Program

Time (Rome)	Energy Center - Auditorium	Classroom 4T	Conference room "Luigi Ciminiera"	Energy Center - Hall & Foyer	Registration & Info Point (Energy Center - Entrance)
Wednesday, June 5					
08:00-09:00					REG1: ***Registration (8:00am-4:00pm)***
09:00-09:30	WO: ***Welcome Opening***				
09:30-10:15	KN1: ***Keynote (L. Chiariglione)***				
10:15-10:45				CF1: ***Coffee Break***	
10:45-12:15	S0-EC: ***Multimedia & Audio/Video Signal Processing***	WK1-4T: ***Workshop (Gesture Recognition via ToF Sensors w/ MATLAB and STM32Cube.AI)***			
12:15-12:45	IF1: ***Industry Forum (World of Gaming between Academia & Industry)***				
12:45-14:15				L1: ***Posters-A & Lunch***	
14:15-14:30		TUT1-4T: ***Tutorial (Level Design w/ Unreal Engine)***	TUT3-LC: ***Tutorial (VR UX/UI Design for Neurodivergents)***		
14:30-15:00	S1-EC: ***Frameworks & Innovative Methodologies***				
15:00-15:45		TUT2-4T: ***Tutorial (Blender BIM for Virtual Worlds)***	TUT4-LC: ***Tutorial (Semantic Communication for Multimedia)***		
15:45-16:15				CF2: ***Coffee Break***	
16:15-18:05	S2-EC: ***Virtual Humans & Digital Twins***	S2-4T: ***Game Studies, Sociology & Psychology of Play(ers)***			
18:05-18:45	null-1: ***Nothing (Buffer Time)***				
18:45-20:30	SC1: ***Social Activity (Exclusive Guided Visit to Royal Palace)***				
20:30-22:30	SC12: ***Dinner alltogheter (Extra Activity - Off Program)***				
Thursday, June 6					
08:00-08:15					REG2: ***Registration (8:00am-4:00pm)***
08:15-10:00	S3-EC: ***SS01: Games for Health***	S3-4T: ***Human-Machine Interaction & Haptics (1/2)***			
10:00-10:25				CF3: ***Coffee Break***	
10:25-11:10	KN2: ***Keynote (M. L. Alcañiz Raya)***				
11:10-11:20	AO: ***IEEE CTSoc Announcements***				
11:20-12:50	S4-EC: ***Human-Machine Interaction & Haptics (2/2)***	S4-4T: ***SS03: Next-Gen Networked XR (NGNXR) | Advancing Multiplayer and Co-Locative Gaming Experiences***			
12:50-14:15				L2: ***Posters-B & Lunch***	
14:15-14:45	IF2: ***Industry Forum (AI Applied to Game Development)***				
14:45-15:30	S5A-EC: ***Machine Learning & AI in Games***	S5-4T: ***Game Design, Game Development & UX***	WK2-1-LC: ***Workshop (Virtual Production w/ Unreal Engine)***		
15:30-16:15	S5B-EC: ***DeepFakes & Privacy of Media***				
16:15-16:45				CF4: ***Coffee Break***	
16:45-18:15	S6-EC: ***Inpiration, Ethical Aspects, Research Insight & Trends***	S6-4T: ***Serious Games for Education and Industry Applications***	WK2-2-LC: ***Workshop (Virtual Production w/ Unreal Engine)***		
18:15-18:30	null-2: ***(Buffer time)***				
18:30-19:15	SC2: ***Shuttle Transfer to Gala Dinner***				
19:15-00:30	SC22: ***Gala Dinner (& Shuttle Transfer Back)***				
Friday, June 7					
08:15-08:30					REG3: ***Registration (8:15am-9:30am)***
08:30-09:00	D-FF: ***Demos Fast Forward***				
09:00-10:00	S7-EC: ***Cultural Heritage & Engagement***	DEMO-4T: ***Demos (Serious & Mobile Gaming)***	DEMO-LC: ***Demos (VR)***	DEMO-ECF: ***Demos (Machine Learning and HMI)***	
10:00-10:30					
10:30-11:00	IF3: ***Industry Forum (Pindarica)***				
11:00-11:30				CF5: ***Brunch (Coffee Break)***	
11:30-12:15	KN3: ***Keynote (M. Zuffo)***				
12:15-13:20	S8-EC: ***Serious & Applied Games for Health and Wellness***	S8-4T: ***SS05 (AI Beyond Boundaries)***			
13:20-13:45					
13:45-14:15	CO: ***Awards & Closing Ceremony***				

Wednesday, June 5

Wednesday, June 5 8:00 - 9:30 (Europe/Rome)

REG1: Registration (8:00am-4:00pm) ☒
Room: Registration & Info Point (Energy Center - Entrance)

Wednesday, June 5 9:00 - 9:30 (Europe/Rome)

