SUMMER SCHOOL CIREVE

VIRTUAL REALITY IN HEALTH AND SPORT: ASSESSMENT, REHABILITATION, PERFORMANCE

Detailed program

August 25 > 27, 2025

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Université Caen Normandie Caen Campus 1

Centre Interdisciplinaire de Réalité Virtuelle (CIREVE) Maison de la Recherche en Sciences Humaines (MRSH)

Scientific managers:
Leslie Decker
Sophie Madeleine

08:45 – 09:15 a.m.

Opening of the CaeSAR Summer School

The Summer School is being organised as part of the Excellences CaeSAR (Caen, Strategy for Acceleration in Research) project.

The 'Caen, Strategy for Acceleration in Research' (CaeSAR) project is funded equally by France 2030 and the Normandy Region over a five-year period with €21.6M.

ADOUI Lamri, President – University of Caen Normandy

Lamri Adoui was elected President of the France Universités association on 30 January 2025. He was also re-elected President of Caen Normandie University on 2 December 2024. He was elected for an initial 4-year term on 27 November 2021.

After obtaining a doctorate in atomic physics from the University of Paris 6 - UPMC in 1995, he joined the UFR de sciences at the University of Caen, where he was a teacher-researcher in physics. At the same time, he carried out his research activities at the CIMAP laboratory, where he was head of a research team, before being elected vice-president of research at the University of Caen in 2012.

The president will be represented by Jean-Marc FOURNIER, Vice-president of the Research Commission.

MADELEINE Sophie, Director of CIREVE – University of Caen Normandy

Sophie Madeleine is a research engineer specialising in the analysis of ancient sources. For the past five years, she has directed the Centre Interdisciplinaire de Réalité Virtuelle (CIREVE), with the aim of making Normandy a leading region in the use of virtual reality for research. Her specialities are the topography and architecture of ancient Rome and the study of mechanical systems in antiquity.

DECKER Leslie, Deputy Director of CIREVE – University of Caen Normandy

Full Professor at the University of Caen Normandy, Leslie Decker is a researcher at the COMETE laboratory (UMR-S 1075 INSERM) and co-coordinator of the Master's program in Sports Sciences (STAPS), specializing in Adapted Physical Activity and Health (APAS), within the track *Prevention, Rehabilitation, and Health Intervention through APA* (PRISAPA). She is also Deputy Director of the Interdisciplinary Center for Virtual Reality (CIREVE), a member of the Scientific Council of the Normandy Gerontopole, and of the Scientific and Academic Board of the doctoral school NBISE (ED 497 – Normandy School of Integrative Biology, Health, and Environment), shared by the universities of Caen, Le Havre, and Rouen Normandy.

Her research focuses on human motor control and the analysis of movement variability, with particular expertise in nonlinear time series approaches. She studies the adaptive dynamics of postural and locomotor control in response to the challenges of aging, whether normal or pathological, as well as impairments of sensorimotor functions, particularly in the presence of cognitive and proprioceptive deficits. At the crossroads of movement science, experimental psychology, and immersive technologies, she designs original experimental paradigms that use motor behavior both as an early indicator of underlying pathological conditions and as a sensitive marker of therapeutic effectiveness.

Actively engaged in health innovation, she also serves as Chief Scientific Officer (CSO) of the company a-gO, which develops a solution for capturing and analyzing the motor signature of the patient's digital twin. This technology combines video capture devices such as iPhones with a software platform based on advanced computational mathematics (nonlinear analyses, multiscale modeling) and artificial intelligence, in order to extract predictive motor biomarkers useful for early diagnosis, clinical monitoring, and personalized care.

In the field of immersive environments, she is particularly interested in the sense of presence and in human factors influencing performance and behavioral responses in virtual reality. To this end, she has co-developed experimental environments, including a virtual version of the Wisconsin Card Sorting Test and a spatial navigation task in a virtual reconstruction of Ancient Rome, targeting executive functions and spatial cognition, respectively. She is currently contributing to the development of a multidimensional cognitive model of the sense of presence, as well as to the design of a validated questionnaire for auditory virtual environments, with clinical applications, notably in post-stroke rehabilitation.

09:15 – 12:00 a.m.

Virtual reality in clinical practice: implementation challenges and contributions of participatory research

9:15 a.m. ### XR in rehabilitation: from acceptability to interventional studies

Extended Reality (XR), which includes virtual, augmented, and mixed reality, offers new opportunities to transform assessment and rehabilitation approaches in healthcare. By combining immersion, interactivity, personalization, and a playful dimension, XR helps address complex challenges such as loss of autonomy, cognitive impairments, and motor deficits. This presentation will outline a user-centered development process, from co-design to user experience evaluation (acceptability, usability, engagement), and the implementation of cognitive-motor training protocols and early diagnostic tools. XR-based exergames enhance motivation and adherence to care pathways. Drawing on prototypes and pilot studies conducted in our lab, we will highlight XR's potential across populations and explore future applications, including AI-supported, home-based personalized interventions.

Presentation in French – 40 minutes

PERROCHON Anaïck – University of Limoges

Anaick Perrochon is a Full Professor of Rehabilitation Sciences at the University of Limoges/ HAVAE UR20217 and Director of the University Institute of Rehabilitation Sciences (ILFOMER) since 2022 and appointed Vice-President of CNU 91 Rehabilitation Sciences since 2023. He has created a research group within the laboratory to establish XR as a scientific axis ("Neuro-XR »). Initially focused on the dual-task paradigm in aging and neurological pathologies, he studied the determinants of locomotor adaptations through behavioral analysis and functional neuroimaging techniques. More recently, he had focused on complex and ecological situations, using Extended Reality (XR) to integrate them into clinical applications, including the detection of adverse events (falls, cognitive decline) and rehabilitation.

9:55 a.m. ### Immersive and 3D sound for virtual reality

While visual elements are widely emphasized in virtual reality, sound is often overlooked, despite its critical role in shaping the quality of the perceived experience. Today, 3D audio technologies, particularly binaural rendering for headphone listening, enable the creation of highly realistic and immersive virtual and augmented reality environments, including setups accessible to individual users. This presentation will explore these techniques and the various spatial audio formats used in immersive applications. Concrete examples and specific use cases will be presented to illustrate their impact and potential.

PETROFF Antoine – Cosmos Acoustique

Antoine Petroff is a graduate engineer from the Swiss Federal Institute of Technology in Lausanne (EPFL), with a specialization in acoustics and signal processing. For over 25 years, he has been working in the research and development of innovative audio systems, with recognized expertise in the field of 3D sound. He has collaborated with leading organizations such as Devialet, IRCAM Amplify, and Sonorium. Alongside his R&D activities, he also works as a sound engineer for both studio and live environments. With extensive experience in the design and implementation of immersive sound systems, he regularly contributes to projects in the fields of music and performing arts.

10:10 a.m. **Musical journey in virtual reality: breaking down hospital walls, one note at a time**

The Virtual Reality Musical Journey project offered a unique therapeutic experience for hospitalized older adults by combining music and immersive virtual reality technology. This feasibility study took place in the geriatric assessment unit at St. Mary's Hospital, Montreal, Canada. Through Virtual Reality headsets, patients were virtually transported to classical music concerts. This initiative explored the benefits of a non-pharmacological approach to pain management and well-being.

Presentation in English – 40 minutes

CHABOT Julia – McGill University

Dr. Julia Chabot is a geriatrician at St. Mary's Hospital Center since 2018 and is an associate professor in the department of Medicine at McGill University. She completed her geriatric residency training at McGill as well as a master's degree in psychology, research component at the University of Montreal. In the context of her master's degree, she completed a study on the effects of music on the health of hospitalized geriatric patients. Since May 2025, she is President of the Association for Geriatricians in the province of Quebec.

10:50 a.m. **Multisensory approaches in augmented reality in the context of neurodevelopmental conditions**

Two augmented reality studies designed using a participatory approach and conducted in a clinical setting with individuals with various neurodevelopmental conditions will be presented. The first aims to reassure autistic children and strengthen their bond with the practitioner by presenting a multisensory augmented reality environment using a headset. The second aims to strengthen collaboration between adults with

neurodevelopmental conditions by combining music and painting in augmented reality in a physical space.

