Next-Generation Healthcare Education:

Leveraging Extended Reality and Spatial Computing with Low-Code and No-Code Content Creation Tools

George Papagiannakis
ORamaVR co-founder, CEO
george@oramavr.com
&
Prof. University of Crete,
Affiliated Researcher at FORTH
Visiting Prof. University of Geneva

FORTH Foundation for Research & Technology - Hellas

ORama VR

UNIVERSITÉ DE GENÈVE

Overview

- Computational Medical XR
- Clinical validation for XR training
- Can AI+XR transform medicine?

"Science is more than a body of knowledge; it is a way of thinking."
Carl Shagan

My Career arcs

TECHNOLOGIE Réalité et images de synthèse mêlées

LE TOURISME EN 3D EST NÉ

GENÈVE Le système révolutionnaire, créé par une équipe de spécialistes européens, permet de visiter des sites archéologiques comme si on voyageait dans le temps

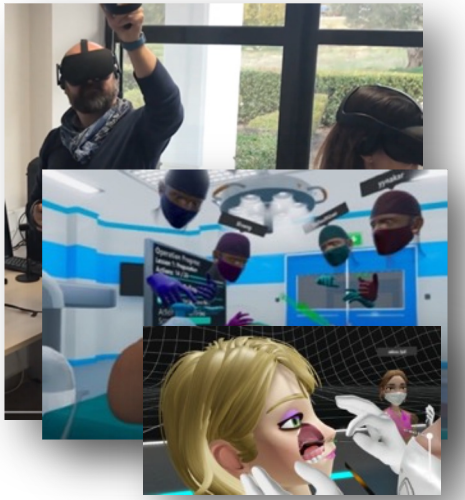
Frédéric Julliard

Un prototype à allonger

Un XVIIIe siècle comme si on y était

SITE INTERNET

www.miralab.unige.ch/recherche/theatre/




VHD++ Development Framework:
Towards Extendible, Component Based VR/AR Simulation Engine
Featuring Advanced Virtual Character Technologies

Michal Ponder (*), Georgo Papagiannakis (**), Tom Molet (**), Nadia Magnenat-Thalmann (**), Daniel Thalmann (*)

(*) Virtual Reality Lab (VRlab) Swiss Federal Institute of Technology (EPFL) e-mail: {name.surname}@epfl.ch

(**) MIRALab, University of Geneva e-mail: {name.surname}@miralab.unige.ch

Abstract

This paper presents the architecture of the VHD++ real-time development framework that after several years of intensive research, design and development effort has been released and enters its validation phase. This paper discusses the key aspects involved in architectural structure, design and practical implementation of an efficient, flexible and extendible real-time software framework based on the modern 3D game-engine design principles. This framework supports researchers and application developers with rapid, component based development of VR/AR systems featuring advanced virtual character simulation technologies. The discussion covers motivation, main concepts, survey of related work, the main functional and design requirements, design principles and key architectural elements. It concludes with the initial validation results including overview of existing VHD++ based VR/AR virtual character simulation applications

1. Introduction: The Demand

The very recent revolutionary advancements in computer graphics and in real-time virtual character simulation technology put a completely new light on the VR/AR systems and in particular on their scaled down cousins: interactive video games. In the extremely competitive environment there is only one rule to follow: deliver always newer, always faster and always more in shorter time. Chasing that continuous tough demand results in system complexity rising exponentially with the number of components and semantically distant technologies being integrated under a single interactive, real-time, audio-visual application roof. This explains the current, rapidly growing interest of both research and industry in advanced, complexity curbing, framework oriented, middleware solutions that while well established in other IT domains are just coming to life in the interactive real-time audio-visual simulation field.

Significant investments combined with intensive research and development in the core fields made the technologies, once affordable only to few research laboratories and government based institutions, now widely available. We are reaching the point where majority of researchers and developers has nearly equal access to similar technologies providing comparable price/performance ratio.

It seems that in the near future the success of a particular interactive real-time audio-visual product or service will unlikely be a function of any certain quality or the number of individual qualities involved. Instead it will be based on the way or rather the art of combining multiple qualities, relating them and letting them interplay inside one consistent and extendible framework. The complexity and the technologies that will let handle it will distinguish the successful products and services in the coming new era of interactive audio-visual applications.

Quoting Bill Raduchel, former Chief Strategy Officer at Sun Microsystems, Inc.: "The challenge over the next 20 years will not be speed or cost of performance; it will be the question of complexity".

2. Motivation: Curbing Complexity

2.1. Common Experience: Facing Complexity

Carrying on proprietary research activities while being at the same time involved in demanding, tightly timed, development projects targeting concrete applications is a daily reality of many research groups. Overall complexity of the resulting applications reaches the levels that one can barely handle with the methodologies currently at hand.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ÉCONOMIQUES ET SOCIALES
Département de systèmes d'information
Professeure Nadia Magnenat-Thalmann

FACULTÉ DES SCIENCES
Département d'informatique
Professeur José Rolim

An Illumination Registration Model for Dynamic Virtual Humans in Mixed Reality

THÈSE

présentée à la Faculté des Sciences de l'Université de Genève

pour obtenir le grade de Docteur ès sciences, mention informatique

par

Georgios Papagiannakis

de

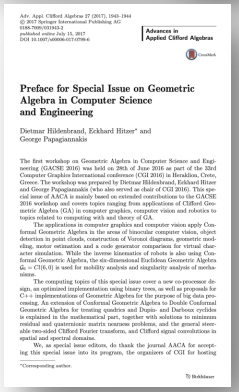
Crète (Grèce)

Thèse N° 3795

GENÈVE

Atelier de reproduction de la Section de physique

2006


Adv. Appl. Clifford Algebras 27 (2017), 1045–1044
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DOI 10.1007/s00006-017-0796-6

Advances in Applied Clifford Algebras

Preface for Special Issue on Geometric Algebra in Computer Science and Engineering

Dietmar Hildenbrand, Eckhard Hitzer* and George Papagiannakis

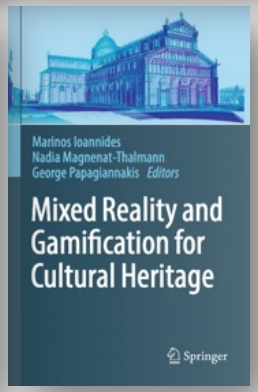
The first workshop on Geometric Algebra in Computer Science and Engineering (GACSE 2016) was held on 28th of June 2016 as part of the 33rd Computer Graphics International conference (CGI 2016) in Heraklion, Crete, Greece. The workshop was prepared by Dietmar Hildenbrand, Eckhard Hitzer and George Papagiannakis (who also served as chair of CGI 2016). This special issue of AACA is mainly based on extended contributions to the GACSE 2016 workshop and covers topics ranging from applications of Clifford Geometric Algebra (GA) in computer graphics, computer vision and robotics to topics related to computing with and theory of GA.

The applications in computer graphics and computer vision apply Conformal Geometric Algebra in the areas of binocular computer vision, object detection in point clouds, construction of Voronoi diagrams, geometric modeling, motor estimation and a code generator comparison for virtual character simulation. While the inverse kinematics of robots is also using Conformal Geometric Algebra, the six-dimensional Euclidean Geometric Algebra $\mathcal{G}_6 = C\ell(6,0)$ is used for mobility analysis and singularity analysis of mechanisms.

The computing topics of this special issue cover a new co-processor design, an optimized implementation using binary trees, as well as proposals for C++ implementations of Geometric Algebra for the purpose of big data processing. An extension of Conformal Geometric Algebra to Double Conformal Geometric Algebra for treating quadrics and Dupin- and Darboux cyclides is explained in the mathematical part, together with solutions to minimum residual and quaternionic matrix nearness problems, and the general steerable two-sided Clifford Fourier transform, and Clifford signal convolutions in spatial and spectral domains.

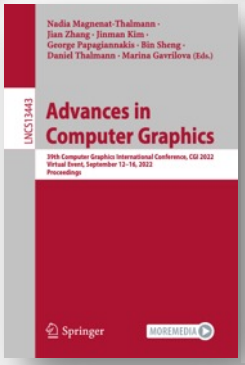
We, as special issue editors, do thank the journal AACA for accepting this special issue into its program, the organizers of CGI for hosting

*Corresponding author.


Marinos Ioannides
Nadia Magnenat-Thalmann
George Papagiannakis Editors

Mixed Reality and Gamification for Cultural Heritage

Springer


Nadia Magnenat-Thalmann · Jian Zhang · Jinman Kim · George Papagiannakis · Bin Sheng · Daniel Thalmann · Marina Gavrilova (Eds.)

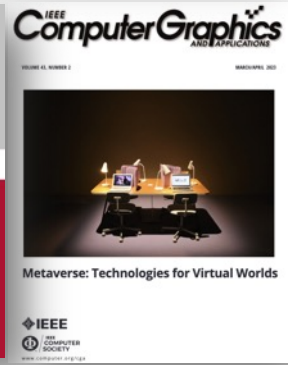
LNCS 13443

Advances in Computer Graphics

39th Computer Graphics International Conference, CGI 2022
Virtual Event, September 12–16, 2022
Proceedings

Springer

MOREMEDIA


IEEE Computer Graphics AND APPLICATIONS

VOLUME 43, NUMBER 2 MARCH/APRIL 2023

Metaverse: Technologies for Virtual Worlds

IEEE COMPUTER SOCIETY

www.computer.org/cga

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Augmenting Human intellect?