WO: Welcome Opening ☒
IEEE CTSoc President: Dr. Wen-Chung Kao,
VP Conference: Prof. Nobuo Funabiki,
Conference Chairs: Prof. Fabrizio Lamberti
Technical Program Chairs: Prof. Bill Kapralos, Ph.D. F. Gabriele Pratticò
Politecnico di Torino Rector: Prof. Stefano Corgnati
Room: Energy Center - Auditorium
Chair: Fabrizio Lamberti (Politecnico di Torino, Italy)

Wednesday, June 5 9:30 - 10:15 (Europe/Rome)

KN1: Keynote (L. Chiariglione) ☒
Leonardo Chiariglione
Room: Energy Center - Auditorium
Chair: Fabrizio Lamberti (Politecnico di Torino, Italy)
35min Speech + 10minutes Q&A

Wednesday, June 5 10:15 - 10:45 (Europe/Rome)

CF1: Coffee Break ☒
Room: Energy Center - Hall & Foyer

Wednesday, June 5 10:45 - 12:15 (Europe/Rome)

S0-EC: Multimedia & Audio/Video Signal Processing ☒
Room: Energy Center - Auditorium
Chair: Chih-Peng Fan (National Chung Hsing University, Taiwan)

10:45 ***Benchmarking MLCommons Tiny Audio Denoising with Deployability Constraints*** ☐
Armin Mazinani (University of Parma, Italy); Danilo Pietro Pau (STMicroelectronics, Italy); Luca Davoli and Gianluigi Ferrari (University of Parma, Italy)

Speech enhancement is a critical field in audio signal processing given its essentiality to overcome obstacles related to loud and damaged speech signals. Due to the revolutionary capabilities of Deep Learning (DL) models, there has been significant interest on benchmarking them and studying their suitability for tiny embedded systems. In this paper, we thoroughly examine the growing field of voice improvement, with a specific emphasis on the use of DL-based techniques under consideration by MLCommons standardization. In particular, among the others, the Legendre Memory Unit (LMU) model achieves an average Scale-Invariant Signal-to-Distortion Ratio (SISDR) on 8.613 in 627 KiB of FLASH memory, making it deployable on tiny microcontrollers by requiring only 7 ms per inference run.

Presenter bio: Armin was born in Mashhad, Iran, in December 1991. He received a bachelor's degree in Computer Engineering, software, in September 2015, from Imam Reza International University, Mashhad, Iran, and a master's Degree in Computer Engineering, Artificial intelligence, in September 2018, from Khayyam University, Mashhad, Iran. He is currently a PhD student at Parma University.

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10:55 ***QoE Enhancement of Multi-View Video Transmission Over ICN/CCN by Means of Cache Control Method*** ☐
Yoshiyuki Takada and Toshiro Nunome (Nagoya Institute of Technology, Japan)

This paper considers multi-view video and audio transmission on ICN (Information-Centric Networking)/CCN (Content-Centric Networking). Routers in ICN/CCN can cache content. Besides, the capacity of routers' caches is finite, so various cache control schemes have been proposed to improve cache efficiency. This paper presents and evaluates a new and suitable control scheme for multi-view video and audio transmission. For this purpose, we construct a network environment with Cefore. We assess application-level QoS (Quality of Service) and QoE (Quality of Experience). We then show the effectiveness of the proposed control scheme.

Presenter bio: Nunome received the B.S., M.S. and Ph.D. degrees from Nagoya Institute of Technology, Nagoya, Japan, in 1998, 2000 and 2006, respectively. From 2000 to 2001, he was with Pioneer Corp. In 2002, he joined Nagoya Institute of Technology as a Research Associate. Now, he is an Associate Professor in the Department of Computer Science and Engineering. His research interests include media synchronization, multicast communications and wireless ad hoc networks. He is a member of the IEEE and the IEICE.

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11:10 ***Semantic Communication Based Complexity Scalable Image Transmission System for Resource Constrained Devices***
Prabhath Samarathunga, Yasith Ganearachchi, Thanuj Fernando, Lahiru Thanippulige and Warnakulasuriya Fernando (University of Strathclyde, United Kingdom (Great Britain))

Multimedia traffic is expanding at an astonishing rate and is finding its way into many new applications, including wireless sensor networks and devices from the Internet of Things. However, the bandwidth and energy requirements associated with them are becoming increasingly prohibitive, challenging the sustainability of many communication networks. Semantic communications offer a novel approach to overcome bandwidth limitations, but the complexity of encoders and decoders limits its application in resource-constrained devices. We propose a semantic communication-based complexity-scalable image transmission system that uses asymmetric autoencoders to shift the complexity of the system to the encoder or the decoder without compromising on human and machine perceived quality. Using a test data set, we demonstrate that the complexity can be shifted between the two without affecting the overall performance of the semantic communication system. This concept will be significant in implementing semantic communication-based wireless sensor network and Internet of Things applications, while also providing a novel tool to further improve conventional encoder simplification approaches such as distributed coding. Furthermore, realization of energy efficient sensors by utilizing semantic communications and complexity scalability will have a direct impact on achieving sustainable development goals related to energy usage and management in media communications.