Presentation in French – 20 minutes

BAUER Valentin – IRCAM, Paris

Currently a postdoctoral researcher at IRCAM, Valentin Bauer is interested in evaluating the sound perception of autistic children in augmented reality. Previously (2023-2024, Politecnico di Milan), he explored the use of augmented reality to promote collaboration among people with neurodevelopmental conditions. This work follows on from his PhD in computer science (2019-2023, University Paris-Saclay) entitled 'Exploring Multisensory Approaches in Extended Reality for Children with Autism: Improving Well-Being and Evaluating Sound Perception'.

11:10 a.m. **Rehabilitation of post-stroke unilateral spatial neglect using auditory virtual reality: a co-constructed intervention**

Unilateral spatial neglect, which is common after a stroke, has major functional repercussions. Current interventions remain limited, with effects that are often short-lived, difficult to transfer to everyday life and hard to integrate into clinical practice. This project aims to develop gamified rehabilitation in an auditory virtual environment, a technology that has yet to be fully explored. At the interface of several disciplines, it combines fundamental validation and clinical study, based on a participatory approach involving end users.

Presentation in French – 30 minutes

LELAUMIER Clémence, Wivy – University of Caen Normandy

After three years of clinical practice as a neuropsychologist, Clémence Lelaumier is currently a doctoral student in neuropsychology at the NIMH laboratory in Caen, funded by CIFRE in partnership with the company Wivy. Her work focuses on auditory virtual reality and its potential for developing assessment and post-stroke rehabilitation tools. At Wivy, she is leading a research programme on social interaction, recreational activities and identity in people with neurocognitive disorders.

11:40 a.m. **Development of REALSoCog for the assessment of social cognition in clinical practice: from expectations to reality**

While social cognition is frequently impaired in various neurological and psychiatric conditions, its assessment remains limited in clinical practice. To improve the ecological validity of assessment tools, it seems important to use material that is dynamic, multimodal and presented in their occurrence context. VR seemed particularly relevant. Here, we describe the various steps that led us to develop the REALSoCog task, as well as the constraints and obstacles we had to consider for (i) applicability with patients and (ii) realistic transfer to clinical practice.

Presentation in English – 20 minutes

NARME Pauline – Paris-Cité University

Pauline Narme is neuropsychologist and Professor of neuropsychology at the Mémoire Cerveau et Cognition laboratory of the Université Paris Cité. Her research focuses on understanding socio-cognitive processes and their evolution in normal aging and in neurological diseases, by using behavioral methods and virtual reality for a naturalistic approach.

12:00 – 02:00 p.m. **Lunch break**

Networking and social time

02:00 – 04:00 p.m.

Virtual reality in clinical practice: implementation challenges and contributions of participatory research

02:00 p.m. **Cognitive-motor exergame training across populations and settings: from theory to clinical implementation**

This presentation will synthesize findings from several pilot studies and randomized controlled trials, emphasizing how cognitive-motor exergame training can be effectively implemented across diverse settings, from inpatient clinics to private homes, and populations, ranging from community-dwelling older adults to nursing home residents with cognitive impairments. Additionally, the talk will address common pitfalls, highlight future research directions, and outline strategies for optimizing cognitive-motor exergame interventions to further enhance clinical outcomes.

GIANNOULI Eleftheria – ETH Zurich

Eleftheria Giannouli is a Research Group Leader at the Department of Health Sciences and Technology at the Swiss Federal Institute of Technology (ETH Zurich). She studied Physical Education and Sports at the Aristotle University of Thessaloniki, Greece, and completed her master's degree in Movement Gerontology at the German Sport University Cologne, Germany. Her research and teaching focus on evidence-based exercise in older adults and various patient populations, also including the use of eHealth and mHealth applications. Her special interests include cognitive-motor training and assessments, exergaming, falls prevention, dual-tasking, ecological momentary assessments, life-space mobility, citizen science, and ICTs for health. Dr. Giannouli also serves as the Science Communication Manager and a Core Group Member of the European Cooperation in Science and Technology (COST) Action "Network on evidence-based physical activity in old age (PhysAgeNet)."

02:40 p.m. **NEO-REEDUC study: mixed reality for motor rehabilitation of patients with neurological lesions - presentation of the protocol and preliminary results**

The NEO-REEDUC project aims to test, in comparison with conventional methods, the effectiveness and benefits of a hybrid rehabilitation program, including the use of a mixed reality device developed in collaboration with the company NeoXperiences (Carpiquet, France). The objective of this presentation is to introduce the study protocol and present preliminary results from ongoing work being conducted in five partner rehabilitation centers in Normandy, involving patients with motor impairments resulting from various neurological lesions.

Presentation in French – 20 minutes

LAILLER Rémi, NeoXperiences – University of Caen Normandy

Trained as a neuropsychologist, I pursued my career in research and was involved in the design and implementation of various protocols as a research engineer/post-doctoral fellow. My area of expertise lies at the crossroads of cognition and motricity at different stages of aging, from normal to pathological aging.

03:00 p.m. **Video games and healthcare: current situation and outlook**

Over the last ten years or so, video games have entered the field of healthcare, providing innovative solutions that complement traditional approaches. From training medical staff to improving adherence to treatment, through to their use as therapeutic or rehabilitation tools, video games are showing remarkable potential to transform healthcare practices. At this conference, we will review the current state of video game applications in this rapidly evolving sector. We will explore the strengths and limitations of these approaches through case studies, feedback and scientific analysis. What can we learn from these uses? What challenges need to be met if video games are to become a real lever for innovation in healthcare? These are just some of the questions we will be addressing in order to gain a better understanding of how video games can contribute, now and in the future, to the well-being and care of patients.

Presentation in English – 30 minutes

CHANCEY Christopher – University of Montreal

With a graduate degree in video game design, Christopher Chancey founded ManaVoid Entertainment, a 50+ person video game development studio, in 2014. The studio's mission is to create video games that blend recognisable genres and themes, but in completely innovative ways. In 2017, Christopher partnered with a serious games company, Affordance Studio, and became a co-founder of the video game business accelerator, Indie Asylum, investing in over ten companies and growing the accelerator to over 200 developers in less than five years.

In 2020, Christopher was awarded the prestigious ARISTA prize in the Young Techno-Creative Leader category by the Jeune Chambre de Commerce de Montréal. He is the outgoing president of La Guilde du jeu vidéo du Québec, representing more than 350 studios and 15,000 jobs in Quebec. Finally, Christopher teaches programming, game design and entrepreneurship at two universities, the Université de Montréal and the Université du Québec en Abitibi-Témiscamingue.

03:30 p.m. **Implementation sciences: how to integrate digital innovations from health research**

Implementation sciences play a crucial role in healthcare in accelerating the integration of research findings into clinical practice. The aim of this conference is to introduce the audience to the key concepts of knowledge mobilisation, to highlight its importance in improving care and to present the main steps involved in successfully implementing evidence-based health innovations.

ZIDAROV Diana – University of Montreal

Pr. Diana Zidarov is a researcher at the Institut universitaire sur la réadaptation en déficience physique de Montréal and associate professor at the École de réadaptation de l'Université de Montréal. She has expertise in implementation sciences, participatory approaches and qualitative methods. Her research focuses on the development, implementation and evaluation of innovative interventions, including rehabilitation technologies, to support clinical and organisational decision-making.

04:00 – 04:30 p.m.

Coffee break

04:30 – 06:45 p.m.

Strategies to alleviate discomfort in virtual reality: remediation approaches

04:30 p.m. **Motion sickness in VR: an introduction**

Virtual Reality technologies have tremendous benefits and becoming more relevant in many domains such as rehabilitation, research, education, training, or entertainment. Unfortunately, side-effects of VR usage associated with motion sickness are still common, resulting in nausea, headache, or disorientation in many users. To make VR fully accessible to a broader population and to unfold the full potential of VR technologies, the issue of VR sickness needs to be solved. In this presentation, I will provide an overview of the phenomenon of motion sickness in VR, with a specific focus on theoretical considerations, factors influencing individual susceptibility, measurement techniques, and potential solutions.

Presentation in English – 30 minutes

KESHAVARZ Behrang – KITE Research Institute, University Health Network, Toronto

Dr. Behrang Keshavarz is a Senior Scientist and the Lead of the Neurorehabilitation and Neuroscience Team at KITE-UHN as well as a professor in the Department of Psychology at Toronto Metropolitan University. Dr. Keshavarz's research program focuses on human perception and performance in virtual environments with a strong applied component, treating VR as a tool to improve health and safety, while also exploring the cognitive and behavioral processes of various VR phenomena. Specifically, Dr. Keshavarz's research focuses on three areas: 1) create a compelling

sensation of self-motion (vection) and presence in VR, (2) while minimizing adverse side-effects related to motion sickness, and (3) investigate realistic behaviours such as driving performance and driving-related applications in VR.

