



THE VR/AR SPECIAL EDITION

#4 HEALTH

CLINICAL VR
MEDICINE
WELL BEING

TAVI VR PROJECT: 'STEPPING INSIDE' THE AORTIC VALVE

TECHER TEAM and the cardiovascular surgeon team of Dr. Xavier Ruyra work together on the development of a new gold-standard in the way TAVI procedures are done, providing and improving the required data to make these procedures safer and with a lower complication rate. The idea is to include throughout the diagnostic process an immersive experience for the surgeon with 6 DoF VR devices.



Victor Herrera wants to help surgeons develop new procedures with VR // © Techer Team

Hear valve diseases are a major public health problem in industrialized countries. Aortic valve disease is common and its prevalence increases with age. For people over the age of 75 years, the prevalence of aortic stenosis is 3%. More than one in eight people over the age of 75 have moderate or severe valve disease.

The Transcatheter aortic valve implantation (TAVI) represents a revolution for these patients and this pathology. This minimally invasive surgical procedure repairs the valve without removing the old, damaged valve. Instead, it wedges a replacement valve into the aortic valve's place.

The rate of TAVI adoption has increased throughout Europe and is currently the most frequently used strategy for treating aortic stenosis in elderly patients. The number of TAVI procedures in the last 10 years has increased massively, with annual growth of 25%. Over 300,000 patients have now received a transcatheter

aortic valve in the world and another 144,000 will be added every year. It is expected to double in 5 years.

In any TAVI procedure, and especially in low or intermediate risk patients, it is necessary to demand the highest security level and a very detailed procedure to avoid complications and adverse effects as much as possible. The more thorough we are in the diagnostic procedure, the fewer potential problems will arise.

Although TAVI procedures have become part of the daily routine in many hospitals around the world with cardiology and cardiac surgery care, and the different implants have been evolving to more effective and safe designs, there are still associated problems that are may be potentially very severe.

While computed tomography (CT) was initially used primarily for the assessment of peripheral access, the role of CT has grown substantially and CT is now the gold standard tool for annular sizing, determination of risk of annular injury and coronary occlusion, and to provide co-planar fluoroscopic angle prediction in advance of the procedure.

VR : A NEW POTENTIAL FOR HEART SURGERY

The use of Virtual Reality in the preliminary analysis of the surgical procedures responds to a series of considerations:

- Visualisation and mapping gives the surgeon a huge advantage when it comes to planning particularly difficult procedures.
- The measurements made with Echos and TACMD techniques are crucial in order to choose the implant, its size, position and technique of it.
- A VR model can enhance the understanding of a patient's anatomy so that the clinical team can plan a surgical procedure in the virtual world prior to theatre
- VR can be a tool to engage with patients

We're just now beginning to even realize its full potential

As well as the additional data provided by other medical tests used in the diagnostic stage, we firmly believe that Virtual Reality can help in the analysis of the patient's aortic root and aortic valve, choose the type and size of prosthetic valve, as well as provide and improve the required data to make these procedures safer and with a lower complication rate.



// © Techer Team

Virtual Reality provides surgeons and their teams with the ability to check the root and aortic valve «from within» in an unimaginable way until the arrival of this technology. Aware of all this, Doctor Xavier Ruyra contacted TECHER TEAM to explore the new possibilities offered by this technology and try to implement a new gold-standard in the way TAVI procedures are done. Dr. Xavier Ruyra-Baliarda is a specialist in Cardiac Surgery and leads The Heart Institute QuironSalud Teknon CM Teknon. Barcelona. With over thirty years of experience and 10,000 heart surgeries performed, is considered one of the best cardiovascular surgeons in Europe. For Dr. Ruyra's team, their main goal is to provide patients with the whole range of possibilities that exists in modern heart surgery. Dr. Ruyra specializes in mitral valve repair, Minimally invasive aortic valve procedures in high risk patients, Bloodless cardiac surgery and cardiac cavity reconstruction surgery.