Let us consider an "augmented" architect at work. He sits at a working station that has a visual display screen some three feet on a side; this is his working surface, and is controlled by a computer (his "clerk") with which he can communicate by means of a small keyboard and various other devices.

He is designing a building. He has already dreamed up several basic layouts and structural forms, and is trying them out on the screen. The surveying data for the layout he is working on now have already been entered, and he has just coaxed the "clerk" to show him a perspective view of the steep hillside building site with the roadway above, symbolic representations of the various trees that are to remain on the lot, and the service tie points for the different utilities. The view occupies the left two-thirds of the screen. With a "pointer," he indicates two points of interest, moves his left hand rapidly over the keyboard, and the distance and elevation between the points indicated appear on the right-hand third of the screen.

STANFORD RESEARCH INSTITUTE
MENLO PARK, CALIFORNIA

SRI

Republished in abridged form in ***Vistas in Information Handling***, Howerton and Weeks [Editors], Spartan Books, Washington, D.C., 1963, pp. 1-29, titled "A Conceptual Framework for the Augmentation of Man's Intellect."

October 1962

AFOSR-3223

Summary Report

AUGMENTING HUMAN INTELLECT: A CONCEPTUAL FRAMEWORK

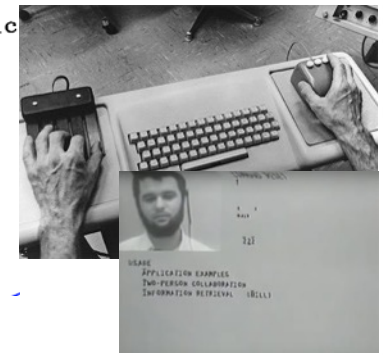
Prepared for:

DIRECTOR OF INFORMATION SCIENCES
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH
WASHINGTON 25, D.C.

CONTRACT AF 49(638)-1024

By: D. C. Engelbart

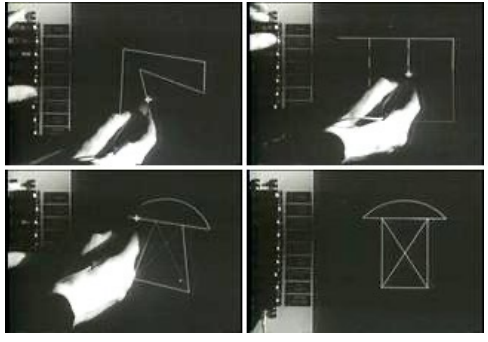
SRI Project No. 3578

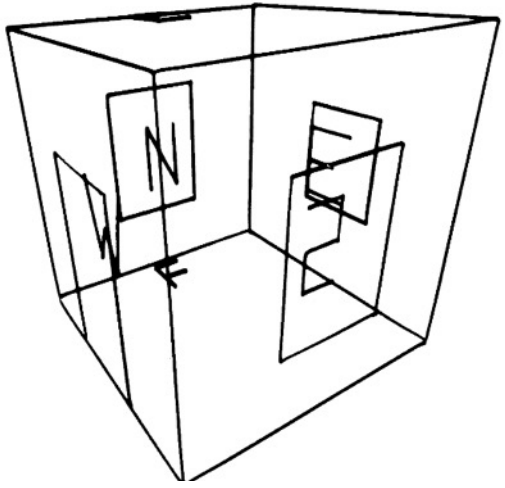


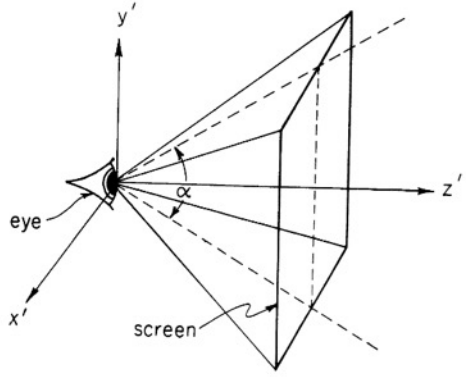
Engelbart, Douglas. "Augmenting human intellect: A conceptual framework. Summary report." *Stanford Research Institute, on Contract AF* 49, no. 638 (1962): 1024.

"Mother of all demos": https://youtu.be/B6rKUf9DWRI , 1968

Head Mounted Displays and natural user interaction?



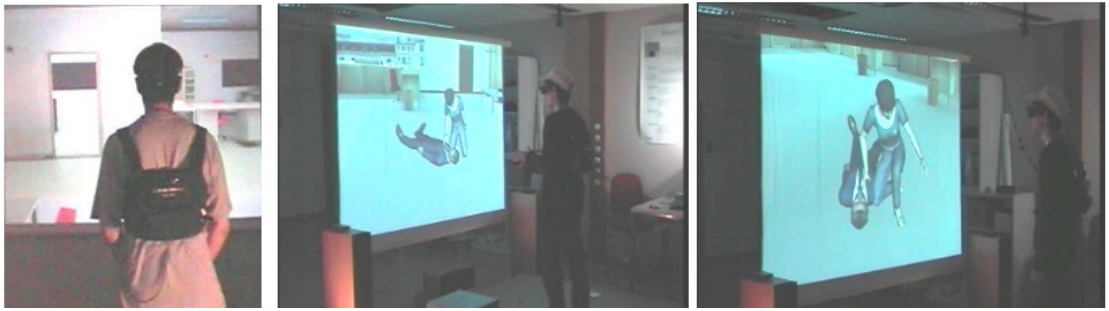


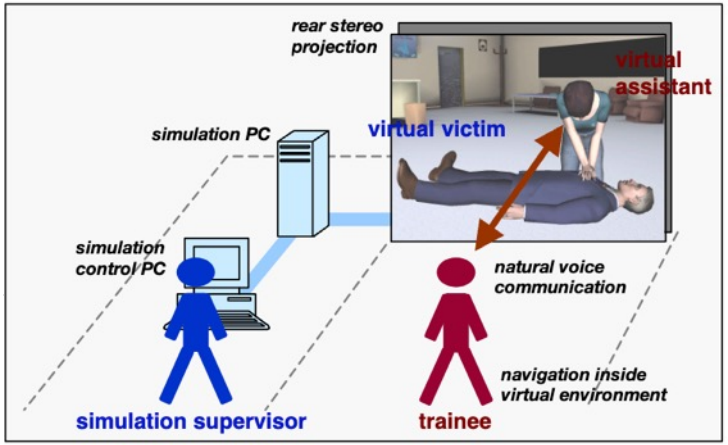


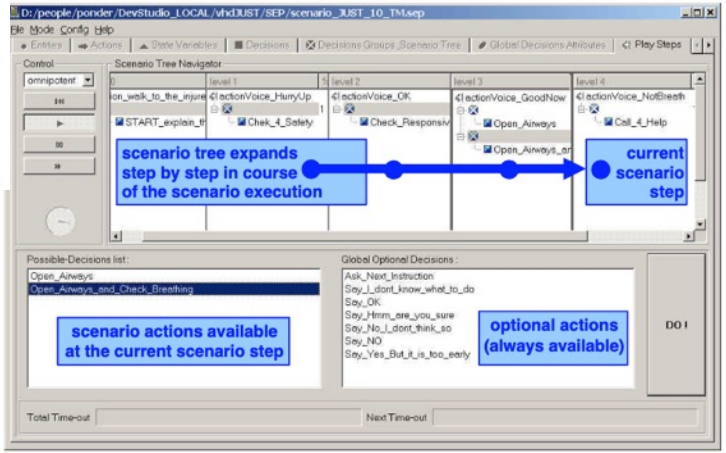
The sketchpad demo: https://youtu.be/6orsmFndx_o,1963

Sutherland, I. E. A head-mounted three dimensional display. *AFIPS Fall Joint Computing Conference* 757–764 (1968) doi:10.1145/1476589.1476686. https://youtu.be/eVUgfUvP4uk

XR and Spatial computing for medical training?

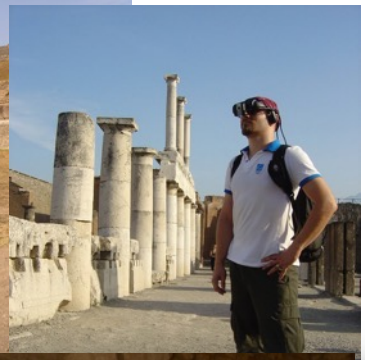






- M Ponder, B Herbelin, T Molet, S Schertenleib, B Ulicny, G Papagiannakis, N Magnenat-Thalmann, and D Thalmann. 2002. Interactive Scenario Immersion:Health Emergency Decision Training in JUST Project. Proc. Of 1st International Workshop on Virtual Reality Rehabilitation, VRMHR2002, Lausanne, (November 2002), 87–101.
- Michal Ponder, Bruno Herbelin, Tom Molet, Sebastien Schertenlieb, Branislav Ulicny, George Papagiannakis, Nadia Magnenat-Thalmann, and Daniel Thalmann. 2003. Immersive VR decision training: telling interactive stories featuring advanced virtual human simulation technologies. DOI:https://doi.org/10.1145/769953.769965

XR and Spatial computing for education?