11:25 ***Explainable AI Based Approach for Broadband Customers' Churn Prediction***
Lucio Ciabattoni (Pegaso University, Italy); Marco Maiolatesi and Martina Mancinelli (Revolt Srl, Italy); Maria Di Tillo (Revolt SRL, Italy); Riccardo Fiandra, Nicolò Gerosa, Lorenzo Trimeloni, Matteo Borghi and Massimo Bertolotti (SKY Italia Srl, Italy)

In the digital era, where seamless connectivity is the lifeblood of modern society, broadband internet service providers face the dual challenge of meeting the ever-increasing demands of consumers while ensuring consistent and reliable Quality of Service (QoS). The quest for superior customer satisfaction and the reduction of churn rates have become paramount in an industry marked by intense competition. To face these pressing industry challenges, this paper presents an innovative Explainable Artificial Intelligence (xAI) algorithm designed for the dual purpose of predicting customer churn due to poor network quality while providing an elucidation of the underlying causal factors. The algorithm's deployment equips providers with a toolkit to take informed and proactive actions, thus enabling enhanced service quality management and customer retention strategies.

Presenter bio: Lucio Ciabattoni, born in San Benedetto del Tronto (AP) on 12 July 1986, he received in 2008 the first level degree in Informatics and Automation Engineering (cum laude) - in 2010 the Master Engineering degree in Industrial Automation Engineering (cum laude) - in 2014 Ph.D. degree in Information Engineering from the Universita' Politecnica Marche, Italy. Founder of the start-up META srl (www.metasistemi.it) in April 2014 and Revolt srl (www.revoltsrl.it) in January 2017. He is currently Associate Professor at Pegaso University and Young Professional Chair of IEEE Consumer Technology Society.

11:40 ***Perceptual Hashing Using Pretrained Vision Transformers*** ☐
Jelle De Geest (Ghent University - imec, IDLab, Belgium); Patrick De Smet and Lucio Bonetto (NICC, Belgium); Peter Lambert, Glenn Van Wallendael and Hannes Mareen (Ghent University - imec, IDLab, Belgium)

The rapid evolution of digital image circulation has necessitated robust techniques for image identification and comparison, particularly for sensitive applications such as detecting Child Sexual Abuse Material (CSAM) and preventing the spread of harmful content online. Traditional perceptual hashing methods, while useful, fall short when exposed to some common image transformations, or when images are doctored to avoid detection, rendering them ineffective for nuanced comparisons. Addressing this challenge, this paper introduces a novel pretrained vision transformer artificial intelligence (AI) model approach that enhances the robustness and accuracy of perceptual hashing. Leveraging a pretrained Vision Transformer (ViT-L/14), our approach integrates visual and textual data processing to generate feature arrays that represent perceptual image hashes. Through a comprehensive evaluation using a dataset of 50,000 images, we demonstrate that our method offers significant improvements in detecting similarities for certain complex image transformations, aligning more closely with human visual perception than conventional methods. While our method presents certain initial drawbacks such as larger hash sizes and high computational complexity, its ability to better handle perceptual nuances presents a forward step in the realm of image forensics. The potential applications of this research extend to law enforcement, digital media management, and the broader domain of content verification, setting the stage for more secure and efficient digital content analysis.

Presenter bio: Hannes is a Postdoctoral Researcher at IDLab-MEDIA. Ghent University - imec Belgium. He obtained the M.Sc. degree and PhD Degree in Computer Science Engineering from Ghent University - imec, Belgium, in 2017 and 2021, respectively. His research interests cover multimedia compression, security, and forensics.

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11:55 ***Semantic Communication Based Video Coding Using Temporal Prediction of Deep Neural Network Parameters***
Prabhath Samarathunga, Yasith Ganearachchi, Thanuj Fernando, Indika Alahapperuma and Warnakulasuriya Fernando (University of Strathclyde, United Kingdom (Great Britain))

Video coding is a critical capability that underpins gaming, entertainment and media ecosystems, enabling effective use of video content in both conventional and non-conventional formats. Deep neural network based video coding, which are now evolving towards semantic communication based systems, is an emerging technique to effectively implement video coding and has the potential to outperform conventional, digital signal processing vased systems A system to exploit the temporal redundancies of deep neural network parameters by predicting them for the decoder is proposed and tested through an autoencoder based implementation. Experimental results demonstrate the system's effectiveness in achieving good rate distortion performance, particularly at higher bitrates, compared with neural network compression alone. Although performance needs further improvements to reach the level of conventional video compression, the potential of it to improve the performance of neural network compression has become evident.