“Every day we treat elderly patients with greater risk. Minimally invasive approach is the cornerstone to reach the best results with fewer complications and patient safety. Transcatheter aortic valve implantation (TAVI) is a revolution in the therapy of elderly and highrisk patient with severe aortic stenosis” says Dr. Ruyra

Virtual Reality provides surgeons the ability to check the root and aortic valve «from within», and have a very real perception in a three-dimensional way, which allows to plan the procedure with greater precision.

After the initial meetings where VR was introduced to Dr Ruyra's team in terms of both software and devices, we jointly had working sessions for the development of a specific

visualization software of the internal structure of the aortic valve for surgery planning, as well as, different ways of interaction to optimize the TAVI procedure.

The options initially opened to us were immense, but we commonly- focused on two targets:

First, to develop a “Proof of concept” to verify the viability of this new method. To this end, based on the results of the CT scan data, we developed 3D models to «step inside» and to be able to enlarge, explore and analyse the aortic root, providing an immersive experience for the surgeon and for the relatives of the patient with 6 DoF VR devices far beyond the capabilities of traditional procedures. The aortic valve as it has never been seen before. Subsequently, we designed an initial benchmark study between the classic TAVI procedure (Eco/CTscan) and the new standard with Virtual Reality.

TAVI VR FOR EVERY SURGERY

We expect Virtual Reality will provide a better understanding of the area where the implant will be placed, as well as the opportunity to study it more precisely through the different degrees of interaction that we have endowed the virtual experience.

We firmly believe that if TAVI VR can be implemented in every surgery, surgeons will be more confident before making an incision, and it will help reduce errors and improve efficiency, for the patient's benefit.

The TAVI VR project led by Dr. Ruyra, Teknon Hospital and the Quirón Salud group clearly shows us that Virtual Reality is and will be a key tool in the diagnosis and surgical planning of all types of pathologies.

Many advantages of Extended Realities are foreseen and already being used in Healthcare; in fact, economic forecasts predict a great future of VR medical developments:

- The Global Healthcare AR-VR Market was valued at US\$ 933.1 Mn in 2018 and expected to reach US\$ 3,192.2 Mn by the end of the forecast period, growing at a CAGR of 36.2% during the period from 2018 to 2023.
- By 2028, that is expected to increase dramatically to 4.64 billion U.S. dollars

Healthcare professionals bet on this technology and confirm the extraordinary future ahead. We, in Techer Team, are committed to research and collaborate as much as we can with all enthusiastic medical staff who are keen to integrate any project with Extended Realities into their diagnostic and learning processes, and provide them with the best software to improve patient's health. the health of their patients. Even if only we get it once, it will be worth it.

Long live VR! ■■■

Strategic Commission for the Sector (CSF) and the European Commission. Guillaume also develops the cluster's new partnerships with the United States and Israel.



NORA YENNEK

Nora Yennek is Head of IfisLab, research laboratory part of Training Institut of Health Industries (Ifis). She has a PhD in Education sciences and is an associate researcher at laboratoire Cognition Humaine et Artificielle, Université Paris Nanterre

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Corentin DUBOC is XR Digital Specialist at SEGULA Technologies, a global engineering group. He is involved in the development and deployment of immersive technologies and leads research projects on haptics and cognition.



GRÉGORY MAUBON

Grégory MAUBON is Chief Data Officer and digital coordinator at HCS Pharma, a biotech startup focused in high content screening and complex diseases. He manages IT missions and leads digital usages linked to company needs. He is also an independant consultant in augmented reality since 2008, where he created www.augmented-reality.fr and founded in 2010 RA'pro (the augmented reality promotion association)»



GRACE MANGIALARDI

At Molecular Devices, Grace was Director and General Manager for a newly developed custom engineering and automation team (AWES), concentrating on paid-per-project customizations of Molecular Devices core technologies and automated workflow to enhance our solutions for Biologics, High Content Screening & Drug Discovery Assays. Responsible for P&L, Sales & Operations for AWES team globally. Today she is Director, Global Commercial Operations & Enablement at SCIEX.