Papagiannakis, G. *et al.* LIFEPLUS: Revival of life in ancient Pompeii. *Proc. of Virtual Systems and Multimedia, VSMM02, Gyeongju* (2002)
Papagiannakis, G. *et al.* Mixing Virtual and Real scenes in the site of ancient Pompeii. *Computer Animation and Virtual Worlds, John Wiley and Sons Ltd* 16, 11–24 (2005)

Computational Medical XR

Intro

***Computational medical XR** is a new interdisciplinary field, bridging life sciences, with mathematics, engineering and computer science.*
*It unifies **computational** science (scientific computing) with intelligent **extended reality** and **spatial computing** for the **medical** field.*

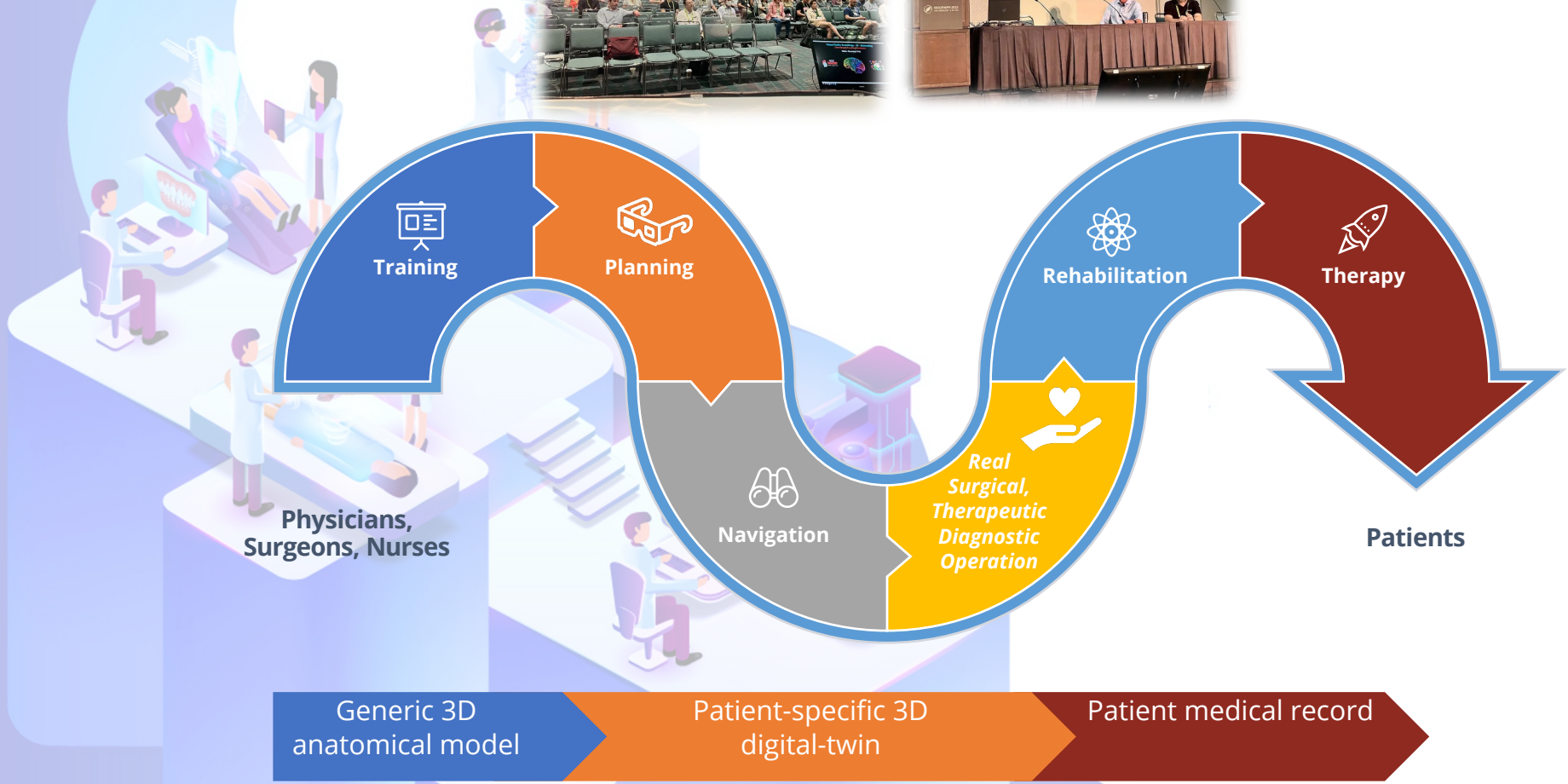
It integrates **computational** methods from computer **graphics**, computational **geometry**, **vision** and **deep learning** to solve hard problems in medicine and neuroscience:

- low-code/no-code **authoring** XR platforms
- XR medical **training**
- XR surgical **planning**
- XR operative **navigation**
- XR for **rehabilitation** and **therapeutics**

- https://s2023.siggraph.org/presentation/?id=fwork_109&sess=sess287, 2023
- Papagiannakis, G., "A computational medical XR discipline", https://arxiv.org/abs/2108.04136v3, 2023
- D. E. Stevenson. 1994. Science, computational science, and computer science: at a crossroads. Commun. ACM 37, 12 (Dec. 1994), 85–96. DOI:https://doi.org/10.1145/198366.198386

Computational Medical XR

Overview



Generic 3D anatomical model → Patient-specific 3D digital-twin → Patient medical record

https://s2023.siggraph.org/presentation/?id=ftalk_101&sess=sess408

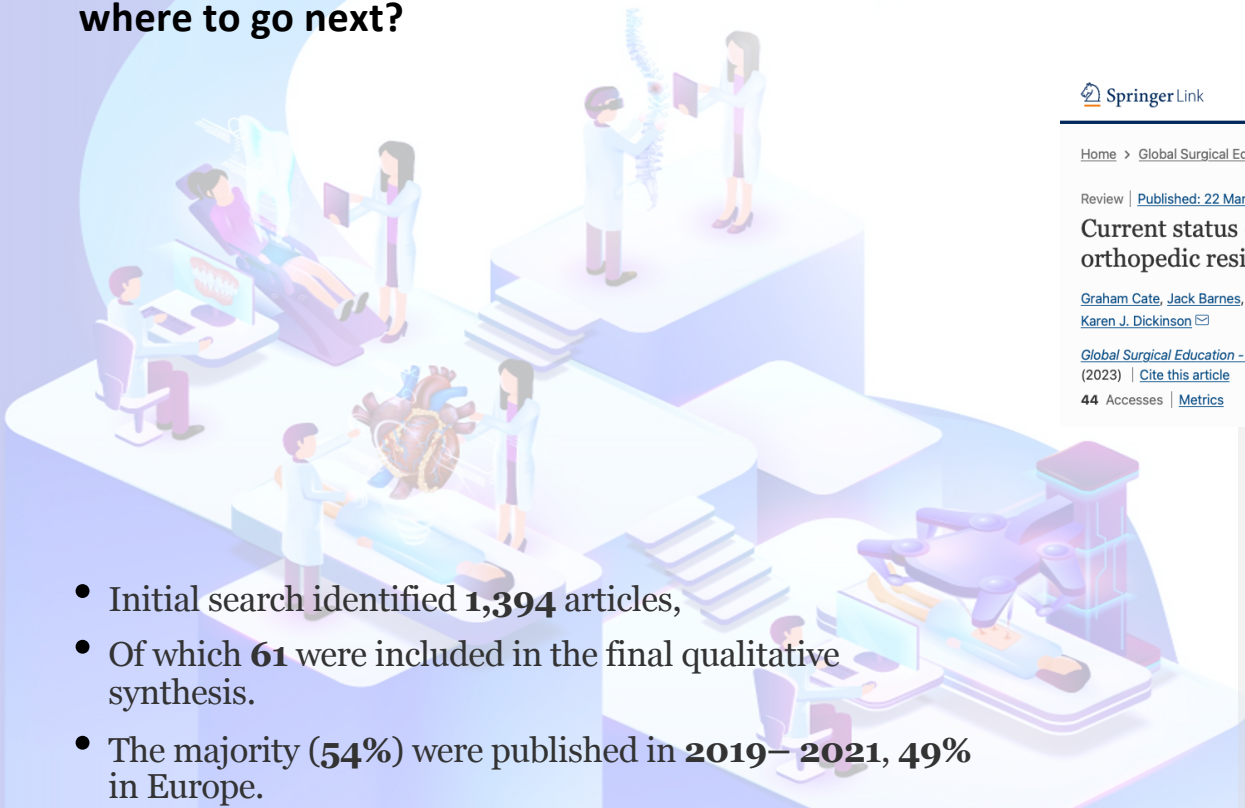
Why now for computational medical XR?