05:00 p.m. ## Motion sickness: neurophysiological basis and role of multisensory integration

Motion sickness results from a difficulty some people have in interpreting multisensory information between visual, vestibular and somatosensory inputs in a dynamic or virtually dynamic environment, and even more so when they themselves are in motion. In other words, the valence or result of this sensory integration exceeds a range of values established by genetic, developmental and experiential components. This results in inconsistency, leading to symptoms of motion sickness that can reduce a person's operational capabilities. The vestibular organ, located in the inner ear, plays a central role in the perception of movement and balance in relation to Earth's gravity and in the onset of motion sickness. Understanding these mechanisms makes it possible to better prevent and treat motion sickness.

Presentation in English – 30 minutes

BESNARD Stéphane, InMind – University of Caen Normandy

Doctor, Researcher, MD-PhD, HDR, affiliated with the University of Caen Normandy, Co-founder and Scientific Director of UR VERTEX 7480, Member of the COPIL of GDR VERTIGE, Director of the Motion Sickness Thematic Team of GDR VERTIGE CNRS, specialist in the vestibular system and extreme environments, underwater and hyperbaric physician, aeronautical and space physician.

05:30 p.m. ## Alleviating cybersickness thanks to pleasant odor imagery: a multimodal approach to sensory evocation

Cybersickness is a multisymptomatic state of discomfort frequently experienced by users of Virtual Reality. Because of its many negative effects, studies have sought factors capable of preventing or alleviating it. This presentation will deal with one of our attempts to this end, based on the mental imagery of pleasant smells. After having determined the best means to help successfully evoke mental odor images, we implemented this method in Virtual Reality to investigate its effects on perceived discomfort.

FANTIN Luca – University of Caen Normandy

Having obtained my PhD in 2023, I am currently a research engineer for the GREYC laboratory (University of Caen Normandie). My research aims at understanding the mechanisms of sensory integration and their effects on behavior, through physiological and psychometrical measurements. In particular, I study the perceptive-motor effects of immersive technologies in terms of benefits for athletes or patients, and of drawbacks such as experienced states of discomfort.

Round table with session speakers   06:00 p.m.

Chairs:

CEYTE Hadrien – Aix-Marseille University

Hadrien CEYTE, University Professor (PhD, HDR) in Human Movement Sciences and Behavioural Neuroscience at Aix Marseille University, is responsible for the Master's degree in Adapted Physical Activities & Health at the Marseille Faculty of Sports Sciences and co-directs the DynamiCC team (Behavioural Dynamics & Cognition) at the Institute of Movement Sciences (ISM - UMR amU CNRS 7287). He is also a member of the Conseil National Universitaire des Sciences du Mouvement Humain (CNU 74th section) and a member of the Conseil National d'Éthique de la Recherche en STAPS (CERSTAPS).

Specialising in sensory and spatial perception and cognitive-motor interaction, his research focuses on cognitive-behavioural vulnerabilities 1) acquired following a stroke, such as Unilateral Spatial Neglect Syndrome, and/or 2) transient following virtual immersion, or occurring during human development. In each of his research projects, he advocates an embodied approach in which our perceptions and actions are constantly influenced by our bodies and by the way in which we interact with the world around us.

LELAUMIER Clémence, Wivy – University of Caen Normandy

After three years of clinical practice as a neuropsychologist, Clémence Lelaumier is currently a doctoral student in neuropsychology at the NIMH laboratory in Caen, funded by CIFRE in partnership with the company Wivy. Her work focuses on auditory virtual reality and its potential for developing assessment and post-stroke rehabilitation tools. At Wivy, she is leading a research programme on social interaction, recreational activities and identity in people with neurocognitive disorders.

07:00 – 08:00 p.m.

Public lecture «Cybersickness: modulation of the state of the individual in immersion»

The use of immersive environments has become increasingly popular in recent years. The ongoing reduction in the cost of the environment and advances in technology and software, particularly for virtual reality (VR) headsets, are contributing to their widespread use, enabling these tools to play an increasingly important role in our daily personal and professional activities. In addition, there is a growing body of work on the benefits that virtual reality brings to different sectors of human activity, from health to education to innovation. However, the current growth of this immersive technology is less strong than expected! Indeed, too often absent from the glowing reports on the effects of these immersive environments, many of us experience a non-negligible state of discomfort when using them, i.e. a cybermalaise. More precisely, depending on the demands of these environments and the level of involvement expected of the user, one person in two may experience a state of discomfort in virtuality, with symptoms similar to those experienced when suffering from motion sickness: nausea, spatial disorientation, vertigo... This highly constraining phenomenon, with its great repulsive power, is still given too little consideration or reported in the experimental protocols carried out in virtuality. Worse still, the cyber-malaise is almost always forgotten when diagnostic, formative and/or summative devices are set up!

At a time when immersive technologies are everywhere, it is more necessary than ever to gain a better understanding of the cognitive and behavioral consequences of their use, taking into account the specific characteristics of each individual, so that everyone can benefit from them. At the same time, we need more than ever to think about how to limit the deleterious effects of their use.

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Presentation in French

CEYTE Hadrien – Aix-Marseille University

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Hadrien CEYTE, University Professor (Ph.D, HDR) in Human Movement Sciences and Behavioural Neuroscience at Aix Marseille University, is responsible for the Master's degree in Adapted Physical Activities & Health at the Marseille Faculty of Sports Sciences and co-directs the DynamiCC team (Behavioural Dynamics & Cognition) at the Institute of Movement Sciences (ISM - UMR amU CNRS 7287). He is also a member of the Conseil National Universitaire des Sciences du Mouvement Humain (CNU 74th section) and a member of the Conseil National d'Éthique de la Recherche en STAPS (CERSTAPS). Specialising in sensory and spatial perception and cognitive-motor interaction, his research focuses on cognitive-behavioural vulnerabilities 1) acquired following a stroke, such as Unilateral Spatial Neglect Syndrome, and/or 2) transient following virtual immersion, or occurring during human development. In each of his research projects, he advocates an embodied approach in which our perceptions and actions are constantly influenced by our bodies and by the way in which we interact with the world around us.

TUESDAY, AUGUST 26

08:45 a.m. – 12:00 p.m.

Virtual reality in sports training: unlocking new dimensions in physical and mental preparation

08:45 a.m. **Using virtual reality (VR) to support an ecological approach to sports training**

In the presentation, I will explore how virtual reality can be used to develop practice environments that support an ecological dynamics approach to skill development. Specifically, I will consider how VR can be used to create practice with levels of variability and challenge that are optimal for a given skill level and age. I will next discuss research showing how a constraints-led approach (CLA) can be implemented in VR to promote exploration of the information-movement space, self-organization, and the perception of affordances.

Presentation in English – 40 minutes

GRAY Rob – Arizona State University, Tempe

Originally from Toronto, Canada, Rob completed his BA in Psychology at Queen's University and his MS and PhD in Experimental Psychology at York University. After receiving his PhD in 1998, he worked as a Research Scientist for Nissan Motor Corporation in Cambridge, MA, USA. In 2001, he was appointed as an Assistant Professor in the newly formed Applied Psychology Program at Arizona State University. In 2006, he was appointed Associate Professor and Program Head. Since 2005, he has also worked part-time as a Research Psychologist for the United States Air Force. From January-June 2010, he was appointed as a Visiting Professor in Sport Sciences at the University of the Mediterranean in France. From 2010-2014, he was a Reader (Associate Professor) in Perception & Action in the School of Sport, Exercise & Rehabilitation Sciences at the University of Birmingham, UK. His research focuses on perceptual-motor control with a particular emphasis on the demanding actions involved in driving, aviation, and sports. His goal is to conduct basic research that can be applied towards the improvement of training, simulation, accident prevention, and human-machine interface development within these contexts. In 2007, he was awarded the Distinguished Scientific Award for Early Career Contribution to Psychology from the American Psychological Association and the Earl Alluisi Award for Early Career Achievement in the Field of Applied Experimental & Engineering Psychology. He has worked as a consultant for several professional sports teams and is currently a Skill Acquisition Specialist with the Chicago Cubs. He hosts & produces the popular Perception & Action Podcast and is the author of the books "How We Learn to Move" and "Learning to Be an Ecological Coach".

