

ISVR

# NEWSLETTER

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## Editorial

December 2022 Newsletter 25

Dear reader

In this newsletter, we introduce a new section, the Student profile, where PhD candidate Salvatore Luca Cucinella from the University of Delft in the Netherlands presents his research on immersive VR for stroke survivors, pages 2-3. On pages 4-5, we introduce you to Romano Daniele and his research on human-technology interaction at MibTec. Meet the year's winner of the ICVR Early Career Award, Athanasios (Thanos) Vourvopoulos, on page 6, and read about his research on Brain-Computer Interfaces applied to upper limb stroke rehabilitation.

Over the past few months, the ICVR board has been making some exciting strategic plans for the Society. These plans include an exciting change to ICVR. We have formally adopted World Congress of the International Society for Virtual Rehabilitation (ISVR) as its new name. After the Covid disruption, we are pleased to announce our first post-Covid, live World Congress will take place in July 2023 in Montreal – watch for news soon with dates and location and key dates for submissions. Also, to realign the congress with other related conferences and their rotational patterns and to continue to present the growing volume of exciting research in our field, we will organize another World Congress in 2024.

Besides other efforts, we are continuing to explore ways to bring added value to our membership such as registration discounts to the World Congress as well as affiliated conferences like, Rehab Week and ICDVRAT, VR 4 Rehab, ICSPORTS and others; online webinars and Journal Clubs; our newsletter; and access to an online repository of conference talks and webinars.

Also, pay attention to the upcoming ISVR elections, where we will elect our new president, vice-president and a few new seats at the board of directors. Should you be interested, check the announcement on page 8. We are looking forward to your involvement!

With so much change and opportunity in the Virtual Rehabilitation research community, ISVR is positioning itself as the best place to network, collaborate and strengthen our science. We look forward to you joining with us to bring this vision to life.

We are always looking for interesting contributions to the newsletter. If you would like to share your news, upcoming events or an overview of your research, lab, clinic or company, please contact us at [newsletter@isvr.org](mailto:newsletter@isvr.org).

Sincerely,

*Sergi Bermúdez i Badia, ISVR President*

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## UPCOMING EVENTS

**4th Congress on Neurorehabilitation and Neural Repair**  
May 31 - June 2, 2023  
Maastricht, The Netherlands  
<http://www.neurorehabrepair.eu/>

**WCISVR 2023 - The international conference on virtual rehabilitation**  
July, 2023  
Montréal, Canada  
<https://isvr.org/wicvr-2023/>



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# STUDENT PROFILE

## Motor Learning and Neurorehabilitation Lab

### Salvatore Luca Cucinella

Ph.D. candidate at the Delft University of Technology

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### Where are you studying and which degree you are pursuing?

I am a Design researcher pursuing a Ph.D. at the department of Cognitive Robotics (CoR; Faculty of Mechanical, Maritime and Materials Engineering – Delft University of Technology - TUD). I am part of the research team directed by Dr. Laura Marchal-Crespo, the Motor Learning and Neurorehabilitation Laboratory ([MLN lab](#)). Dr. Laura Marchal-Crespo, Dr. Joost de Winter (CoR; TUD), and Dr. Heike Vallery (BMechE; TUD, and Erasmus MC) are my supervisory team.

### What motivated you to study VR/Technologies for health?

The field of Immersive Virtual Reality (IVR) using Head-Mounted Displays (HDMs) and its applications for medical purposes has been my research area since my master's degree.

In my previous research, I used IVR as a research tool to investigate the physiological and psychological stress responses of healthy young adults exposed to medical alarms during an Immersed Virtual Intensive Care Environment ([VICE](#)). In this case, IVR allowed me to conduct users' experience evaluation in a clinical virtual environment while combining qualitative with objective research methods.

I believe that immersive technologies are the future of healthcare. Virtual reality is opening new modalities of treating patients and supporting healthcare professionals resulting in better patient health outcomes and reduced healthcare costs. This technology is leading to stimulating



Salvatore Luca Cucinella, Ph.D. candidate at the Delft University of Technology

scenarios progressively, making healthcare more democratic. Nowadays, potentially, everyone from everywhere could have access to many medical treatments without leaving home. This digital transformation in healthcare is significant given the social impact.