Stable Diffusion prompt:
"doctors and nurses with 3D VR and AR glasses in digital and real objects and environments integrated and communicating between each other based on immersive experiences"

"After **years** of **validation** and **use** by early adopters – XR medical technology is poised to move to the **mainstream**; recent changes in **access** and **cost** make XR quite **affordable**"
Dr. Walter Greenleaf,
Stanford Health Care & Virtual Human Interaction Lab

"The biggest **challenges** in **healthcare** are (1) **access**—there aren't enough enough good doctors to provide timely care to all who need it (and clinicians are leaving the field in droves due to burn out), and (2) **cost**—the cost of healthcare has skyrocketed, largely because of increasing labor costs.
AI will **solve both** of these issues."
Daisy Wolf and Vijay Pande,
https://a16z.com/2023/08/02/where-will-ai-have-the-biggest-impact-healthcare/

VR simulation-based training for surgical education: where to go next?



- Initial search identified **1,394** articles,
- Of which **61** were included in the final qualitative synthesis.
- The majority (**54%**) were published in **2019– 2021**, **49%** in Europe.
- The majority of studies (**70%**) focused on simulator validation.

- Cate, G., Barnes, J., Cherney, S. *et al.* Current status of virtual reality simulation education for orthopedic residents: the need for a change in focus. *Global Surg Educ* **2**, 46 (2023). https://doi.org/10.1007/s44186-023-00120-w

SpringerLink

Home › Global Surgical Education - Journal of the Association for Surgical Education › Article

Review | Published: 22 March 2023

Current status of virtual reality simulation education for orthopedic residents: the need for a change in focus

Graham Cate, Jack Barnes, Steven Cherney, Jeffrey Stambough, David Bumpass, C. Lowry Barnes & Karen J. Dickinson

Global Surgical Education - Journal of the Association for Surgical Education **2**, Article number: 46 (2023) | Cite this article

44 Accesses | Metrics

Current literature pertaining to **VR training** for orthopaedic residents is **focused on establishing validity and rarely forms part of a curriculum**. Where the focus is education, the majority are discrete educational modules and do not teach a comprehensive amalgam of orthopedic skills. This suggests **focus is needed to embed VR simulation training within formal curricula.**

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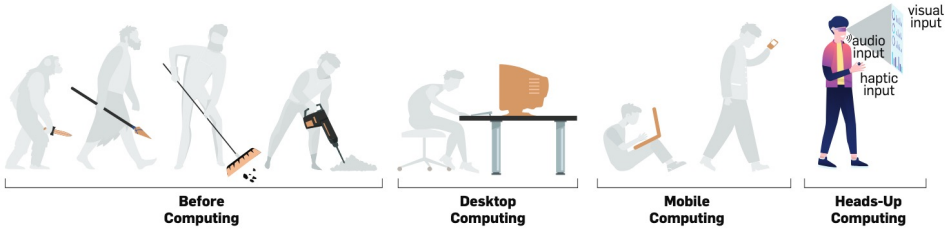

Heads-up computing*

Do our tools really complement us, or are we adjusting our natural behavior to accommodate our tools?

* Shengdong Zhao, Felicia Tan, and Katherine Fennedy. 2023. Heads-Up Computing Moving Beyond the Device-Centered Paradigm. Commun. ACM 66, 9 (September 2023), 56–63. https://doi.org/10.1145/3571722

METAVERSE GENERATION (VIRTUAL WORLDS): CODE -> LOW-CODE -> NO-CODE (GENERATIVE AI)

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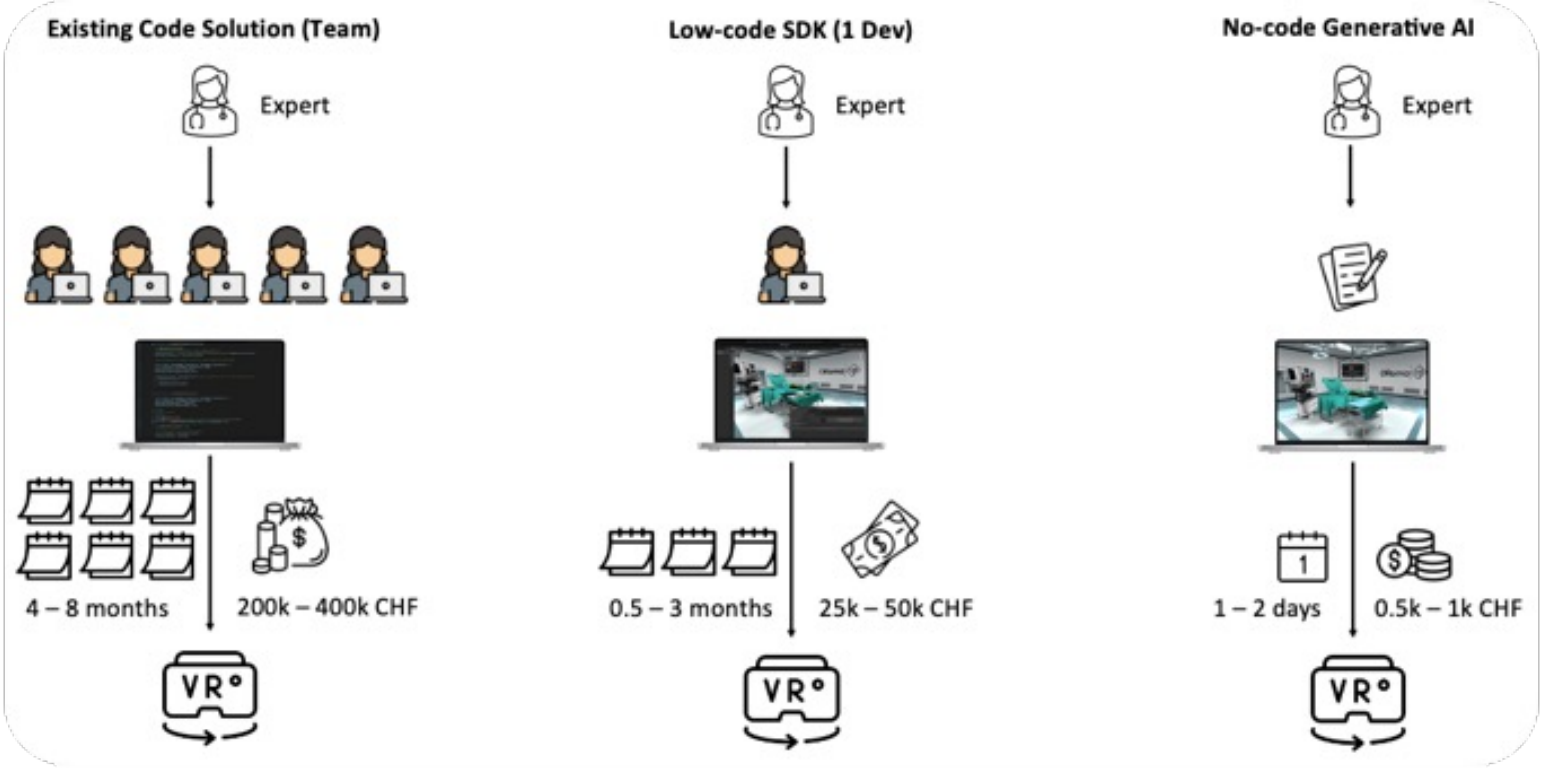

Stable Diffusion prompt:
"interacting in extended reality with a photorealistic environment of a hospital"

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XR draws on AI

"In order to get to **ultrarealistic** and **useful** 3D, there's a need to **step beyond** hardware and incorporate AI.

Even the most powerful GPU wouldn't be able to **generate** high-quality **ray-traced** 3D models in real time.

Just when Moore's Law is **expiring** and graphics as usual has run into a roadblock, AI has appeared as a **valuable** tool.

It provides us with new and powerful methods to **push** graphics forward, by being smarter about the rendering process.

We are at the **cusp** of **enormous innovation** in the 3D rendering space"

Samuel Greengard. 2023. 3D Modeling Draws on AI. Commun. ACM 66, 8 (August 2023), 15–16. https://doi.org/10.1145/3603748

ORama VR

Deep learning and generative AI

"Deep learning takes **data points** and turns them into a **query-able structure** that enables **retrieval** and **interpolation** between the points.

You could think of it as a continuous **generalization** of **database** technology."

"It is categorically **different** from even the simplest of **embodied biological agents**. As in, it's an entirely different category, with no shared characteristics.

Analogies to the brain are just as misleading as when people used the same analogies to describe computers in the 1950s."