09:25 a.m. **Virtual reality and elite sport: new frontiers in performance evaluation and training**

This presentation demonstrates how virtual reality can enhance athletes' evaluation and training through immersive, quantifiable simulations. After outlining the limits of traditional methods and the potential benefits of VR, we describe several studies conducted at M2S laboratory using the Immermove experimental platform. These projects illustrate how VR sheds light on the perceptual-decision mechanisms at work in athletes and lay the groundwork for developing training tools whose real-world impact can be validated under actual playing conditions.

Presentation in French – 40 minutes

SOREL Anthony – University of Rennes 2

Anthony Sorel is a research engineer at the Movement, Sport, Health (M2S) Laboratory of Rennes 2 University, holding a PhD since 2012. He studies the biomechanics of movement using motion capture, virtual reality, and other emerging digital technologies. His research spans various disciplines (football, rugby, tennis, fencing) and aims to understand and optimize sports performance while reducing injury risk. He collaborates with professional clubs and supervises doctoral theses to transfer these methods from the laboratory to the field.

10:05 a.m. **From virtual reality to on-field reality: transferability of perceptual-cognitive skills in football**

This preliminary study examined the effect of virtual reality (VR) training on the perceptual-cognitive skills of young elite football players. Sixteen 13-year-old players were divided into two groups (control vs. intervention) and followed a protocol of four weekly 20-minute sessions of VR training, targeting scanning. Performance was assessed before and after the intervention through filmed reduced matches. The results showed a positive trend in scanning frequency in the VR-trained players, with no statistically significant difference between the groups.

Presentation in French – 20 minutes

TIERCERY Mathis, French Football Federation – University of Rennes 2

Mathis Tiercery is an engineer by training and is currently doing a CIFRE thesis at the Research Centre of the French Football Federation (FFF), part of the M2S laboratory at Rennes 2 University. His research focuses on the use of virtual reality to assess and train the perceptive-cognitive skills of football players.

10:25 a.m. **Mental preparation and virtual reality to optimise the sporting performance of female footballers**

Performance is the result of complex interactions between physical, technical, cognitive and emotional dimensions. However, mental imagery and motor imagery, although widely documented in scientific literature, remain underused in practice, particularly in women's team sports. The SanEtPerf protocol offers an innovative experimental approach aimed at improving athletic performance in female footballers through two complementary components: the use of mental imagery in a mental preparation framework, targeting mental health, and the integration of motor imagery in virtual reality, targeting motor performance.

Presentation in French – 20 minutes

RIDANE Rim, Malherbe Caen Stadium – University of Caen Normandy

Rim RIDANE, second-year PhD student specialising in behavioural neuroscience in athletes at the COMETE laboratory in Caen. As a former high-level athlete, mental coach and hypnotherapist, I am interested in the impact of mental health on athletic performance. I am working on the impact of emotional disturbances (stress, sleep, anxiety) on the performance of female footballers.

10:45 a.m. **Can virtual reality redefine gymnastics training to drive performance?**

A common challenge for many elite athletes is managing to train more without increasing the risk of injury. In this context, the REVEA project aimed to optimize the performance of gymnasts in the French national team by supplementing their training with virtual reality. The underlying idea was to provide the gymnast with the opportunity to observe a sequence of virtual elements, the arrangement of which could be modified on demand, and even to facilitate the athlete's immersion in performing a movement they had not yet fully mastered. The presentation will aim to highlight the stakes, contributions, limitations, and perspectives of such an approach in the context of high-level gymnastics training.

Presentation in French – 30 minutes

GOUELLE Arnaud – University of Reims Champagne-Ardenne, French Gymnastic Federation

Arnaud GOUELLE is an Associate Professor (PhD, HDR) at the University of Reims Champagne Ardenne, UFR STAPS, Laboratory of Performance, Health, Metrology, Society (PSMS). Using concepts from motor control and biomechanics, he seeks to identify the strategies adopted by individuals based on the constraints of the

task, the environment, and their own degrees of freedom. He is particularly interested in movement variability and the meaning that can be attributed to it, sometimes considered as noise or unnecessary disturbances, other times a sign of the system's resilience. These themes resonate in both clinical and artistic gymnastics fields.

Round table with session speakers   11:15 a.m.

Chairs:

RIDANE Rim, Malherbe Caen Stadium – University of Caen Normandy

Rim RIDANE, second-year PhD student specialising in behavioural neuroscience in athletes at the COMETE laboratory in Caen. As a former high-level athlete, mental coach and hypnotherapist, I am interested in the impact of mental health on athletic performance. I am working on the impact of emotional disturbances (stress, sleep, anxiety) on the performance of female footballers.

DRIGNY Joffrey – University of Caen Normandy

Joffrey Drigny is an Associate Professor of Universities – Hospital Practitioner (MCU-PH) in Physical and Rehabilitation Medicine and in Sports Medicine at Caen University Hospital and the University of Caen Normandy. A researcher within the COMETE unit (UNICAEN/INSERM), his work focuses on therapeutic physical activity and the prevention of sports injuries. He is also a physician for both professional and amateur sports teams.

12:00 – 02:00 p.m.   **Lunch break**

Interactive demonstration stands

02:00 – 03:20 p.m.

Leveraging virtual reality and AI-driven movement analysis to identify early neurocognitive decline in aging

02:00 p.m. **Innovative technologies to harness variability in movement**

A large body of research demonstrates the existence of an optimal level of variability which enables us to interact adaptively and safely to a continuously changing environment, where often our movements must be adjusted in a matter of milliseconds. Decrease or loss of this optimal level due to neurodegenerative and physiological disorders makes the system more rigid and less adaptable to different perturbations. Increase makes the system noisier and more unstable. Stable behavior is a rich behavioral state with high complexity, where complexity is defined as highly variable fluctuations in physiological processes resembling mathematical chaos and fractals thus being more nature based. In this presentation, I present updates of this field of research regarding the innovative "next step" that goes beyond the many descriptive studies that characterize levels of variability in various populations. These updates are based on our recent work using innovative technologies such as virtual and augmented reality as well as pattern analysis to devise novel interventions that will harness the existing knowledge on variability and create new possibilities for those in need to improve performance and/or restore their decreased physical abilities.

Presentation in English – 40 minutes

STERGIOU Nick – University of Nebraska at Omaha

Dr. Nikolaos "Nick" Stergiou is the Distinguished Community Research Chair and Professor in Biomechanics, the Director of the Center for Research in Human Movement Variability, and the Assistant Dean and Director of the Division of Biomechanics and Research Development at the University of Nebraska at Omaha (UNO). He is the Founding Chair of the first ever academic Department of Biomechanics that graduates students with a BS, MS, and PhD in Biomechanics. He is also a part-time Professor at the Aristotle University of Thessaloniki Greece at the Department of Physical Education & Sport Science. His research focuses on understanding variability inherent in human movement and he is an international authority in the study of Nonlinear Dynamics. He has published 4 scientific textbooks, 250+ peer-reviewed papers with 17000+ citations and has an H-index of 70+ in Google Scholar. He has been inducted as a Fellow to American Association for the Advancement of Science, the American Institute for Medical and Biological Engineering, the American Society of Biomechanics, and the National Academy of Kinesiology. His research spans from infant development to older adult fallers. It has impacted the training techniques of surgeons and the treatment and rehabilitation of pathologies, such as peripheral arterial disease. He has received more than 40 million dollars in funding from NIH, NASA, NSF, and many other agencies. He has also received a NIH P20 grant that was worth more than 10 million dollars which

at its time was the largest research grant in the history of UNO. This grant has allowed him to develop the Center for Research in Human Movement Variability. He was also able to renew this grant by receiving another 10.3 million dollars. He has several inventions and has procured a private donation of $6 million to build the 23,000 square feet Biomechanics Research Building that opened in August of 2013. This is the first building dedicated to biomechanics research in the world. It is also the first building on his university campus exclusively dedicated to research. He was also able to procure 11.6 million in private donations to build a 30,000 square feet expansion to this building which opened in October of 2019.

02:40 p.m. **5-minute gait test for early detection of neurodegenerative diseases: a-gO, a scalable, non-invasive solution**

We present an innovative 5-minute gait analysis system designed to detect early signs of Motoric Cognitive Risk (MCR) syndrome, a known precursor to major neurodegenerative diseases. Our AI-powered solution extracts digital biomarkers from walking patterns using camera-based motion capture, requiring no training or invasive procedures. Easily deployable in routine clinical practice, it offers a low-cost, scalable path to early intervention and improved patient outcomes.