### Tell us about your project/ solution and what problem aims to solve.

In my current project, I am using IVR as a therapy system for the neurorehabilitation of people suffering from a stroke.

In the context of neurorehabilitation, the first weeks after a stroke are

crucial for survivors to regain functional autonomy, and healthcare professionals should provide patients with personalized, task-specific, high-intensity training to maximize recovery. However, in conventional rehabilitative training programs, the time for training is often shorter and less intensive than the time required to obtain an optimal therapeutic outcome, resulting in patients having little opportunities to practice. To overcome this issue, patients are more often trained with the support of robotic devices and Virtual Reality (VR). Nevertheless, although VR-based therapies increase patients' opportunities to practice, they offer too abstract tasks in cognitively too demanding environments for stroke survivors.



# STUDENT PROFILE

(continued from page 2)



Robotic motor training in Immersive Virtual Reality (IVR) – MLN LAB

Using Immersive VR with robotic devices can further stimulate patients physically and mentally - promoting neuroplasticity - by allowing them to train the paretic limbs to practice activities of daily living (ADL) in controlled, more familiar, and realistic virtual environments (VEs). IVR seems to have the potential to improve neurorehabilitation over conventional VR in terms of efficiency, accessibility, and patient adherence. However, the effectiveness and success of IVR depend on multiple intrinsic and extrinsic factors playing a crucial role in the therapy outcome, such as motivation.

## What makes it unique?

I believe that our approach, scientific aims, and technology in use are what make the project unique!

First, active collaboration between stakeholders involved in the care of stroke survivors is needed to develop a relevant and meaningful solution. We are involving physicians, physio- and occupational therapists, psychologists, patients, and their families in the design process. User-Centered Design (UCD) and Participatory Design (PD) approaches facilitate stakeholders' participation in the decision-making process of design. User observations,

individual semi-structured interviews, and co-creation sessions are helping us shape and negotiate our system's requirements and discover the users' latent needs.

Additionally, it is by analyzing the psychophysiological responses of stroke survivors - during an immersed IVR-based neurorehabilitation - that we will define the definitive requirements VEs must have to provide stroke survivors with an optimal training environment.

## Which are the main challenges that you are encountering during your studies?

We are very lucky to have two medical institutions on board, the Erasmus Medical Center (EMC) and the Rijndam Revalidatie - Rotterdam. I spend part of my research time there, where I am in direct contact with patients and caregivers, which is amazing!

However, one of the main challenges for me is to learn how effectively communicate and design with the stakeholders involved in this process. Improving the way developers, caregivers, and patients interact during the design process is key, and I believe

our approach will allow me to reach my goals.

Another challenge is technology. I am not a software developer, nor do I have experience with programming. In this journey, I must learn how to use a game engine and develop a method allowing us to measure patients' responses and adapt the VEs to them.

## How do you envision your project/solution coming to fruition in a near future?

I expect this project will allow me to build a solid network with current stakeholders and new people and institutions. Sharing knowledge and working together is the strategy I want to adopt to make our project feasible and come to fruition in the near future. I want to see stroke survivors use our therapy system at the end of this journey.

This technology has the potential to make therapy more transparent and accessible to everyone, and I want our system to become a platform where therapists and patients can synergically interact.

In the next four years, I will finalize the user research, develop a prototype, and design and conduct two experiments for evaluating our hypothesis with actual patients. In this process, I will maximize the involvement of the different stakeholders to explore further the possibilities the technology can offer stroke survivors and therapists. For instance, we want to involve students to investigate how our solution can be used throughout the continuum of care, following patients through time while adapting to their changing needs. I am also looking at collaborations with other research teams in the same or similar research area to push innovation and allow the testing of intriguing hypotheses.

**Romano Daniele**  
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<https://www.mibtec.it/en/>

### Where is your research institution located?

I work at the University of Milan-Bicocca, where we have a research centre called MibTec to study Human-technology interaction (especially XR) from the human perspective.

### What patient populations do you serve?

We are not a rehabilitation centre but a research centre. For this reason, we only study patients in the context of research, even when it is for applied research or intervention/treatment procedures. Thus we do not have a fixed or regular number of patients served.