F. Chollet, Google AI

Stable Diffusion prompt:
"an explosion of colorful powder"


ORama VR
Operation Progress:
Lesson 1: Knee Incision
Actions: 0 / 68
Cut Epidermis
Operation Start
Action Time: 13.98 Sec
Score: 100%
Errors: 1

THE PROBLEM

XR training improves learning outcomes[1],
XR content creation cannot keep up with demand:

- **LENGTHY CREATION TIMES: 2 – 8 MONTHS**
- **HIGH AUTHORING COSTS[2]:**
  MIN $20K PER MINUTE
- **INFINITE NUMBER OF TRAINING EXPERIENCES**
  TO BE SIMULATED AS DIGITAL TWINS
- **LACK OF LOW/NO-CODE, CONTENT AUTHORING TOOLS**

1 https://www.sciencedirect.com/science/article/pii/S0883540319303341
and more than 55 published clinical trials since 2020 verify this fact

2 https://roundtablelearning.com/cost-of-virtual-reality-training-full-vr-2020/

METAVERSE LOW-CODE AUTHORING FRAMEWORKS

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Numerous **authoring frameworks** have emerged to sustain the creation of VR/AR applications

Main characteristics of virtual reality authoring tools: [1]

- Virtual environment **creation**
- Manipulating and importing **3D** objects
- Interactive **human characters** development
- Artificial intelligence **automation**

"Our medical virtual-worlds **(or digital twins)** will seem fundamentally different in the future due to the incorporation of developing technology" [3]

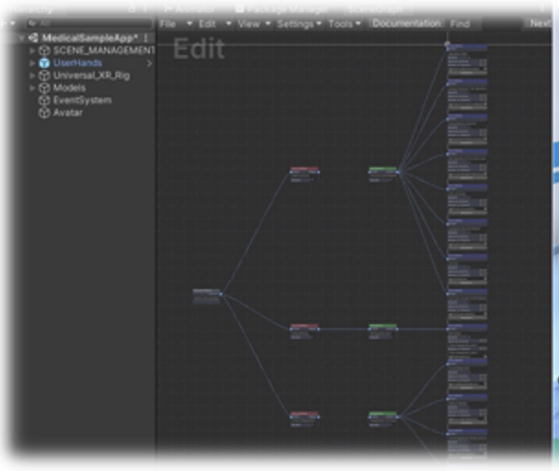
"The most evaluated metrics were **usability**, **effectiveness**, **efficiency**, and **satisfaction**." [2]

[1] Chamusca, I. L., Ferreira, C. V., Murari, T. B., Apolinario, A. L. & Winkler, I. Towards Sustainable Virtual Reality: Gathering Design Guidelines for Intuitive Authoring Tools. *Sustainability-basel* **15**, 2924 (2023)

[2] Coelho, H., Monteiro, P., Gonçalves, G., Melo, M. & Bessa, M. Authoring tools for virtual reality experiences: a systematic review. *Multimed Tools Appl* 1–24 (2022) doi:10.1007/s11042-022-12829-9

[3] Bansal, G., Rajgopal, K., Chamola, V., Xiong, Z. & Niyato, D. Healthcare in Metaverse: A Survey On Current Metaverse Applications in Healthcare. *Ieee Access* **PP**, 1–1 (2022)

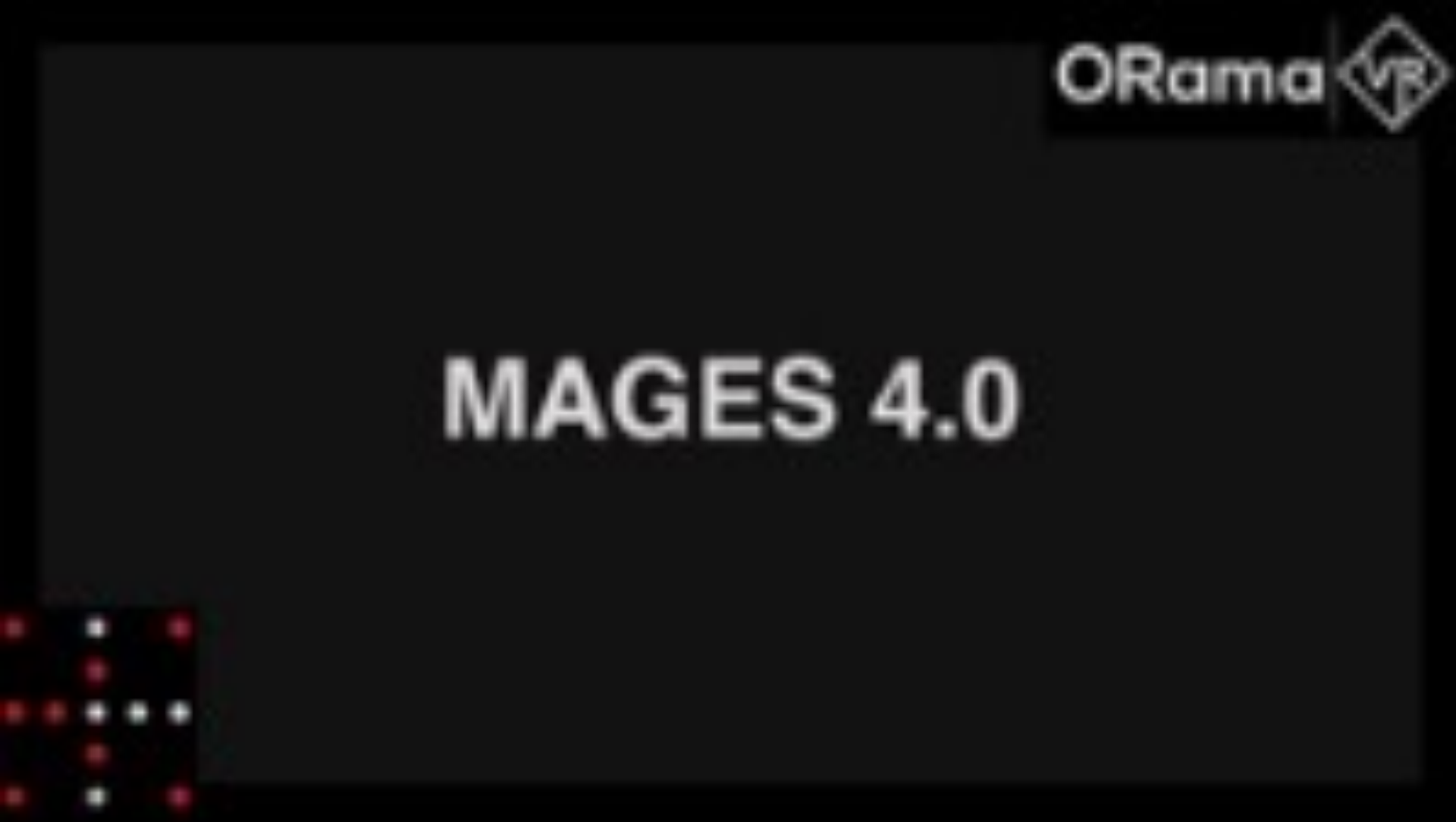
METAVERSE AUTHORING FRAMEWORKS: MAGES 4.0



MAGES 4.0 introduces

- Automations in VR design-patterns for interaction-design **Actions development**
- VR recorder to capture and replay VR sessions
- Realistic real-time **cut, tear and drill** algorithms
- AR and mobile (iOS/Android) support
- Dissected edge physics engine
- Edge-cloud **remote** visual **rendering**
- Optimized networking layer with collaboration of **AR/VR** devices
- Convolutional **neural network** automatic assessment
- New template applications (open source)

P. Zikas *et al*., "**MAGES 4.0: Accelerating the World's Transition to VR Training and Democratizing the Authoring of the Medical Metaverse**," in *IEEE Computer Graphics and Applications*, vol. 43, no. 2, pp. 43-56, 1 March-April 2023, doi: 10.1109/MCG.2023.3242686.



MAGES 4.0: Accelerating the world's transition to medical VR training

Computational medical XR use cases

Medical XR training in action

INSELSPITAL - UNIVERSITÄTSSPITAL BERN

One of the six hospitals of the Insel Group
Switzerland's leading full-service medical care system.

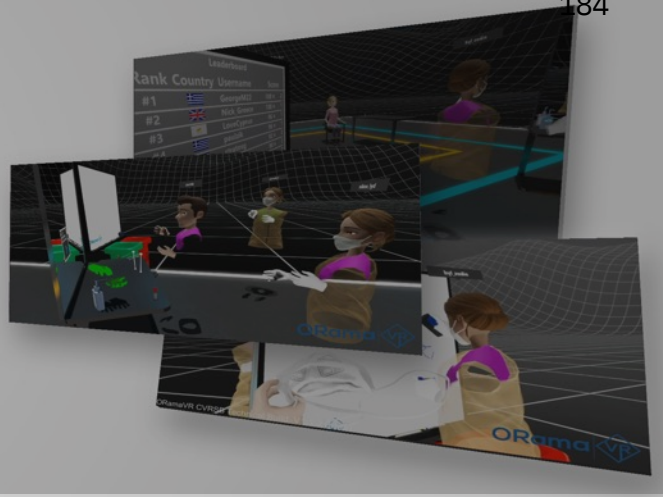
ORama VR

Nasopharyngeal Swab Taking in Virtual Reality

INSELSPITAL
UNIVERSITÄTSSPITAL BERN
HÔPITAL UNIVERSITAIRE DE BERNE

"VR is the Future of medical education, and we are pushing further the limits with ORamaVR and MAGES SDK!"

Prof. Thomas Sauter,
Emergency Telemedicine, University of Bern, Switzerland



THE CHALLENGE

Effective Nasopharyngeal Swab Taking Training.