Presentation in English – 30 minutes

VINZANT Hugues, a-gO

Hugues Vinzant, engineer from EPFL in bioinformatics and AI, is in charge of all technical developments at a-gO. He combines his expertise in biomechanics with ongoing research on pathological gait modeling using generative AI.

03:10 – 04:50 p.m.

Identifying neurophysiological markers of cognitive contributions to motor control using VR

03:10 p.m. **Flexibility of voluntary neural drives enables control of a supernumerary degree of freedom**

Humans with six-fingered hands exhibit enhanced manipulation abilities, demonstrating that the central nervous system can control additional degrees-of-freedom (Mehring et al., 2019). Given the redundancy of the musculoskeletal system, multiple neural drives can produce the same motor outcome. This redundancy could theoretically be exploited to coordinate natural and artificial supernumerary degree of freedom (Lisini Baldi et al., 2024). This presentation explores the flexibility and

constraints of voluntary neural control, and how this flexibility can be utilized to control a supernumerary degree of freedom in a virtual reality environment.

Presentation in English – 30 minutes

ROSSATO Julien – University of Caen Normandy

Julien ROSSATO is a research fellow in Human Movement Science at the University of Caen Normandie, France. He earned his PhD in 2023 from the University of Nantes, France, where he investigated the flexibility of neural drives within muscles belonging to the same muscle group. He later worked as a postdoctoral researcher at the Santa Lucia Foundation in Italy, contributing to the European project HARIA. His research focuses on the neural control of movement, with a particular interest in understanding human motor function to enable its restoration or enhancement.

03:40 p.m. **Toward digital biomarkers of cognitive impairment based on gait control**

While muscle coordination is largely automated in gait, cognitive processes are thought to influence motor control. This is supported by empirical results from cognitive dual-task gait experiments and because cognitive impairment is often associated with gait impairment. However, the phenomenon is not well-understood, and this limits development of gait-based digital biomarkers for early detection of Alzheimer's disease and related dementias. Slow and declining usual gait speed is most often cited for this purpose, but it may have poor specificity because it can result from other geriatric syndromes unrelated to cognition. In this talk, I will present results from two studies toward developing digital biomarkers of cognitive impairment based on gait control. Our approach considers older and middle-aged adults with variable cognitive abilities and cognitive-gait dual-task experiments in young adults.

Presentation in English – 30 minutes

GURCHIEK Reed – Clemson University

Dr. Reed Gurchiek is an Assistant Professor in the Department of Bioengineering at Clemson University where he directs the Human Movement Biomechanics Lab. His work combines mobile and wearable technologies with musculoskeletal modeling and simulation for research in rehabilitation and motor control. His current projects explore the interaction between cognitive and motor processes toward development of digital biomarkers for early detection of cognitive impairment. He is a faculty affiliate in the Clemson University Institute for Engaged Aging, School of Health Research, and Robert H. Brooks Sports Science Institute. Prior to Clemson, he was a Wu Tsai Human Performance Alliance

04:10 p.m. **Muscle synergies as neurophysiological marker of cognitive contributions to motor control: complexity index and complementary approach with nonlinear methods.**

The talk will propose to apply the attractor complexity index (ACI; Terrier, 2019), a nonlinear approach based on Lyapunov exponents, on the activation of muscle synergies (motor primitives) to assess their complexity. The changes in motor primitives' complexity while walking under challenging conditions will be presented in comparison with other nonlinear metrics based on spatiotemporal parameters. In addition, in the context of walking under dual-task and visual perturbations, changes in locomotor dynamics and muscle synergies activation will be presented to understand the cognitive involvement in gait control.

Presentation in English – 30 minutes

FRÈRE Julien – University of Grenoble Alpes

Julien Frère is associate professor at the University of Grenoble-Alpes. He teaches biomechanics applied to human movement in the Faculty of Sports Sciences and is a member of the MOVE team at GIPSA-Lab (UMR CNRS 5216). His research focuses on (i) understanding the control of complex movements through a neuromuscular approach (e.g., muscle synergies) and (ii) identifying biomechanical factors of sport performance.

DECKER Leslie – University of Caen Normandy

Full Professor at the University of Caen Normandy, Leslie Decker is a researcher at the COMETE laboratory (UMR-S 1075 INSERM) and co-coordinator of the Master's program in Sports Sciences (STAPS), specializing in Adapted Physical Activity and Health (APAS), within the track *Prevention, Rehabilitation, and Health Intervention through APA* (PRISAPA). She is also Deputy Director of the Interdisciplinary Center for Virtual Reality (CIREVE), a member of the Scientific Council of the Normandy Gerontopole, and of the Scientific and Academic Board of the doctoral school NBISE (ED 497 – Normandy School of Integrative Biology, Health, and Environment), shared by the universities of Caen, Le Havre, and Rouen Normandy.

Her research focuses on human motor control and the analysis of movement variability, with particular expertise in nonlinear time series approaches. She studies the adaptive dynamics of postural and locomotor control in response to the challenges of aging, whether normal or pathological, as well as impairments of sensorimotor functions, particularly in the presence of cognitive and proprioceptive deficits. At the crossroads of movement science, experimental psychology, and immersive technologies, she

designs original experimental paradigms that use motor behavior both as an early indicator of underlying pathological conditions and as a sensitive marker of therapeutic effectiveness.

Actively engaged in health innovation, she also serves as Chief Scientific Officer (CSO) of the company a-gO, which develops a solution for capturing and analyzing the motor signature of the patient's digital twin. This technology combines video capture devices such as iPhones with a software platform based on advanced computational mathematics (nonlinear analyses, multiscale modeling) and artificial intelligence, in order to extract predictive motor biomarkers useful for early diagnosis, clinical monitoring, and personalized care.

In the field of immersive environments, she is particularly interested in the sense of presence and in human factors influencing performance and behavioral responses in virtual reality. To this end, she has co-developed experimental environments, including a virtual version of the Wisconsin Card Sorting Test and a spatial navigation task in a virtual reconstruction of Ancient Rome, targeting executive functions and spatial cognition, respectively. She is currently contributing to the development of a multidimensional cognitive model of the sense of presence, as well as to the design of a validated questionnaire for auditory virtual environments, with clinical applications, notably in post-stroke rehabilitation.
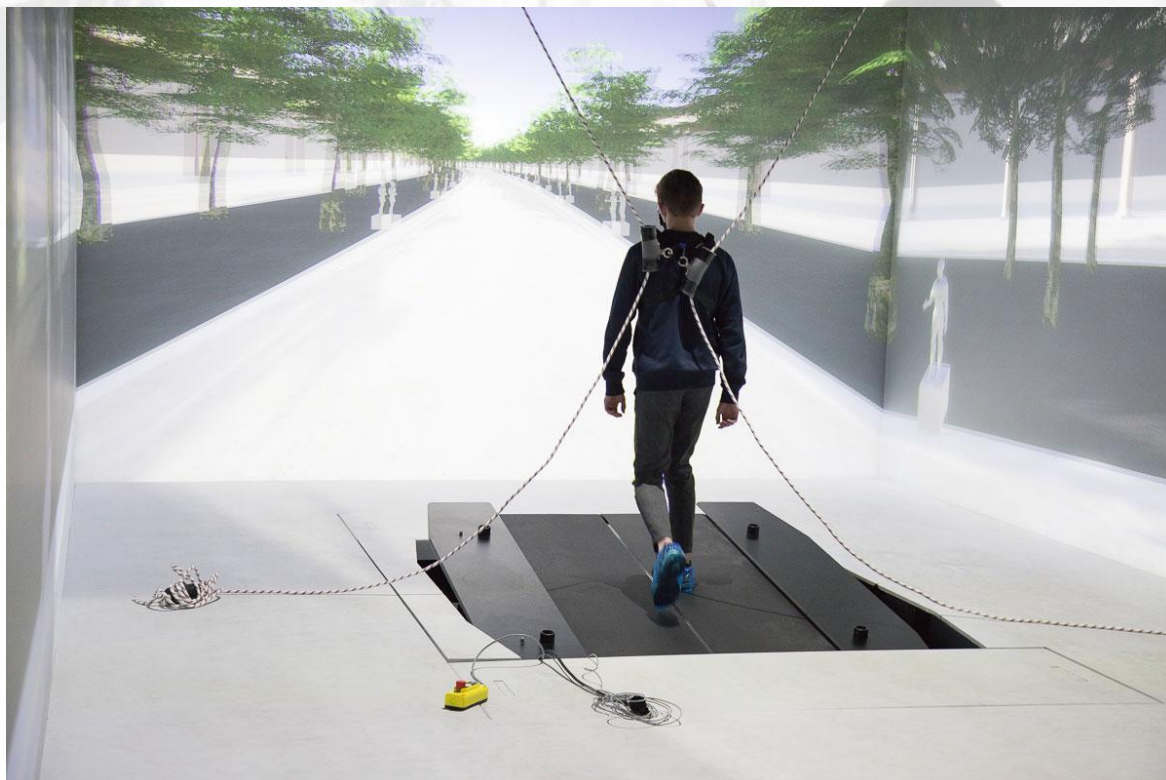
04:40 – 05:00 p.m.