### What VR rehab system(s) do you have installed?

As a research centre, we develop new procedures. I am currently leading three streams of XR-related research:

- The development of a screening test for cognition in VR (using 360° videos) that is psychometrically reliable and ecologically valid;
- The development of a treatment procedure for amputee patients suffering from phantom limb sensations and phantom limb pain in mixed reality (using the Holo Lens 2);
- An intervention to reduce behavioural symptoms in severe dementia by using a semi-immersive virtual reality stimulation (using a non-interactive, CAVE-like multisensory stimulation).



Romano Daniele

### The Mental Status – 360°

**Mental Status 360° (MS-360°)**

- A pilot screening tool
- 14 scenarios
- Tasks resembling everyday activities
- Familiarization Phase → Test Phase
- Administration: 20 minutes

**Familiarization Phase**

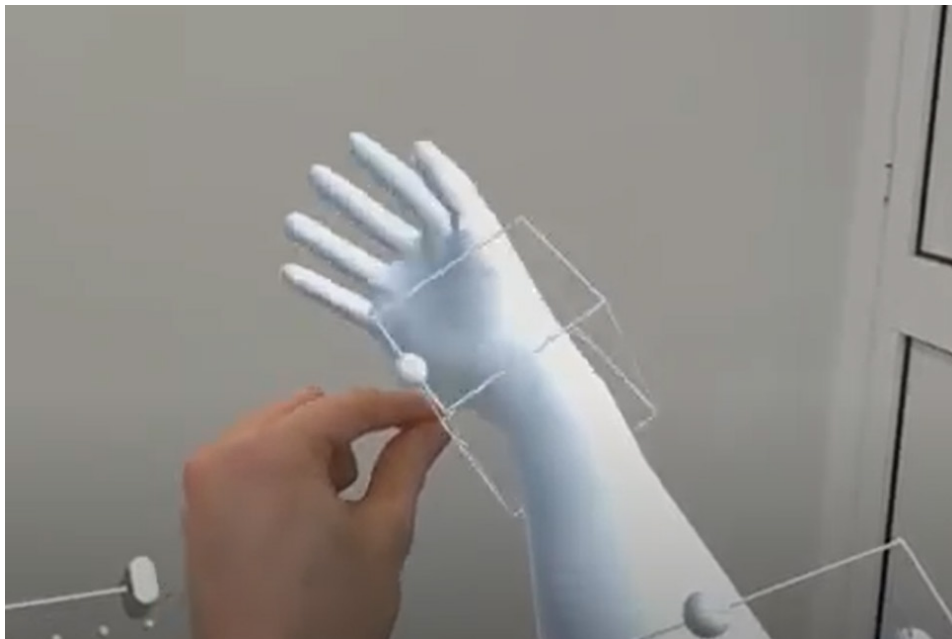
**MS-360 Administration**

MS360.exe → VR Headset → QUEST 2

The picture shows the different elements of the MS-360°, a new screening test for cognition that takes advantage of 360° video potentialities. The screening test is composed of 14 scenes aimed at measuring human behaviour in specific cognitive tasks. All the tasks are streamed into the VR head-mounted display and controlled by the clinicians on a PC monitor connected to a local network via cable or Airlink. The entire 14 tasks administration lasts about 20 minutes.

# RESEARCH PROFILE

(continued from page 4)



The figure shows a screenshot of HoloLimb, a mixed reality application aimed at virtually replacing a limb in the case of people with amputation. The limb hologram is fully customizable in terms of size shape and position so that it can perfectly match the position of the phantom limb. The aim is to develop a new tool for patients suffering from phantom limb sensations and phantom limb pain

## What benefits do you gain from using this VR rehab systems?

We have new opportunities. In project a) we have the chance to provide ecological stimulations that are at the same time standard for everyone, something almost unachievable with typical neuropsychological procedures.

In project b), we reconstruct the visual appearance of the amputated limb that is visible in the real world and in real time. Again something is simply unachievable without this technology. In project c) we are developing a treatment procedure for a population that is largely neglected. We make it possible again to travel for a person with severe dementia.