VICTOR HERRERA

Victor Herrera is Project Manager & Founder of TECHER TEAM. With over 20 years of expertise in 3D modeling and visualization technologies, animation and programming, he has led several R&D immersive technologies projects specially VR and AR since 2015. Together with his team, they advise leading companies in areas such as Healthcare, automotive and singular architecture during the implementation process of Extended Reality technologies.



HELENA ORTIZ GIL

A postgraduate in marketing with experience in sectors such as banking, neuromarketing and biomedicine. Recently discovered digital realities and since then, passionate about them. It is the natural evolution of marketing. Now at Techer Team making VR projects to be profitable for the brand and engaging for the user. Virtual is Real -> Future is now



XAVIER RUYRA BALIARDA

Dr. Xavier Ruyra Baliarda is an expert in minimally invasive cardiac surgery and bloodless cardiac surgery, mitral repair surgery and sutureless aortic valve replacement surgery and TAVI. He is one of the world's leading specialists in the Ross procedure, a heart operation which involves using the patient's own pulmonary valve to replace the diseased aortic valve. As well as being one of the most prestigious cardiologists in the field, he is a professor at the University of Barcelona and has developed various patents to repair and reconstruct valves.



CHRISTOPHER LAFAYETTE

An Emergent Technologist in medtech, ecotech, education, virtual, augmented and mixed reality, artificial intelligence, telepresence, disruptive media and several additional applied sciences.

Thought leader. Ecobiotic Diversity Advocate. Christopher is a Silicon Valley National & International speaker. Founder of XR platforms, Flotilla, HoloPractice and the Immersive Directory. He's creating a series of immersive medical incubator platforms, building fully equipped immersive Holodecks and creating emergent technology applications and hardware. He's also executed and managed business development for thousands of campaigns and projects. An expert in lab-to-market acceleration. He's working with corporations and startups to bring eco-culture into hardware, software, and content development.



VALENTIN JOUET

Valentin is Lead developer C# and Unity in Labforsims 2 project. His role is to integrate plugins from CEA labs into the virtual environments such as conversational agents or tracking and to build the application the students use to train themselves. Valentin now works for IMASCAP (Wright Medical)



LAURIANE CAUCHON

Lauriane is a 3D computer graphics designer. Passionate by 3D design and real-time environments and interactions, she provides all the 3D and 2D graphic content and manage the user experience listening to the doctor's needs.



AMINA MOHAMED-SOILHI

Amina was LabForSIMS 2 Project Manager. She coordinated the actions and federated the contributions of the actors of the project. She managed the monitoring and reporting to the funding agency. She is Digital Scientific Advisor for the Janssen Pharmaceutical Companies of Johnson and Johnson.



PROF. DAN BENHAMOU

is Director of the LabForSIMS 2 simulation laboratory (Faculty of Medicine Paris Sud), he is Director of the Anesthesia Laboratory of the Faculty of Medicine Paris Sud, member of the INSERM 1195 Unit "Small molecules of neuroprotection, neuroregeneration and remyelination".

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Training future health professionals, preventing cancer, evaluating cognitive skills, diagnosing musculoskeletal disorder risks, training dentists, visiting places, detecting eye disorders, creating a living environment lab, swapping with patients to develop better soft skills, blood transfusion training, treating burn-out, addressing PTSD, stepping inside the aortic valve, using collaborative immersive environment, practicing sport for rehab, launching a new drug, forging the missing link in surgical education, training medical emergency teams, rethinking anesthesia, helping vulnerable people, assisting neurosurgeons, helping low vision patients, improving mental health : these are the possibilities available to you by discovering the use cases in this publication written by health professionals who use VR or AR technologies.

Because immersive technologies also contribute to improving the health of your patients, whether you are residents, physiotherapists, surgeons, dentists, nurses, engineers, technicians, hospital managers, clinic directors, psychologists, pharmacists, occupational therapists, nurses' aides, academics, students, training managers or patients: this Laval Virtual magazine is made for you.
Enjoy reading it!

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