Coffee break

05:00 – 06:20 p.m.

Visit to the immersive room

Due to time and space constraints, visits to the immersive room are reserved for guests only. The guest list is posted on the door to the immersive room.

Website: https://cireve.unicaen.fr/
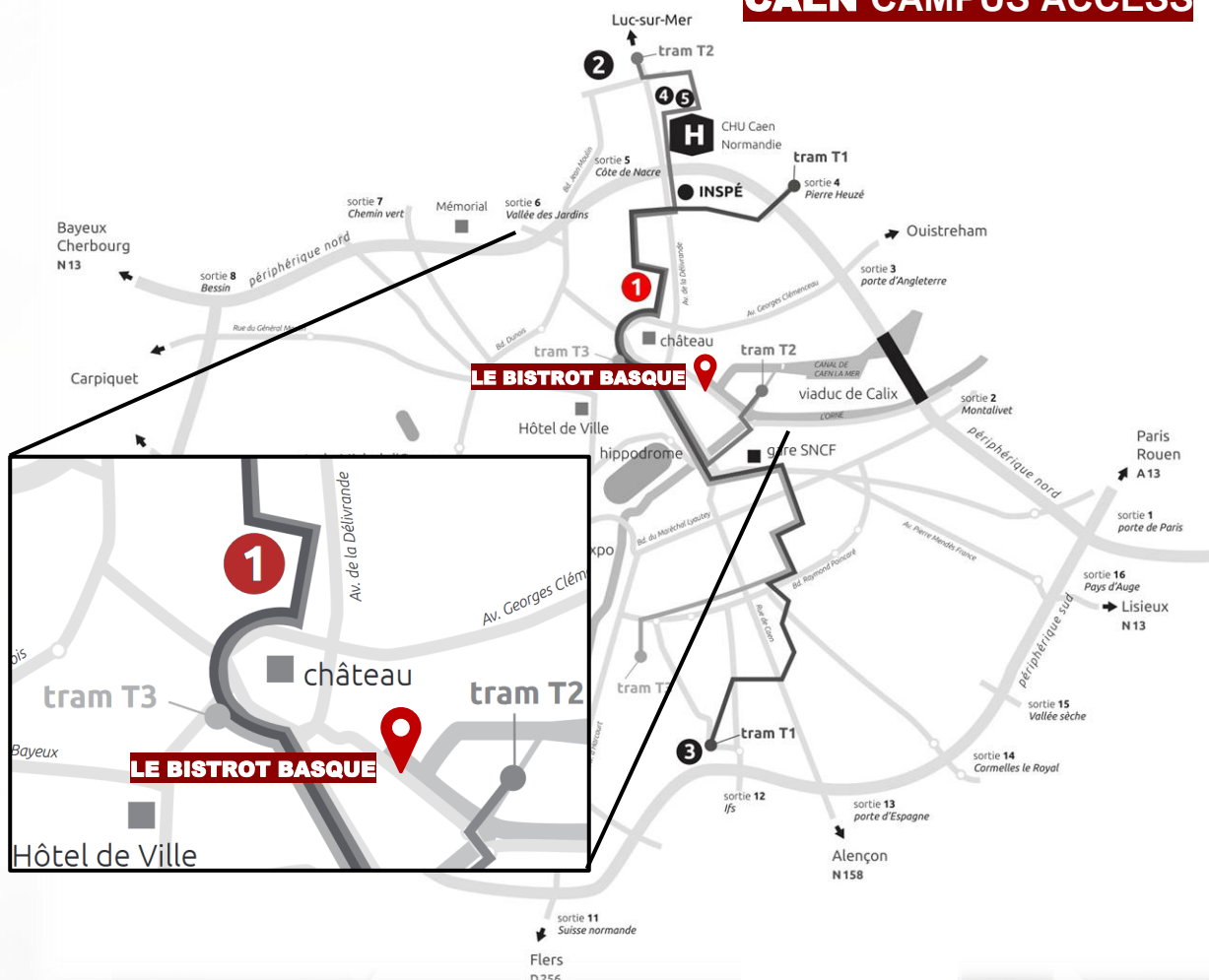

08:00 p.m.

Gala evening

Le Bistrot Basque

26 Quai Vendeuvre

14000 Caen

LE BISTROT BASQUE

LE BISTROT BASQUE

08:45 – 11:00 a.m.

Enhancing postural control and psychological well-being through immersive virtual reality

08:45 a.m. **Exploring the therapeutic potential of a multisensory VR room for mental well-being in youth and the elderly**

Presentation of the results from a pilot study evaluating the feasibility of using a multisensory immersive VR room—featuring realistic environments projected onto four walls, accompanied by environmental sounds and simulated wind—in residents with psychological and behavioral symptoms of dementia (BPSD), with the goal of enhancing mental well-being and engagement. Additionally, the presentation will introduce the North-Western Europe Interreg project "Forest4Youth", which aims to explore the therapeutic potential of both real and virtual forest environments to promote well-being in adolescents.

Presentation in English – 25 minutes

KLASS Malgorzata, InMersiv Technologies – Free University of Brussels

Malgorzata Klass is a Professor at the Faculty of Human Movement Sciences at the Université libre de Bruxelles (ULB), and a co-founder and academic committee member of the Interuniversity Certificate in Physical Activity, Health, and Exercise Therapy, jointly organized by ULB, UCLouvain, and ULiège.

Her research primarily focuses on health-related fitness adaptations resulting from reconditioning programs, incorporating both onsite and remote interventions, with a particular interest in the added value of wearable technologies for monitoring and engagement.

More recently, she has initiated research on immersive multisensory virtual reality environments for rehabilitation and the enhancement of psychological well-being in elderly patients and youth.

09:10 a.m. **Toward immersive rehabilitation: the virtual reality room for managing psychomotor disorders in elderly patients with psychomotor disadaptation syndrome**

Current literature suggests that immersive rehabilitation using advanced virtual reality systems, such as immersive rooms or head-mounted displays, may represent a promising and innovative approach to treating psychomotor disorders associated with psychomotor disadaptation syndrome (PMDS) in elderly patients. This presentation will explore the potential benefits and limitations of such interventions in the context of PMDS.

Presentation in French – 25 minutes

BERLEMONT Christophe – Free University of Brussels

Physiotherapist at the Ortho-Geriatric Clinic of Erasme Hospital (H.U.B.). Assistant in charge of exercises at the Faculty of Sciences and Motor Skills (Université Libre de Bruxelles) and assistant professor at the Haute Ecole Libre de Bruxelles (Ilya Prigogine). His work and supervision of final-year thesis are primarily devoted to the management of geriatric syndromes, particularly in the area of end-of-life care, as well as dementia and balance disorders. His research has been recognized twice by the Dr. Jean Fagnard Fund (King Baudouin Foundation) and by the Color Your Hospital Fund (Belfius Foundation). He is also a recipient of the Belfius Starters Fund for the Brussels-Capital Region (Belfius Foundation). Christophe is currently pursuing a doctoral program, with a thesis on immersive rehabilitation for the management of disorders in elderly patients suffering from psychomotor disadaptation syndrome.

09:35 a.m. **Using VR to examine public open space features that promote older adults' use, physical activity, relaxation, and social interaction: lessons learned**

During this presentation, a brief overview will be provided of three research projects conducted in Ghent (Belgium). In these projects, VR was used to examine the features of streets and parks that influence older adults' use of these spaces as well as their activity levels, feelings of relaxation and social interactions when using these spaces. The three projects used different methods and VR set-ups. Benefits and limitations of these different approaches will be discussed.

VAN CAUWENBERG Jelle – Free University of Brussels

Jelle Van Cauwenberg is an assistant professor at the School of Public Health of the Université Libre de Bruxelles. His research focuses on the environmental determinants of physical activity and health among older adults with a particular interest in the application of causal inference methods and experiments in virtual reality (VR). He has contributed to studies using VR to explore how public open spaces should be designed to promote older adults' (active) use, as well as their emotional and social experiences.