Wednesday, June 5 10:45 - 12:15 (Europe/Rome)

WK1-4T: Workshop (Gesture Recognition via ToF Sensors w/ MATLAB and STM32Cube.AI) ☒
Room: Classroom 4T
To participate effectively you will need to bring your laptop (220V sockets are availale for each seat in the room) and suggested to download the workshop material in advance, which can be found at **https://github.com/Brenda-MW/WaveYourWay_Workshop**

10:45 ***Wave your way: Deploy Personalized Gesture Recognition using ToF Sensors with MATLAB and STM32Cube.AI Dev Cloud***
Shixin Zhuang (The MathWorks, USA); Danilo Pietro Pau and Martin Joel Mouk Elele (STMicroelectronics, Italy); Giuseppe Ridino (The MathWorks Italy, Italy)

Just as speech and handwriting bear the unique signature of an individual, human gestures carry a distinct personal touch. Crafting a one-size-fits-all classifier for gesture recognition poses significant challenges due to the inherent variability among individuals. Accurately recognizing gestures in different scenarios, such as driving and gaming, under variable carry position of a tiny device, remains challenging due to limited and costly data availability. In this hands-on workshop, we present an end to end approach that combines the power of MATLAB and ST machine learning development environments to address the challenges of data preprocessing, model selection and performance evaluation in a systematic, productive, and efficient workflow. Movement-based signal data captured by time-of-flight (ToF) sensors contain patterns specific to different gestures. Deep learning models are trained to automate feature extraction within a gesture dataset gathered from human volunteers. Participants will explore different architectures, layers, and compression techniques. We then introduce STM32Cube.AI Dev Cloud, a cutting-edge platform for deploying and optimizing deep learning models on microcontrollers (MCU). Participants will export the trained models from MATLAB to STM32Cube.AI Dev Cloud. They will gain insights into evaluating performance benchmarks against the stringent requirements of tiny devices. Throughout the workshop, participants will engage in practical exercises, applying the MATLAB workflow to ToF dataset and deploying it to MCU development boards. By the end, they will possess the skills to navigate the complexities of deep learning model selection and performance evaluation to achieve deployment goals in an unprecedented productive way.

Presenter bio: Danilo Pau, graduated at Politecnico di Milano, on 1992 in Electronic Engineering. He joined SGS-THOMSON (now STMicroelectronics) on 1991

Wednesday, June 5 12:15 - 12:45 (Europe/Rome)

IF1: Industry Forum (World of Gaming between Academia & Industry) ☒
panel
Room: Energy Center - Auditorium
Chair: Marco Mazzaglia (Politecnico di Torino, Italy)

The World of Gaming Between Academia and Industry
Marco Mazzaglia (Politecnico di Torino, Italy); Davide Cavuoto (Ubisoft, Italy); Matteo Lana (Tiny Bull Studios, Italy); Nicola di Meo (UNSPACE, Italy); Davide La Sala (Meta Reality Labs)

The panel discussion will tell about the state of collaboration between the University and Game Industry. What links and what types of activities? What potential ways still need to be mapped out to bring two such experimental environments closer together? Facts, opinions, and perspectives told by people who have had or have experiences in companies belonging to different areas of Game Industry and Academia.

Wednesday, June 5 12:45 - 14:15 (Europe/Rome)

L1: Posters-A & Lunch ☒
Room: Energy Center - Hall & Foyer
Chair: Francesco Strada (Politecnico di Torino, Italy)

The Introduction Regarding an Implementation of Local Revitalization RPG in Ishinomaki City ☐
Yasumasa Yamaguchi (Sendai University); Yuta Mitsuhashi (Ishinomaki Senshu University, Japan)

This study explores the symbiotic relationship between regional revitalization and smartphone game applications, focusing on their potential for sustainable development. Smartphone games, strategically integrated into local culture, serve as tools for catalyzing tourism and fortifying local industries. The case of Ishinomaki City in Japan highlights the importance of tailoring game apps to specific regions through collaborative efforts with local residents. Beyond revitalization, these games act as educational tools and platforms addressing social issues, contributing to sustainable development. We conducted an exploratory experimental survey in this study and revealed that gameplay improved players' attachment and interest in Ishinomaki City. The study delves into the Local Revitalization RPG in Ishinomaki City, showcasing its innovative approach and potential for both domestic and international tourism. The convergence of regional revitalization and smartphone game apps offers a promising frontier, intertwining economic prosperity, cultural preservation, and social consciousness. Ongoing research is imperative to harness their full impact and discover innovative approaches supporting sustainable development.

A Video Game About Gulag Archaeology and the Memoirs of Women Prisoners ☐ ☐
Petros Selekos, Stefania Stamou, Konstantinos Cornelis Apostolakis and Anastasia Ntagianta (Foundation for Research and Technology Hellas, Greece); Stavroula Ntoa (ICS-FORTH, Greece); George Margetis (Foundation for Research and Technology - Hellas (FORTH), Greece); Constantine Stephanidis (FORTH, Greece)

Video games can be an effective medium for attaining learning goals, going beyond the function of entertainment. They also offer people an opportunity to virtually explore past an present sites of historic importance. With the growing popularity of video games comes the need for developing more inclusive content, embracing the medium's diverse audience, and engaging them in more serious narratives. In this paper, we present the design of a video game with the purpose of memorializing the victims of the the Gulag prison-labor system. Grounded in the principles of human-centered design, we employed collaborative and inclusive tools to facilitate the direct engagement of historians in the game's design. Through a series of co-creation workshops, history experts, video game developers and human-computer interaction designers established a platform for exchanging knowledge and sharing ideas, which led to a collective understanding of the game's historical argument, and the game features elected to convey it. Thus, in this paper, the resulting prototype video game is presented, along with insight into the iterative collaborative process itself, whereby we distill our experience into higher-level takeaways, with hopes of informing similar interdisciplinary game design undertakings.