- **Effective** and **riskless** medical training.
- Resume training with strict social **distancing** measures.
- Conform with world-standard **hygiene protocols**.

VIDEO →

THE SOLUTION

COVID-19 XR Simulation: Nasopharyngeal Swab, Hand Hygiene & Personal Protective Equipment (PPE).

- A **hardware-agnostic, collaborative** training simulation made with **MAGES SDK .**
- Detailed **analytics** that inspect user **errors** and overall **progress.**
- **Immersive, engaging** experience for skill transfer from virtual to real world.

Designed in Switzerland

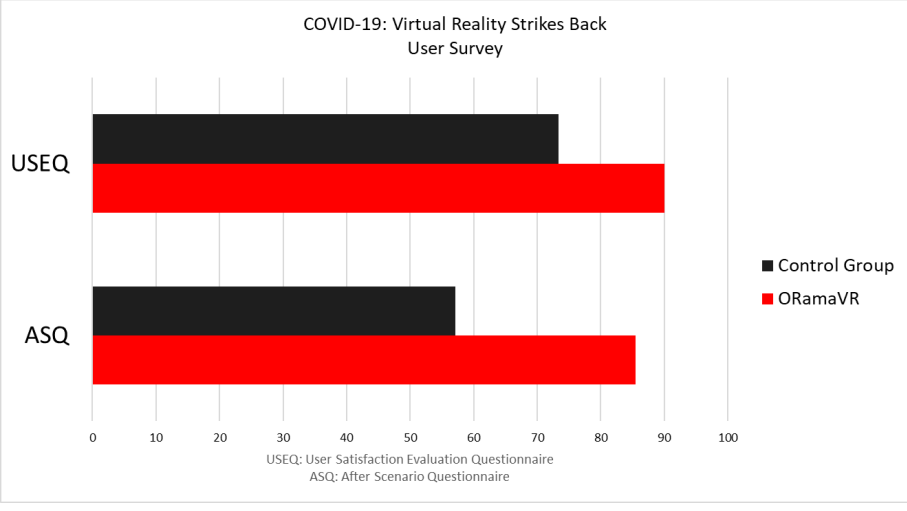
THE INNOVATION

Enhancing Learning Experience.

- 16% improvement in sensorimotor performance**.**
- Increased **user satisfaction** via **gamification.**
- Clinical Trial: "Enhancing COVID-19 Diagnostics with VR".

INSELSPITAL - UNIVERSITÄTSSPITAL BERN

Clinical Trial Main Results



VR Training Boosts COVID-19 Diagnostics with Nasopharyngeal Swab Performance.

A VR-based Nasopharyngeal Swab Taking training program led to a significant **16% improvement** in **sensorimotor** skills, increased satisfaction, and enhanced usability among 29 students. Participants expressed higher satisfaction levels with the training, and those trained in VR reported **positive feedback** regarding emotional **engagement** and **immersion**.

VR Enhances COVID-19 Diagnostics Education.

Participants found VR training **comfortable** and **engaging**, with strong **presence** and **immersion**. Workload ratings were similar for both VR and non-VR groups. The survey affirms VR's effectiveness in improving COVID-19 diagnostics education.

CLINICAL TRIAL →

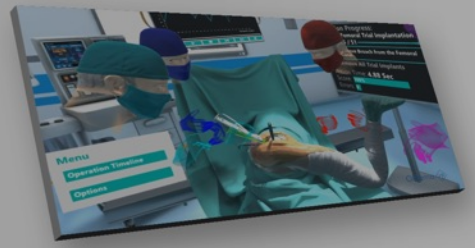
Zikas P, Kateros S, Lydatakis N, Kentros M, Geronikolakis E, Kamarianakis M, Evangelou G, Kartsonaki I, Apostolou A, Birrenbach T, Exadaktylos AK, Sauter TC and Papapagiannakis G (2022) Virtual Reality Medical Training for COVID-19 Swab Testing and Proper Handling of Personal Protective Equipment: Development and Usability. *Front. Virtual Real.* 2:740197. doi: 10.3389/frvir.2021.740197

NYU Langone Health

NYU Langone Health: One of the largest Healthcare systems in the Northeast

ORama VR

The Effectiveness of VR Surgical Training



NEW YORK UNIVERSITY

"Very nice experience and it will be very fruitful for young surgeons. It's a great tool and helpful for the training!"

Lazaros A. Poultsides, MD, MSc, PhD,
NYU Medical Associate

THE CHALLENGE

Enhance surgical training for orthopaedic residency.

- Clinically validate **VR surgical training** for **psychomotor** skills.
- **Improve** PGY-1 orthopaedic resident **training** using **immersive VR**.
- Improve **surgical skills** and knowledge in **Total Hip Arthroplasty**.

THE SOLUTION

Cutting-edge Total Hip Arthroplasty simulation with MAGES SDK.

- **Innovative** Total Hip Arthroplasty VR Simulation with **MAGES SDK** .
- **Cutting-edge** collaborative training for **enhanced learning** experience.
- Real-time **analytics** and **error detection** for optimal **assessment** .

THE INNOVATION

Revolutionary VR Clinical Trial: 8% Improvement in PGY-1 Surgical Skills.

- Easily **modify** and **extend** simulations with the **MAGES SDK**.
- **8%** improvement in PGY-1 in **just 2 sessions** (Journal of Arthroplasty).
- NYU and ORamaVR receive prestigious AAHKS Fare Grant Award .
- **First-ever collaborative VR surgical training**, connecting 4 reputable Medical schools.

VIDEO →

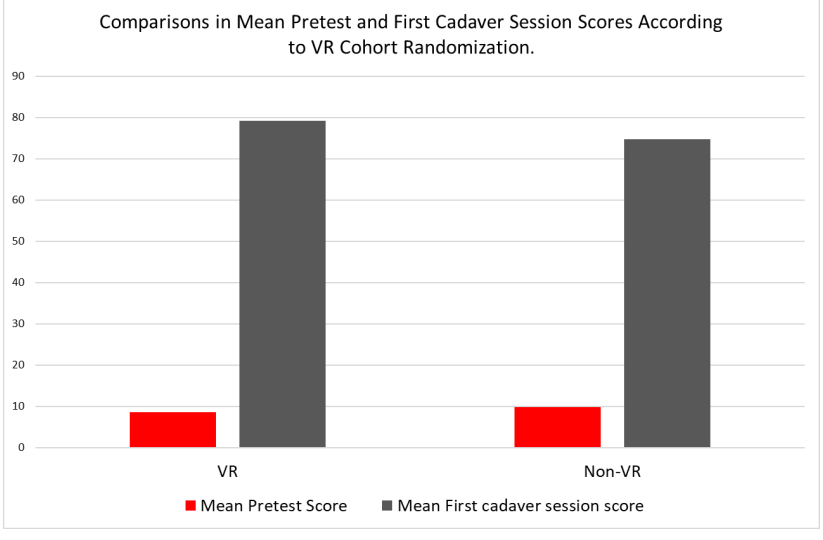
Designed in Switzerland

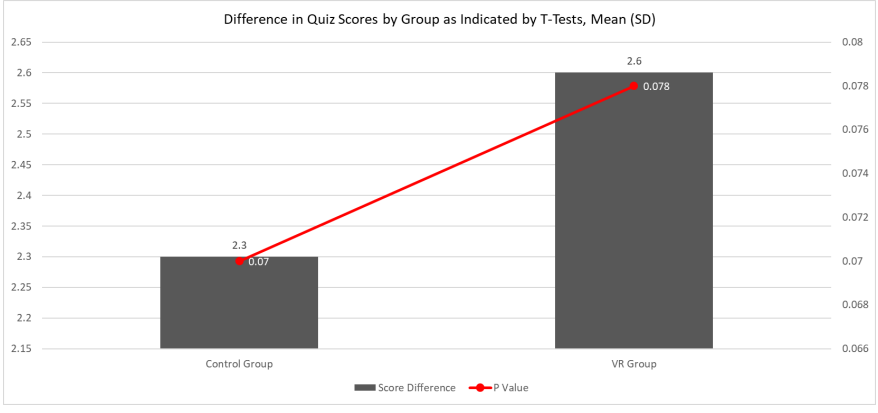
NYU Langone Health

Clinical Trial Main Results

Impact of VR Training on Cadaver Session Scores: A Comparative Analysis

The study found no baseline differences in knowledge or surgical skills between cohorts. However, **VR training improved participants' performance during cadaver sessions by 18 points (8%), leading to better skill development** .





Assessing the Effectiveness of VR Training on Quiz Scores: A Group Comparison

VR training showed positive trend in written quiz performance, suggesting theoretical knowledge acquisition potential. **Further research with larger sample sizes may be needed to establish a significant correlation.**

CLINICAL TRIAL →

Jessica Hooper, Eleftherios Tsiridis, James E. Feng, Ran Schwarzkopf, Daniel Waren, William J. Long, Lazaros Poultsides, William Macaulay, George Papagiannakis, Eustathios Kenanidis, Eduardo D. Rodriguez, James Slover, Kenneth A. Egol, Donna P. Phillips, Scott Friedlander, Michael Collins,Virtual Reality Simulation Facilitates Resident Training in Total Hip Arthroplasty: A Randomized Controlled Trial, The Journal of Arthroplasty, Volume 34, Issue 10, 2019, Pages 2278-2283,SSN 0883-5403, https://doi.org/10.1016/j.arth.2019.04.002.