10:00 a.m. **From motion to emotion: virtual reality for balance and well-being in neurorehabilitation**

This presentation will explore the therapeutic potential of virtual reality in neurorehabilitation through the preliminary results of two different studies. Firstly, it will discuss how immersive VR can be used to assess and improve balance in stroke and neuromuscular patients. Secondly, the presentation will address the potential psychological benefits of VR, in particular on stress, anxiety and well-being in neurorehabilitation inpatients.

Presentation in French – 25 minutes

SAUVAGE Chloé – Free University of Brussels

Dr. Chloé Sauvage is a Belgian physiotherapist and academic with a PhD in Motor Sciences, specializing in neurological rehabilitation. She's a clinician in the neurorehabilitation department at Erasme-ULB Hospital since 2001. Her research focuses on mental imagery, gait assessment, virtual reality, and stroke recovery. As a lecturer and academic leader at ULB, she leads advanced training programs in neurological physiotherapy and is involved in various research projects.

Round table with session speakers   10:25 a.m.

Chairs:

LANGEARD Antoine – University of Caen Normandy

Antoine Langeard, PhD, is an Associate Professor at the University of Caen Normandy and a researcher at the COMETE laboratory (Inserm U1075). His work focuses on aging, fall prevention, and the interplay between physical activity, cognitive function, and mobility. He teaches biomechanics, physiology, and aging-related health issues in both sports sciences (STAPS) and medical curricula. He is actively involved in several national and international research projects and networks on fall risk prevention, digital health interventions, and participatory science. He is also Editor-in-Chief of the European Review of Aging and Physical Activity (EurAPA).

KLASS Malgorzata, InMersiv Technologies – Free University of Brussels

Malgorzata Klass is a Professor at the Faculty of Human Movement Sciences at the Université libre de Bruxelles (ULB), and a co-founder and academic committee member of the Interuniversity Certificate in Physical Activity, Health, and Exercise Therapy, jointly organized by ULB, UCLouvain, and ULiège.

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More recently, she has initiated research on immersive multisensory virtual reality environments for rehabilitation and the enhancement of psychological well-being in elderly patients and youth.

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11:00 – 11:30 a.m.

Coffee break

11:30 a.m. – 12:30 p.m.

Virtual reality modulations of the perception and memory of time

11:30 a.m. **Harnessing rhythmic learning for cognitive and motor rehabilitation in immersive environments**

Auditory–motor coordination, fundamental to everyday activities such as speaking, dancing, and social interaction, develops naturally and is supported by brain plasticity. Using rhythmic learning as a means to train auditory–motor coordination, I will present recent evidence demonstrating the benefits of rhythmic training delivered through a tablet-based serious game in clinical populations. This protocol lends itself to adaptation in immersive environments, allowing us to investigate how multisensory information and cognitive load influence rhythmic learning within complex, ecologically valid contexts. These objectives will be pursued in our newly developed Music & Movement Immersive Lab (MuMI Lab), designed to explore rhythm-based interventions in dynamic, multisensory settings.

Presentation in English – 30 minutes

DALLA BELLA Simone – University of Montreal

Simone Dalla Bella is Professor of Psychology at the University of Montreal and Co-Director of the International Laboratory for Brain, Music and Sound Research (BRAMS). He holds a Canada Research Chair in Music, Auditory–Motor Skill Learning, and New Technologies. His research focuses on rhythm perception, auditory–motor synchronization, and their clinical applications in neurological and developmental disorders, using innovative technologies such as serious games, mobile apps, and immersive environments.

12:00 p.m. **VR TIME: virtual reality modulations of the perception and memory of time**

The temporal dimension of our perceptions and memory is central in the adaptation to a constantly accelerating world, with its ever-increasing demands. VRTIME proposes to initiate an innovative research topic combining fundamental explorations and clinical applications: the use of virtual reality to study the perception and memory of time. This mechanism lies at the heart of normal and pathological cognitive functioning, yet is traditionally understudied because of difficulties in evaluation, that immersive technologies can overcome.

Presentation in English – 20 minutes

HINAULT Thomas – University of Caen Normandy

Following an international research experience (McGill University, Canada; Johns Hopkins University, United-States), Thomas Hinault is now associate researcher at INSERM (Institut National de la Santé et de la Recherche Médicale), in the « Neuropsychology and Imaging of Human Memory" research unit. His work aims at better understanding cognitive aging through the study of the associated neural correlates. In particular, current research aims at uncovering temporal processing changes with aging at both behavioral and neural levels.

12:20 p.m.

NeuroApps by InMind: the software suite and technological devices for your research in neuroscience, sciences of sport and psychology

Developed by neuroscientists, InMind provides accessible software suite and technological devices to facilitate the design, deployment and analysis of your scientific protocols notably in immersive environments. Researchers often struggle with complex VR setups, real-time tracking, and data synchronisation. InMind solves these by tools allowing no-code protocol authoring, easy tests execution and automated visualization of results, for lab or field evaluations. Our software suite can be used for studies in clinical, sports, but also aerospace, defense, and industry, making advanced neuroscience research more accessible.

Presentation in French – 10 minutes

LE GALL Anne, InMind-VR – University of Caen Normandy

Anne LE GALL, joined InMind-VR as a research engineer in October 2022 and also teaches at the University of Caen. She holds a PhD in Neuroscience from the University of Caen, specializing in sensory integration, particularly within the vestibular system. Her research focuses on the vestibular system's role in cognitive functions through virtual environment manipulation, a topic she further explored during a postdoctoral fellowship at New York University. This work strengthened her interest in how the brain manages sensory conflicts, especially in spatial contexts.

12:30 – 12:45 p.m.

Closing of the CaeSAR Summer School

**MADELEINE Sophie**, Director of CIREVE – University of Caen Normandy

DECKER Leslie, Deputy Director of CIREVE – University of Caen Normandy

a-gO

a-gO develops an innovative AI-based medical imaging system to detect early signs of Parkinson's and Alzheimer's through video analysis. Founded in 2022, the company enables healthcare providers to anticipate disease progression and improve patient care strategies.

Company's founders:
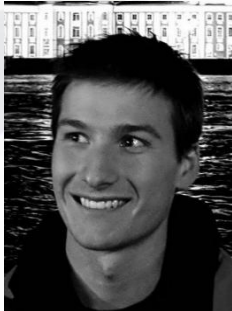
Hugues Vinzant, engineer from EPFL in bioinformatics and AI, is in charge of all technical developments at a-gO. He combines his expertise in biomechanics with ongoing research on pathological gait modeling using generative AI.

Alexandre Dalibot, osteopath specialised in movement analysis, created a-gO in 2022 to improve early care for neurodegenerative diseases. Trained in movement neuroscience at the Barça Innovation Hub, he leads product development and strategic direction.

COSMOS ACOUSTIQUE

Cosmos Acoustique, founded by Antoine Petroff, is a company specialising in 3D audio and immersive sound technologies. It has recognised expertise in the design of innovative audio systems, combining hardware development and advanced signal processing, serving research laboratories, industrial players and audio brands. Cosmos Acoustique is also involved in the creation of sound content optimised for specific playback devices, such as multi-channel systems or binaural headphones. The company positions itself at the intersection of research, music and product innovation, as a scientific and creative expert.

Company's founders:

Antoine Petroff is a graduate engineer from the Swiss Federal Institute of Technology in Lausanne (EPFL), with a specialization in acoustics and signal processing. For over 25 years, he has been working in the research and development of innovative audio systems, with recognized expertise in the field of 3D sound. He has collaborated with leading organizations such as Devialet, IRCAM Amplify, and Sonorium. Alongside his

R&D activities, he also works as a sound engineer for both studio and live environments. With extensive experience in the design and implementation of immersive sound systems, he regularly contributes to projects in the fields of music and performing arts.

inmersiv technologies

inMersiv Technologies is a Belgian med-tech startup founded in 2021 and based in Waterloo, specializing in immersive wellness solutions for healthcare institutions. Its flagship product, Sam Therapy, is a standalone 4D multisensory capsule offering customizable immersion with 360° imagery, spatial sound, airflow, and motion capture, all driven by real-time and without any wearable. Sam sessions aim to enhance well-being and reduce anxiety or cognitive decline, especially for residents in hospitals, nursing homes and psychiatric centers. The system requires no technical training, operates with a single button and delivers session reports to support care teams.