## What problems did/do you have with using these systems?

Technological development is still very challenging, especially with MR. Secondly, a few elders are still sceptical about using technological devices, although many are very interested and engaged in these new possibilities.

## What do you see as the most important challenge for VR rehab research and development?

In my opinion, a key advancement would be to make rehab software usable at home independently by patients and caregivers. Unsupervised (or minimally supervised) training would potentially increase the number of hours of treatment per patient exponentially increasing the plasticity effect on the brain. However automating a software making it easily usable and engaging for impaired and/or older people remains a challenge.

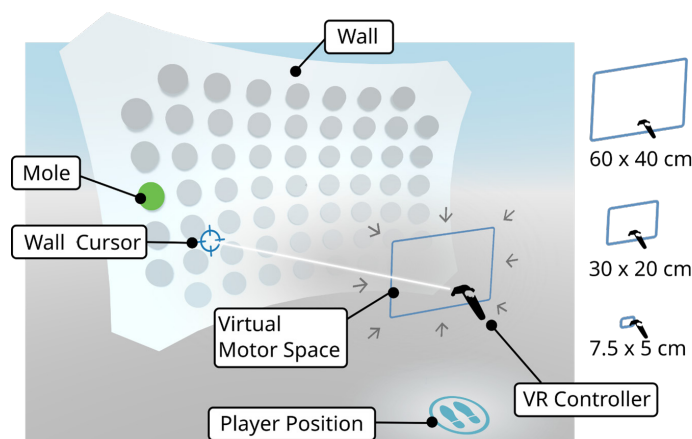
Technology-related costs remain a challenge for many people and countries. Making VR treatments an inclusive technology is another important challenge for the next future.

# ISVR POSTER PRIZE

## Virtual Motor Spaces: Exploring how to amplify movements in VR stroke rehabilitation to aid patients with upper limb hemiparesis.

Bastian IIsø Hougaard, Milo M. Skovfoged, Lars Evald, Iris Brunner, and Hendrik Knoche

Varying severity of upper limb hemiparesis provide challenge how to design player input control in virtual reality (VR) rehabilitation systems. We designed virtual motor spaces as a novel input method in VR which amplify limited hand movement for a Whack-A-Mole game. Results from an initial pilot study showed that participants were able to reach the same number of targets in the same amount of time. The virtual motorspaces aim to facilitate rehabilitation and for neuropsychological comparison of patient performance despite differing severity of hemiparesis.





# EARLY CAREER AWARD



## Athanasios (Thanos) Vourvopoulos

Athanasios, is invited Assistant Professor at the Bioengineering Department of Instituto Superior Tecnico (IST) and Research Fellow at the Evolutionary Systems and Biomedical Engineering Lab (LaSEEB) of the Institute for Systems and Robotics (ISR-Lisboa). His main research area involves the use of EEG-based Brain-Computer Interfaces (BCI) with interactive systems (e.g. user-interfaces, virtual environments) or robotic devices for neurorehabilitation.

Overall, his research is in the intersection between the fields of computer- and neuro- engineering with a two-fold objective: On the one hand, to design robust brain-computer interaction for communication and control, while on the other hand to identify the underlying mechanisms of brain recovery after stroke.

### Presentation Summary

In rehabilitation, the utilization of Virtual-Reality (VR) is considered a novel and effective low-cost approach to re-train the lost motor and cognitive functions through strictly defined training tasks in a safe simulated environment. However, most of these novel VR approaches require increased volitional motor control, hence are suitable only for a reduced subset of patients, generally those with better recovery prognostics and better motor ability. Consequently, the idea of directly training the central nervous system was established, through the use of Brain-Computer Interfaces (BCI's) and motor-imagery (MI) practice. Concretely, restorative BCI's can provide an alternative non-muscular channel for directly interfacing patients with VR training,

and ultimately induce neuroplastic changes.

In the past ten years, our research has broadened further modern VR rehabilitation approaches to:

(1) include those patients with worse prognostic (motor and cognitive) through an accessible and interface-independent architecture; (2) provide low-cost rehabilitation solutions by making available all developed technology for free to the community; and (3) by bringing new insights on the impact and use of VR technologies for rehabilitation, including neurofeedback systems through the development of a novel VR-BCI upper-limb rehabilitation training system called NeuRow.