SOFMEDICA

Pioneering Excellence in Medical Education and Innovation

ORama VR

Virtual Robotic Surgical Training Simulation

SOFMEDICA
LIFE SAVING INNOVATION

THE CHALLENGE

Enhancing Performance and Reducing Costs for surgical robotic training.

- Enhance **trainee performance** before **robotic training** .
- Boost **memory retention** and **psychomotor** skills .
- **Reduce** training **cost**, while **elevating learning outcomes** .

THE SOLUTION

Future-Proof Robotic Training with Digital Twins and Custom Escalating XR Simulations.

- **XR** simulations as **'digital twins'** of **existing robotic training modules**.
- **Future-proof** and **cross-platform** training for **da Vinci Surgical System**.

THE INNOVATION

Revolutionizing Robotic Training: Immersive XR with Minimal Equipment.

- Novel **physics-based** simulation for robotic training. .
- **Innovative** robotic arm interaction with **hand-tracking** .
- **Train anywhere, any time**. Minimal equipment required for simulating the whole robotic experience .

VIDEO →

Designed in Switzerland

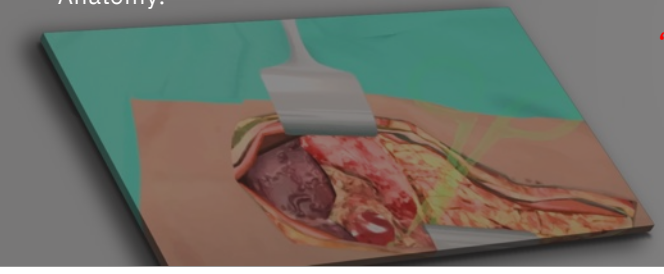

ORama

University Hospital Cologne

One of Germany's most outstanding medical centers

ORama VR

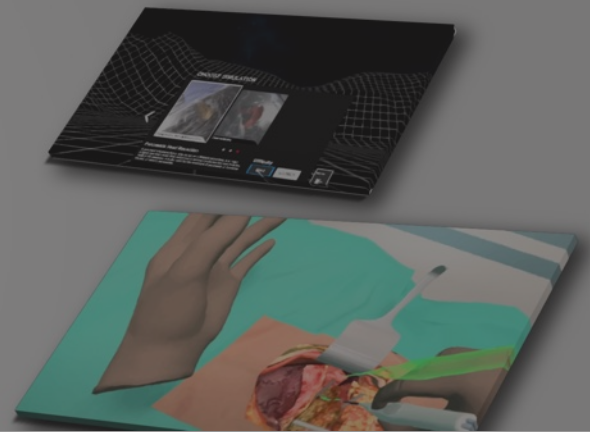
The most detailed VR collection of Topographical Anatomy.



UNIKLINIK KÖLN

"Working with ORamaVR on the Bursa omentalis simulations is really exciting for us. No one ever before had this opportunity to do it like that."

Dr. Rabi Datta
Specialist for Visceral Surgery – Coordinator Medical Education



THE CHALLENGE

Deformities and Rigidity in Cadaveric Anatomy Representations

- **Pursuing** enhanced effectiveness **beyond traditional** teaching methods and textbooks.
- Addressing challenges in understanding **Omental Bursa (OB)** anatomy (collapsed OB, dehydration, autopsy malformation).
- High-quality XR simulation offering **cost** and **time efficiency**.

THE SOLUTION

XR Human Anatomy: Surgical Modes & Exploration.

- Collection of **7** custom-made abdominal surgery XR simulations.
- **Novel**, **scalable** and **immersive** XR experience to tackle OB anatomy challenges.
- Visualization and interaction with **realistic real-time** simulation of **soft bodies.**

THE INNOVATION

Unique XR Representation of the Topographical Anatomy Courses.

- **Largest** ever **interactive** abdominal anatomy and surgery collection of **XR simulations.**
- Ground-breaking approach to **visualization** of **Omental Bursa** morphology.
- **10+ scenarios** per simulation.
- An **In-Depth First-Person** Exploration of Topographical Anatomy from the Inside Out.

VIDEO →

Designed in Switzerland

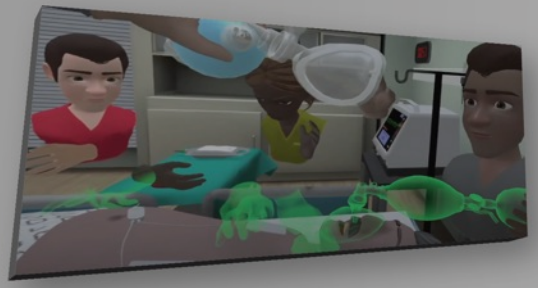

ORama

University of Michigan Medical School

Advancing Healthcare Excellence Through Education and Innovation

ORama VR

Cardiac Arrest Resuscitation XR Training



UNIVERSITY OF MICHIGAN

Advanced approaches for comprehensive analysis and enhancement of cardiac arrest resuscitation training for emergency medicine and nursing.

THE CHALLENGE

Real-World team-based training (crew resource management) for Medical Professionals.

- Training for **immediate response** and **treatment** to sudden **heart attack.**
- **Time-sensitive** scenario that simulates real-life **stress** to improve communication and decision-making **skills**.
- **Cost** and **logistically effective** training method compared to traditional ones.

THE SOLUTION

A non-linear, collaborative, gamified simulation.

- A **Collaborative VR simulation** to precisely **replicate real-life** scenarios.
- Monitoring user **movements**, **speech**, and **levels of anxiety** by tracking heart rate.
- **100+ possible errors**. A truly **non-linear** operation with **random events** & **branching paths**.

THE INNOVATION

Enhanced Cardiac Arrest Resuscitation Training.

- The **largest** clinical trial on cardiac arrest resuscitation **training**
- Prospective control group design **comparing** outcomes from **traditional mannequin**-based training and **VR** training participants.

VIDEO →

Designed in Switzerland


ORama
VR

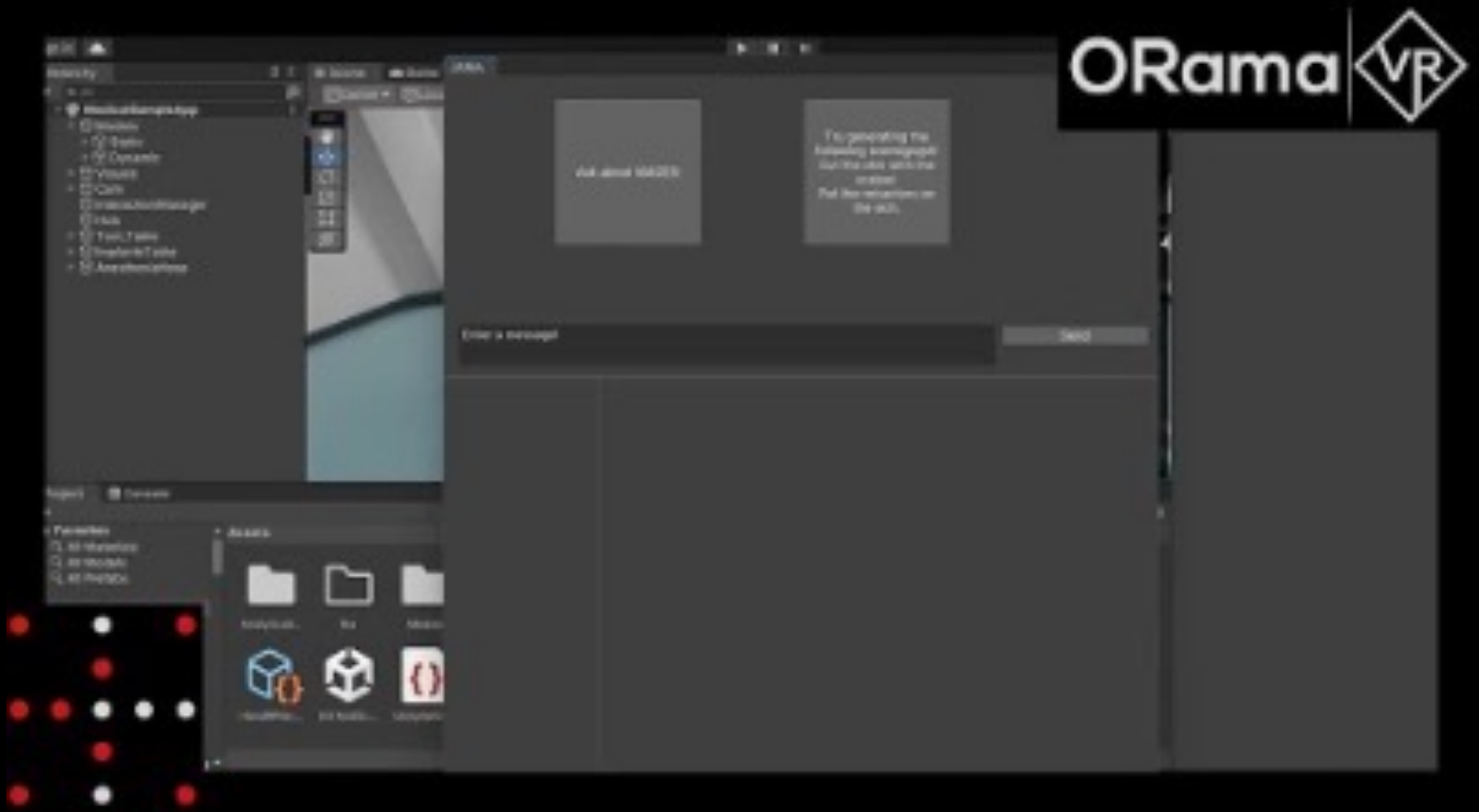
ORama VR

One more thing

What about

no-code generative-AI?