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Exploring Cognitive Learning Theory Application in Safety Education Games for Preschoolers ☐
Siyuan Liu and Xin Fang (Xiamen Academy of Arts & Design, Fuzhou University, China); Jun He (Fuzhou University, China)

With the rising exposure of preschoolers to the Internet and digital technology, they encounter more intricate safety risks. Consequently, effectively teaching safety to preschoolers has become pressing.Educational games, being innovative educational tools, captivate children's interest, foster motivation to learn, and offer a conducive learning setting. Cognitive learning theory, serving as the foundation for educational game design, stresses active learner participation, knowledge construction, and metacognitive skill development. Consequently, integrating cognitive learning theory into safety educational games for preschoolers is anticipated to improve educational outcomes and user engagement. This study aims to investigate how cognitive learning theory is utilized in safety education games for preschoolers, analyzing its effects on game functions, user experience, and educational outcomes.Implementing cognitive learning theory can improve the efficacy of safety education for preschoolers, offering valuable guidance and support for game design and educational implementation. This holds immense importance in bolstering safety awareness and self-protection skills among preschoolers, offering an innovative educational approach for their secure development.

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Empowering Aging in Place: An Innovative Web-Based Simulation Approach for Enhancing Domestic Risk Evaluation Among Older People ☐
Emmanuel Monfort (University Grenoble Alpes & FLORALIS UGA FILIALE, France); Sidonie Salomé and Nicolas Vuillerme (University Grenoble Alpes, France)

Context: Faced with the growing challenge posed by the aging population, preserving autonomy at home is now essential. To achieve this goal, it is necessary to identify and prevent domestic risks associated with aging, using innovative and inclusive solutions. In this regard, the web platform PREVIE has been developed to provide contextualized phenotypes of cognitive difficulties in older individuals, based on the simulation of activities of daily living. - Method: Two participants aged 69 and 70 were included in the study. They underwent six sessions over three weeks, using the web platform PREVIE on a tablet. Pre- and post-test assessments included measures of self-efficacy, computer anxiety, expectations, and technology acceptance. The methodology integrated learning phases, unassisted application, and assisted application, with continuous performance assessment. - Results: A significant improvement in participants' performances over the sessions was observed. Self-efficacy, expectations, and the intention to use the platform also evolved positively. The types of errors varied, highlighting the platform's sensitivity to cognitive changes in a simulated environment. - Conclusion: The results of this case study suggest that the PREVIE web platform offers an accessible approach to assess cognitive difficulties in simulated activities of daily living, which can subsequently be used as a basis for understanding home risks in older individuals. Current findings suggest that it is feasible to explore the potential of digital phenotyping in older adults, in addition to conventional household risk assessments. This approach opens the door to earlier, tailored interventions for this demographic group.

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eXBCU: A Multiplayer Game for Game Design Education ☐
Zuby Ahmed (Birmingham City University, United Kingdom (Great Britain))

Since the COVID-19 pandemic, there has been escalated shift for wider online interaction above and beyond gaming - education, working from home, knowledge economy, entertainment brands and artists looking for innovative ways to reach their audiences, using current and future technologies as alternatives to a physical presence. This presents new opportunities for teaching and learning in Higher Education (HE); to bring together people from all walks of life, fostering a new digital society, or Multiplayer Game of University. This extended reality work-in-progress project, currently named eXtended BCU (eXBCU) aims to play a role in this transformational change. The platform works synergistically and cohesively, through online/virtual means, taking into consideration the option for participants, educators and learners, to design and implement key modes of experiential learning pedagogy which work for gamified scenarios for Game Design Education. A network supported cross platform virtual system was built, which can run on PC's, Mobiles, Tablets and Extended Reality devices. This paper discusses the design methodology behind the project. It also showcases how the result impacts the Game Design Education learning process. The result contributes to building digital education readiness, redefining the model of teaching and learning in HE, developing positive impact on education, training and learning, for Generation Z and beyond.

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HiveVR: Enhance Realism Interaction in Virtual Reality Using Game Physics ☐ ☐
James Price (Third Kind Games, United Kingdom (Great Britain)); Xi Guo (Birmingham City University, United Kingdom (Great Britain))

Beekeeping is good for the environment in the long run, but it needs a lot of training. Virtual Reality (VR) training simulations are an area of research that is growing in interest. HiveVR is a VR training system built to teach fundamental skills for performing weekly inspections for beehives and serves as an alternative teaching method when learning in the real-world environment is not possible due to various factors. However, it is challenging to ensure that the VR system provides a realism level that fits the training needs while maintaining a meaningful mode of expression. Additionally, simulating realistic interaction, especially when interacting with virtual objects, presents challenges. The project contributed knowledge about how to design and implement such a system, utilising realism features in VR and achieving realistic interaction using game physics. The result shows that the project successfully applied realism design and implementation to facilitate beekeeping training. The level of realism, including visual, audio, and interaction aspects, aligns well with the learning content and allows learners to immerse themselves in the training.