Currently, the developed VR-BCI training paradigms are installed in various clinics, including hospitals in

Portugal and in Spain, treating chronic stroke patients with severe upper-limb disability, while providing also essential information through brain imaging concerning neuroplastic changes post-intervention.

Overall, current approaches have exhibited some initial success in supporting motor recovery after stroke, especially in patients with the worse prognostic. The purpose of this line of research is to investigate the efficacy of BCI training paradigms for rehabilitation, and provide further insights concerning the impact of VR in re-training the lost function of patients. Last but not least, the use of restorative BCI's in Virtual Rehabilitation, can provide a unique way on interfacing a wider range of patients with VR training, and help to assert further the efficacy of VR tools for rehabilitation.



The website at <http://www.isvr.org> acts as a portal for information about the society. We are keen to enhance the community aspects of the site as well as to make it the first port of call for people wanting to know what is going on in the field of virtual rehabilitation and its associated technologies and disciplines. Please do visit the site and let us know details of any upcoming events or conferences or news items you would like us to feature on the site. We intend to add further features in the coming year including member profiles; a directory of journals who publish virtual rehabilitation related work; and a list of Masters and PhD level theses completed or currently being undertaken in the field. As well as sending us details of events and news for display, we would welcome suggestions from members about what else they would like to see on the site, or ideas for how we can further develop the virtual rehabilitation community through it.

Please mail [webdec@isvr.org](mailto:webdec@isvr.org) with any information/ideas using ISVR INFO in the subject header.

## Membership information

Membership of ISVR is open to all qualified individual persons, organizations, or other entities interested in the field of virtual rehabilitation and/or tele-rehabilitation. Membership (regular, student or clinician) entitles the member to receive reduced registrations at ISVR sponsored conferences and affiliated meetings (see webpages for more details). There is also an active ISVR facebook page, which is another source of useful information, currently with 1.3K members.

## Call for Contributed Articles

- If you are a technology expert in virtual rehabilitation or you have experience in the clinical use of virtual rehabilitation technologies, and would like to be featured in an upcoming ISVR newsletter issue
- If you would like to submit a contributed article relevant to the ISVR community
- If you have any news, summaries of recent conferences or events, announcements, upcoming events or publications

We are looking forward to your contribution! Please contact us at [newsletter@isvr.org](mailto:newsletter@isvr.org).



Connect with us



Join our mailing list: <http://isvr.org/join-our-mailing-list/>

## Dear ISVR Community,

The International Society for Virtual Rehabilitation (ISVR) is inviting nominations from current members in good standing for new Directors and Officers to serve on its Board of Directors. Directors are volunteers who serve a three-year term and are the core of the society's leadership. The Board of Directors attend monthly board meetings (remotely, apart from the one aligned with the annual meeting). Directors may serve on one or more committees, either as a Chair, or as a committee member (e.g., awards, communications). In accordance with the ISVR bylaws, officers, such as the President, Vice-President, Secretary, and Treasurer may only be selected from the existing Board of Directors. Current and past Directors-at-Large have enjoyed being part of ISVR leadership, having input on consequential society decisions, and networking with other members. If you are not currently a member in good standing and wish to be considered for Board service, please renew or sign-up for membership [here](#). Please review the instructions as the membership portal has changed.

Officer Positions Open: President, Vice-President

General Director Positions: Six - roles looking to be filled include communications (webinar, social media, newsletter etc.), and industry liaison.

**To nominate yourself or someone else, please contact us at [ISVR@podiumconferences.com](mailto:ISVR@podiumconferences.com) by January 6, 2023.**

Please include a short bio, CV, and a statement of intent as to why you would like to join the board. The statement of intent will be shared with ISVR members as a part of the vote. If nominating others, the application must also include confirmation from the nominee that they accept the nomination. Voting will be done electronically and will be open to all members in good standing at the time of voting.

Sincerely,

**Sergi Bermudez i Badia**, President  
**Philippe Archambault**, Vice President  
**Mindy Levin**, Outgoing President