JARIA – MAGES SDK



- Computational Medical XR
- Focus on curriculums not discrete, 1-off simulations
- AI+XR are revolutionizing the field

Source: Accenture Consulting. WAKING UP TO A NEW REALITY | Accenture. 2019.

```python
# general imports
# import openai and dependencies
import os
import openai
openai.api_key = os.getenv("OPENAI_API_KEY")
openai.Model.list()
import textwrap
# ask ChatGPT via its API and get a response
response = openai.ChatCompletion.create(
    model = "gpt-3.5-turbo",
    messages=[
        {"role":"system", "content": "You are a helpful assistant."},
        {"role":"user", "content": "Can you say 80 words to inspire the audience of Shift Medical 2023 about computational medical extended reality?"},
        ]
    )
chatReply = response['choices'][0]['message']['content']
print(textwrap.fill(chatReply, width=100))
```

```
... Welcome to Shift Medical 2023!

Today, we explore the limitless potential of computational medical
extended reality.

Imagine a world where diagnoses are made with pinpoint accuracy, surgeries are perfected through
virtual simulations, and patients receive personalized treatments through immersive experiences.

With computational medical extended reality, we bridge the gap between technology and healthcare,
pushing boundaries and revolutionizing patient care.

Let us embrace this incredible innovation, harnessing its power to transform lives. As we embark
on this journey together, remember, the future of medicine lies within our grasp — a future where
healing knows no bounds.

Together, let us shape the future of healthcare.
```

ORama VR

One really last thing

New Open Access Journal

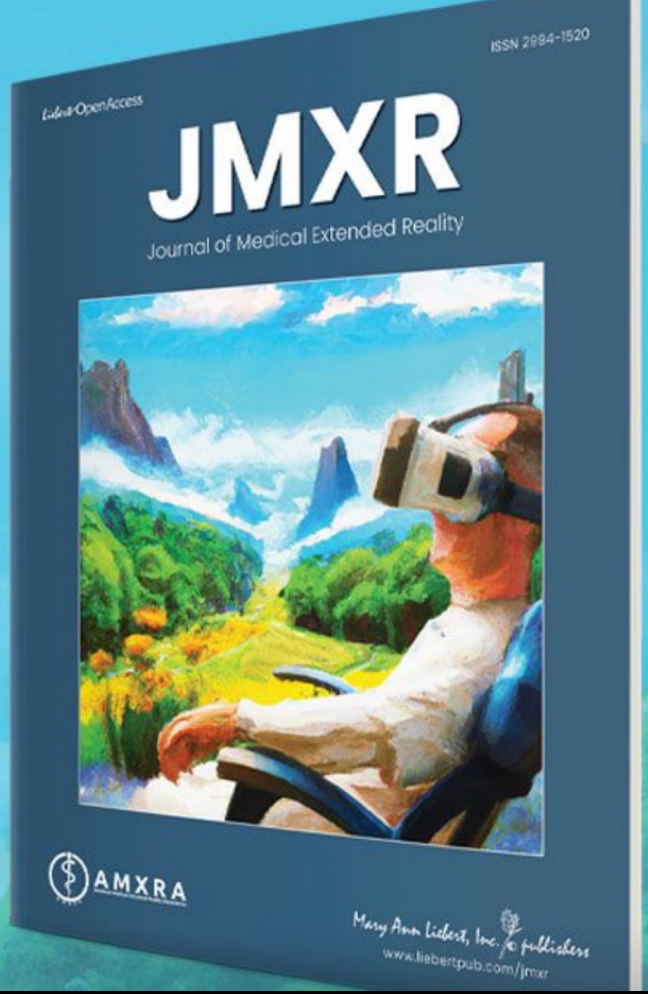
JMXR

Journal of Medical Extended Reality

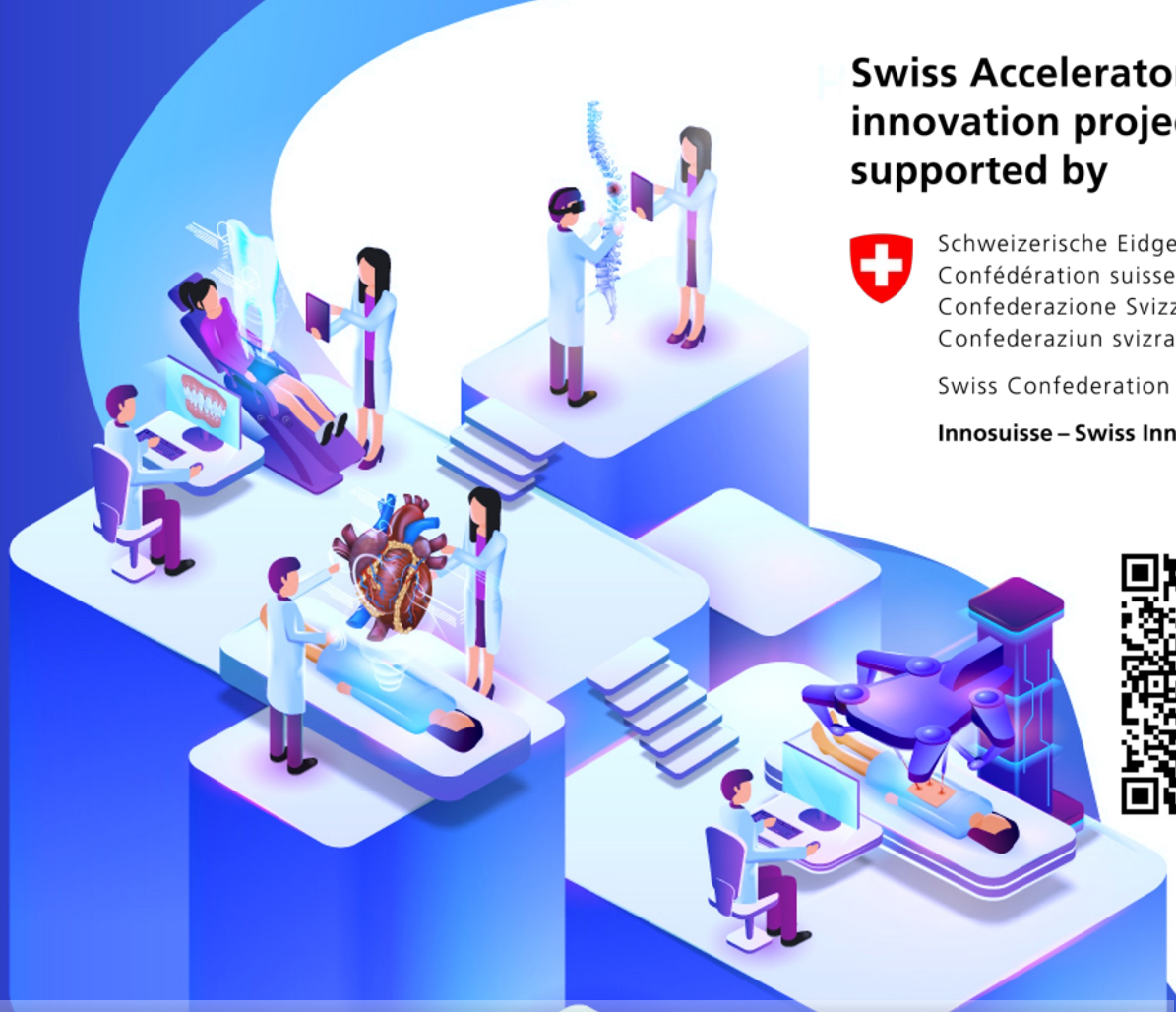
The Official Journal of

AMXRA

American Medical Extended Reality Association



https://home.liebertpub.com/publications/journal-of-medical-extended-reality/680



Swiss Accelerator innovation project supported by

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fidal field trials beyond 5G

5G-EPICENTRE

Dr. George Papagiannakis
Prof. University of Crete,
Affiliated Researcher at FORTH
Visiting Prof. University of Geneva
&
ORamaVR co-founder, CEO
george@oramavr.com

FORTH Foundation for Research & Technology - Hellas

ORama VR

UNIVERSITÉ DE GENÈVE

Let's accelerate world's transition to computational medical XR!