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Revisiting Generative Adversarial Network for Downstream Task of Speech Recognition ☐
Sheng Li (Institute of Science Tokyo, Japan); Bei Liu and Jianlong Fu (Microsoft Research Asia, China)

The generative adversarial network (GAN)-based method was used effectively to address environmental mismatches and speech distortion caused by noise and reverberation, substantially improving the accuracy of automatic speech recognition (ASR) in the distant speech recognition task. However, due to the distinct training objectives, GANs often produce features that may not align well with the requirements of downstream ASR systems. In this paper, we propose an improved GAN training method. While the generator generates clean speech embedding, we replace the binary-output discriminator in standard GAN with a multiclass predictor (an ASR model). Extensive experimental results on the real-world database demonstrate that our proposed approach outperforms the traditional GAN-based method and has the potential to be extended as a new training paradigm for more tasks.

Presenter bio: Sheng LI received his BS and ME degrees in 2006 and 2009 from Nanjing University, Nanjing, China, and his Ph.D. from Kyoto University, Kyoto, Japan, in 2016. From 2009 to 2012, he worked at the joint lab of the Chinese University Hong Kong and Shenzhen City, researching speech technology-assisted language learning. From 2016 to 2017, he worked as a researcher at Kyoto University, studying speech recognition systems for humanoid robots. From 2017 to Feb.2025, he worked for the National Institute of Information and Communications Technology, Kyoto, Japan, as a researcher working on speech recognition. In March 2025, he joined the Institute of Science Tokyo as an assistant professor working on speech recognition.

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A Serious Game for Environmental Education Utilizing 3D Virtual Worlds ☐
Dimosthenis Minas and Michalis Xenos (University of Patras, Greece); Dimitrios Papatheodorou (National Technical University of Athens, Greece)

In today's era, where environmental concerns are escalating, educating the younger generation about these issues is paramount. The RAISE gamified learning environment introduces an innovative approach to fostering environmental awareness among school students by leveraging the capabilities of a 3D virtual world learning environment. This platform enables students to engage in immersive game scenarios that mirror real-world environmental challenges, facilitating experiential learning. Alternatively, it offers interactive sessions where students can delve into discussions about environmental sustainability, enabling them to understand and reflect on their roles in combating climate change and broader environmental issues. This initiative examines the impact of such a virtual learning environment on students' understanding of environmental issues, their engagement with the topic, and the development of proactive attitudes towards sustainability. Preliminary feedback from the implementation of the alpha version at Arsakeia Schools, involving students aged between 10 to 15 years, indicates a positive reception towards this educational approach. Ultimately, the RAISE gamified learning environment demonstrates significant potential in elevating students' understanding and engagement with environmental issues, as preliminary results from semi-structured interviews reveal insightful feedback on both the educational impact and areas for further enhancement

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Equity and Embeddedness: A Dominant Theme for Contemporary Gaming Research ☐
Hari C Gangadharan (Ocean Grove Charter School, USA)

COVID-19, a shared global event, presented similar geo-political, social and health challenges for every country across the globe. It created a theoretical divide in the field of gaming research as well. From a deepened focus on morality and aggression, impact on social behavior and linking games to education; studies since 2020 started discussing and highlighting the need to 'include' and 'represent equitably' at a larger level. The new theoretical developments in gaming research have included strong characterization of female and LGBTQ+ characters, promoted tolerance for cultural and racial differences and advocated gaming features that accommodate disability and neurodivergence. The aim of this paper is to consolidate the deviation in research focus of gaming studies post COVID-19 into a consolidated layout of equity and embeddedness for gaming research and development in the future.

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Leveraging Large Language Models for Enhanced VR Development: Insights and Challenges ☐
Amany Alkhayat (Columbia University, USA); Brett Ciranni, Rupa Samyukta Tumuluri and Rohit Srinivas Tulasi (New York Institute of Technology, USA)

This paper delves into the capabilities of Large Language Models (LLMs) in supporting beginner programmers in crafting virtual reality (VR) content for gaming and simulation applications. Our research group, comprising both seasoned and novice VR developers, engaged with versions of ChatGPT, including 3.5, 4, and Bard with Gemini Pro, during the development of various VR projects, spanning games to simulations. The outcomes of our investigation reveal that LLMs offer significant advantages for newcomers in the field. However, we also identify several challenges that must be addressed. This study enriches the discourse on obstacles faced in VR development and elucidates the impact of LLMs on coding and software creation, shedding light on both the advantages and hurdles of integrating LLMs into VR game production.