Company's founders:

As CEO since the company's inception, Diana Borcescu has developed a comprehensive vision, creating effective operational, financial, and commercial strategies while providing thoughtful strategic leadership to guide the company toward its short- and long-term goals. She is also an alumna of Start.LAB Brussels and continues her training at IGNITY & Start.it CBC. With her degree in digital creation, she brings additional expertise in understanding and applying the XR technologies.

Maxime Jacobs is CTO and co-founder of inMersiv Technologies. He holds a master's in art and scientific complexities (Ecole de Recherche Graphique) and initially worked with director Yves Gellie on a docu-fiction exploring humanoid robotics in medical settings (L'Année du Robot). In 2019, he began a PhD in artificial intelligence at the IRIDIA lab under Hugues Bersini, focusing on applying technology to healthcare. He led the conception and development of Sam, inMersiv's autonomous multi-sensory 4D system tailored for medical institutions.

INMIND

At InMind, we offer a complete software package dedicated to cognitive assessment, integrating virtual reality so that you can independently design protocols in immersive

environments. Our no-code platform gives you the keys to developing customised scenarios, enabling you to launch them with one click, integrate any type of sensor and automatically extract or analyse the data. Thanks to our modular tools - MindDev, MindRun and MindBox - each project can be customised to suit your scientific objectives, with robustness and ease of use.

Company's founders:

Quentin Montardy is co-founder and CEO of InMind. A neuroscience researcher, he has carried out research at the CNRS, the Chinese Academy of Sciences and Monash University. His work focuses on instinctive survival behaviours, in relation to perception and their role in associated emotions and behaviours (fear, anxiety, stress).

Stéphane Besnard is co-founder and Scientific Director of InMind. A doctor and associate professor of physiology at Caen University and University Hospital, he specialises in the brain's adaptation to extreme environments (space, diving, flight) and multisensory integration in real or simulated conditions.

Nicolas Lefèvre is co-founder and technical director of InMind. A computer engineer and developer specialising in virtual reality and complex immersive systems, he designs the software tools in the NeuroApps package and ensures their technical robustness and interoperability with cognitive sensors.

NeoXperiences transforms every space into a playground, where digital and physical experiences combine to create unforgettable moments. Their installations have already entertained millions of people in over 30 countries. They are marketed to players in the entertainment, sports, events and retail sectors. Today, there are more than 30 configurations, based on three technologies: impact detection, motion capture and virtual reality without helmets. NeoXperiences invites young and old to move, think and have fun together, anywhere in the world.

Company's founder:

Boris Courté has a passion for sport, and football in particular, and started from a simple observation: new technologies often tend to isolate us and reduce our physical activity. So he and his team developed an innovation that combines the pleasure of moving with the appeal of interactive technologies. Founded in 2018, NeoXperiences gets participants to engage in physical activity without even realising it, as they are having fun together. Their first innovation, Neo-One, gets people moving, thinking and challenging each other... with just one aim: to have fun!

Wivy

In 2017, cousins Loïc, Baptiste and Thomas launched Wivy, a company committed to ageing well. Specialising in entertainment for senior citizens, Wivy already equips 1,000 residences in France, Belgium and Switzerland, reaching 80,000 elderly people. Working with the University of Caen and the University of Montreal, Wivy is integrating neuropsychological research to enhance its fun digital tools and provide better support for the elderly and their families.

Company's founders:

Loïc Fruleux, co-founder and director of Wivy, leads the company's development and management with a people-centred vision. Alongside him, his cousin Baptiste Fruleux, engineer and technical director, designs the application's architecture and tackles the technological challenges. Clémence Lelaumier, a doctoral student in neuropsychology on a CIFRE placement with Wivy, contributes her scientific and clinical expertise to improve support for senior citizens and their families. Together, they are combining their skills to innovate in the interests of ageing well.

TRANSLATION SYSTEM
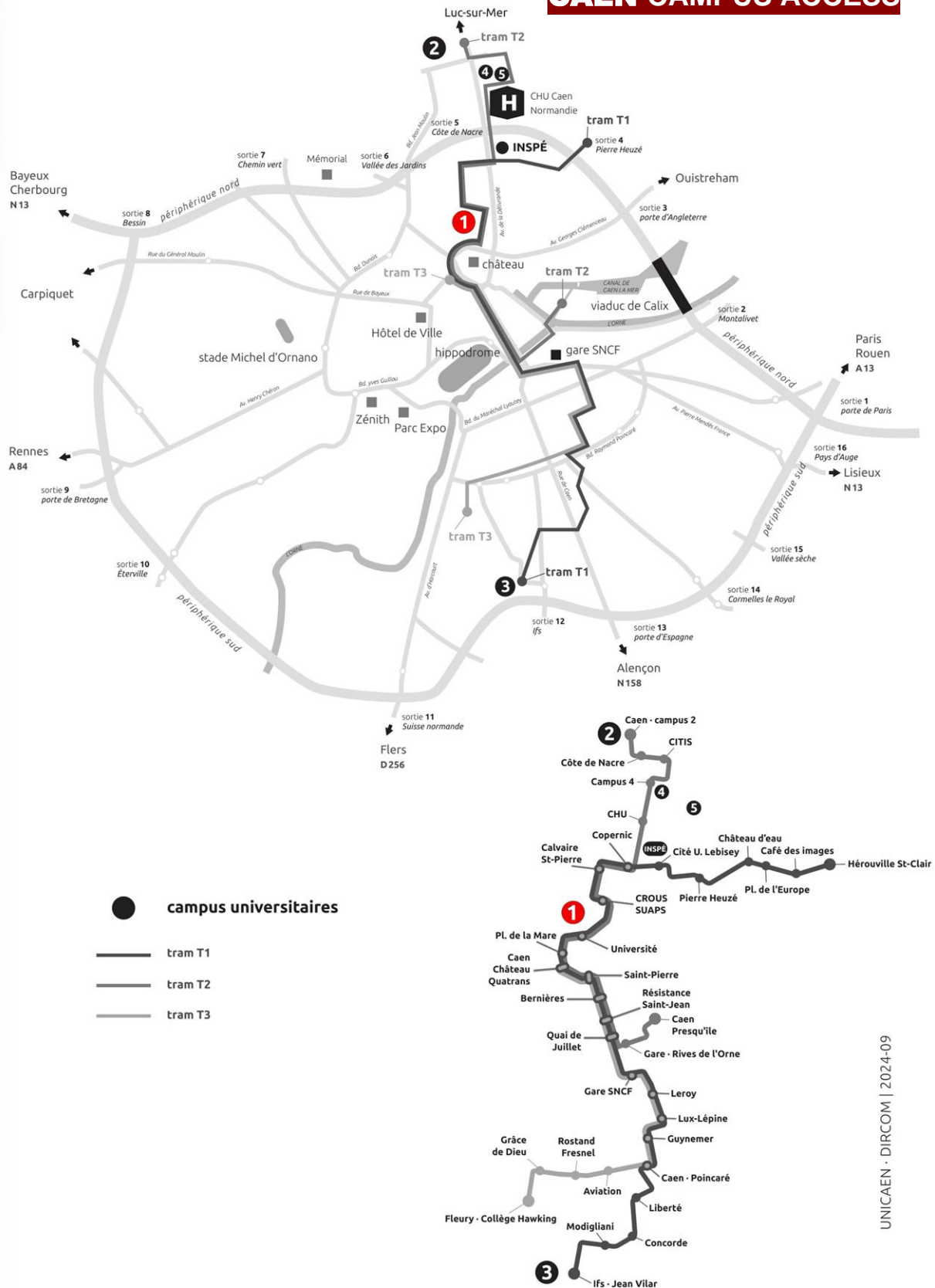
Join the Google Meet meeting!

French to English:

1. On your computer or phone, join the Google Meet conference.
2. In your meeting, click More options ⋮ > Settings ⚙ > Captions 🔲
3. Select Language of the meeting.
4. Turn on translated captions.
5. Select the language that you prefer to translate into.

Anglais vers le français :

1. Sur votre ordinateur ou votre téléphone, rejoignez la conférence Google Meet.
2. Dans votre réunion, cliquez sur Plus d'options ⋮ > Paramètres ⚙ > Sous-titres 🔲
3. Sélectionnez la langue de la réunion.
4. Activez les sous-titres traduits
5. Sélectionnez la langue dans laquelle vous souhaitez traduire.

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Université de Caen Normandie

Campus 1, Maison de la Recherche en Sciences Humaines (MRSH)

Esplanade de la paix, CS 14032, Caen Cedex 5

MAP OF CAMPUS 1