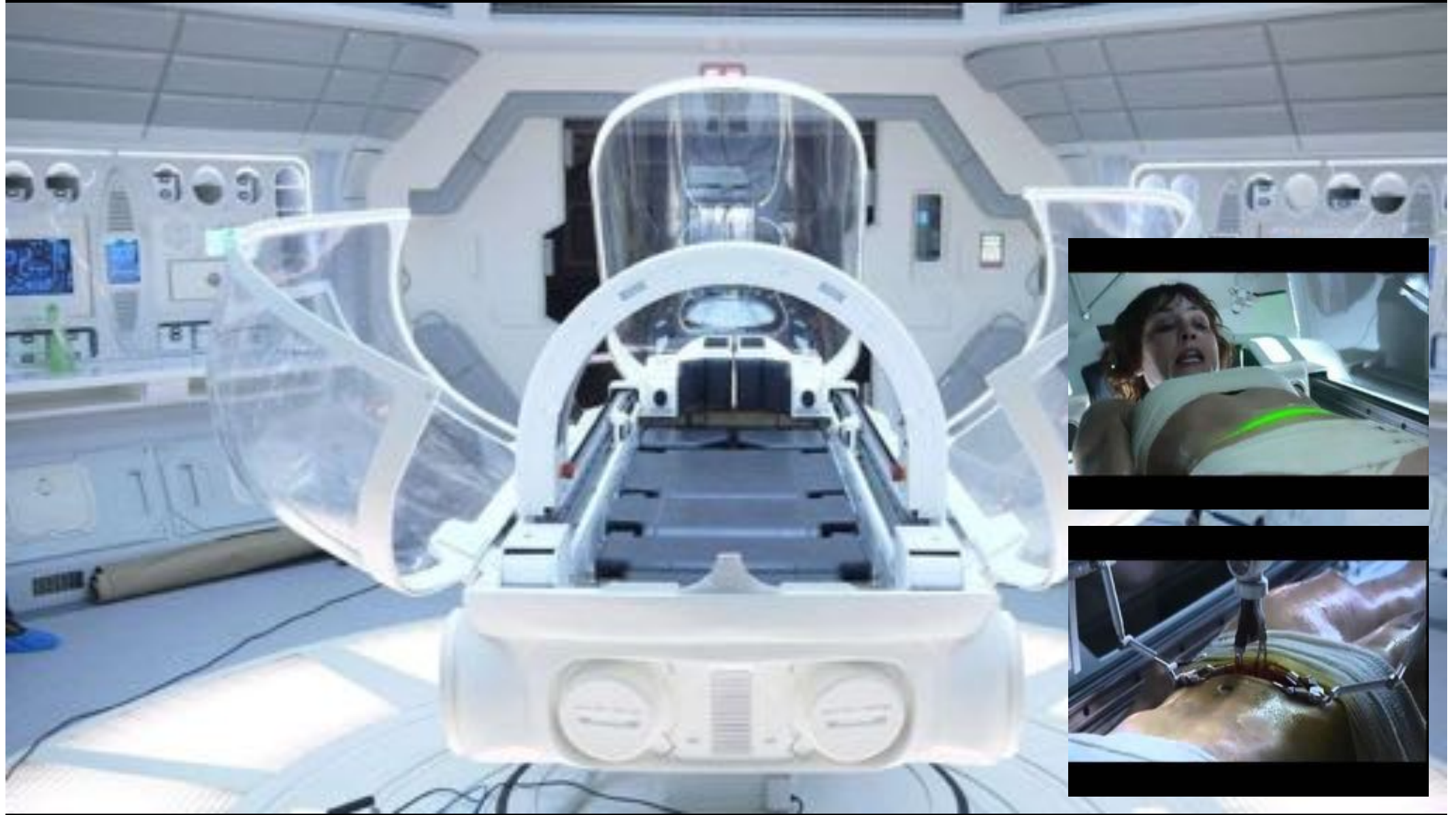
Perception

**Ergo,
Hygiene**

Multi-Format

Multi-Mode

Gestural Language



FCT

Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR



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>

Acknowledgments

ARCADE

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LOCOMOTIVER

Alexandre Gordo

VRRRRRoom

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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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