Presenter bio: Amany Alkhayat is a consultant to VR companies. She is an adjunct faculty at New York Institute of Technology. She is currently pursuing her Doctoral degree in Instructional Technology and Media at Teachers College, Columbia University. She is also the founder and Chair of the NYS TESOL Technology Enhanced Language Learning SIG and the VirtualTELL conference. Amany is also the co-founder and CEO of Language Cities, a VR game, and a Udemy Instructor. As an author and instructional technology designer, Amany is always exploring emerging technologies to enhance the learning experience. She is committed to using her expertise to help learners and trainees reach their full potential.

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Balancing Act: Leveraging 'PARAMETERS' Serious Game as a Tool for Mastering Game Design in Higher Education ☐
Jens-Martin Loebel (Magdeburg-Stendal University of Applied Sciences, Germany); Jochen Koubek (University of Bayreuth, Germany)

This paper introduces "PARAMETERS", a serious game implementation, as a novel pedagogical tool for enhancing game design and balancing education within higher education settings, specifically in game development courses. Recognizing the complexity and educational value of game balancing-a process crucial for ensuring fairness, engagement, and replayability in games-this research aims to bridge the gap between theoretical knowledge and practical application in academic curricula. By integrating PARAMETERS into a game design curriculum, we examine its effectiveness in facilitating active learning and mastery of game design principles among students. Our methodology leverages PARAMETERS' simplified RPG mechanics, focusing on numerical interactions and stat management, to allow students hands-on experience with core game development tasks without the distractions of complex graphics or narratives. The outcomes of this integration, evaluated through a detailed case study, indicate a significant enhancement in students' comprehension of game balancing concepts and their application in real-world scenarios. Our study contributes to the discourse on game-based learning in technical education by demonstrating the pedagogical benefits of using serious games like PARAMETERS. It offers insights into effective strategies for embedding practical game design exercises into higher education, underscoring the potential of serious games to complement and enrich traditional learning approaches in this field of game development.

Presenter bio: Jens-Martin Loebel is a Professor of Business Information Systems at Magdeburg-Stendal University of Applied Sciences. He holds a double degree in Computer Science and Psychology and a doctoral degree from Humboldt-University of Berlin. His research spans Human-Computer Interaction, Long-Term Preservation of Digital Cultural Heritage, Digital Media, and Computer Game Sciences. In his previous role as the Managing Director of bitGilde IT Solutions UG, he dedicated almost a decade to developing tailored software solutions and infrastructure for research, education, and cultural applications.

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Learner-Oriented Game Design: The Evolution of Cipher ☐ ☐
Liang Xu (Dublin City University, Ireland); Jenny Thomson (University of Sheffield, United Kingdom (Great Britain)); Elaine Uí Dhonnchadha (Trinity College Dublin, Ireland); Monica Ward (Dublin City University, Ireland)

This paper explores the integration of a digital game, Cipher, into language learning. It emphasises the balance between maintaining a playful game approach and ensuring robust pedagogical foundations. Motivating learners, especially for endangered languages (in this case Irish), can be challenging, but digital game-based learning offers an effective solution. The game has evolved via a pragmatic, pedagogically informed, learner-oriented game design approach. The game includes key elements such as levels, power-ups, scoring system and life mechanism all of which are important in maintaining the game ethos, in challenging the player and maintaining interest and to avoid the chocolate-covered broccoli scenario. The game framework, derived from an existing model, is modular and designed to be language independent. This enables the game to be adapted to the local culture, language and context. Crucially, the co-creation process, involving feedback and insights from teachers and learners, has driven the game's refinement through multiple iterations, resulting in enhanced content and features. This semi-agile approach enabled the evolution of the game through various stages to the current iteration, featuring more appropriate texts, improved game components and planned enhancements including AI-generated audio, images, and other innovative features. Cipher serves as a valuable asset for low-resourced languages, fostering inclusivity by catering to individual learning speeds and diverse learner needs. This paper outlines an approach centered on reuse/repurpose, pragmatism, and co-creation, which holds promise for application across various other contexts.

Presenter bio: Liang Xu is a doctoral researcher and a lecturer at Dublin City University, affiliated with the SFI Centre for Research Training in Digitally-Enhanced Reality. His research interests include Computer-Assisted Language Learning, Natural Language Processing, Human-Computer Interaction, games and Virtual Reality.

☒

A Study on the Utilization of Ink and Wash Style in the Performance of Weapon Strike Effects in Wuxia Games ☐
Minmin Huang (FuZhou University, China); Jun He (Fuzhou University, China); QingRui Chen (FuZhouUniversity, China); Chanyuan Yan (FuZhou University, China & Xiamen Academy of Arts & Design, China)

Games have become an indispensable form of entertainment for people; Chinese ink and wash, with its style and unique local characteristics, has increasingly become an elegant spiritual connotation. Utilizing the combination of the two qualities, excellent games can create new ideas and bring players different experiences and attractions. In this paper, based on the analysis of ink and wash characteristics, centering on the design of weapon striking effects in martial arts games, we further explore the advantages of ink and wash style in the use of this kind of content and re-creation ideas. In game design, the use of ink elements can give it humanistic and cultural value, bring new development space for the future of the game, and also better inherit the ink culture.

☒

Enhancing Fetal Heart Rate Monitoring Through Digital Twin Technology ☐
Tunn Cho Lwin (Miyazaki International University, Japan); Thi Thi Zin, Pyke Tin, Tsuyomu Ikenoue and Emi Kino (University of Miyazaki, Japan)

In the era of digital twin technology (DTT), which involves creating virtual replicas of physical systems, healthcare applications have seen a surge in innovation. Fetal heart rate monitoring, a rapidly advancing field within healthcare, is benefiting greatly from the effective implementation of DTTs. Digital twin, supported by Artificial Intelligence (AI), Virtual Reality (VR), and Extended Virtuality (EV), have already demonstrated significant impact in entertainment, gaming, and media sectors. This paper explores and analyzes fetal heart rate monitoring systems during labor using digital twin technologies. During labor, there is an elevated risk of developing non-communicable diseases (NCDs) such as diabetes, cardiovascular diseases, cancer, and chronic respiratory diseases. The developmental origins of health and disease hypothesis posits that environmental conditions during fetal and early postnatal development have enduring effects on growth, structure, and metabolism, ultimately influencing long-term health and well-being. Understanding and effectively monitoring fetal heart rate dynamics during labor using digital twin technologies can provide valuable insights into maternal and fetal health. The findings underscore the value of entropy analysis in FHRV assessment, presenting a pioneering predictor of fetal health via ECG data. Moreover, it reveals the current landscape of fetal heart rate monitoring, discusses the integration of digital twins, and proposes future directions for optimizing healthcare outcomes in the digital era.

Presenter bio: I received Bachelor of Science (Hons.) and Master of Science degrees in Mathematics from the University of Yangon, Myanmar, in 2018 and 2020, respectively. In 2017, as part of my undergraduate studies, I studied Mathematics at Ateneo de Manila University, the Philippines. I also obtained a Master of Engineering degree from the University of Miyazaki, Japan, in 2020 by double master degree program. I worked as a mathematics tutor in the Department of Mathematics at the University of Yangon from 2019 February to 2021 January. In 2022, I worked as an actuarial analyst at AIA Myanmar insurance company. Currently, I am pursuing a PhD at the University of Miyazaki, Japan. My research focuses on differential equations, predictive modeling, statistics, big data analysis, biomedical engineering, artificial intelligence and digital twin technology.

☒

Workflow for Evaluating Vehicle Interiors Using Serious Gaming ☐
Thirumanikandan Subramanian (University of Stuttgart, Germany); Fabian Schlichtherle (Institute for Engineering Design and Industrial Design, Germany); Wolfram Remlinger (University of Stuttgart, Germany)

The evaluation of vehicle interiors is necessary for ensuring user comfort, and safety, as well as overall acceptance and satisfaction. Carrying out these evaluations with a user-centric approach helps to understand the requirements from the user's point of view. Implementing the virtual reality (VR) method using real-time rendering to create a Digital Twin (DT) of the vehicle interior and environment provides a multi-dimensional opportunity for simulating and assessing user interactions with the vehicle interior elements and interfaces along with user experience in vehicle interiors. A workflow for creating virtual environments, focusing on scenario-based evaluations in vehicle interiors is presented in this paper. The workflow comprises multiple stages, including the creation of 3D models, integrating 3D assets, defining functionalities using blueprint mode of scripting, creating sequences to display animations, creating triggers for events within scenarios, and activating VR preview mode. The workflow described in this paper can be implemented based on the use cases and aspects that require evaluation.

Presenter bio: Researching and developing Mixed Reality Methods for the simulation and evaluation of Future Mobility along with associated HMIs

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Designing a Virtual Learning Environment Authoring Platform: Determining Educator Requirements ☐
Cole Craven, Bill Kapralos and Adam Dubrowski (Ontario Tech University, Canada)

The expanding demand for virtual learning environments, particularly serious games and virtual simulations, emphasizes the need for tools that empower educators to easily customize learning experiences to suit their learners without reliance on game developers/programmers. Before such tools are developed, educator needs and requirements must be examined. In this work-in-progress paper, we outline the use of formal approaches in the development of a questionnaire that will be distributed to educators to gauge their technical skillset/knowledge and the features they seek in educational authoring tools. Results will be made freely available to guide developers of educator authoring platforms.

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Co-Designing Pilot Games with Citizens and Policy Stakeholders to Increase Climate Action ☐
Jane Yau (DIPF Leibniz Insitute for Research and Information in Education, Germany); Dana Kube and Hendrik Drachsler (DIPF Leibniz Institute for Research and Information in Education, Germany); David Griffiths (Research Institute for Innovation & Technology in Education, Spain); Barbara Kieslinger, Claudia Magdalena Fabian and Katharina Koller (Centre for Social Innovation, Austria); Paul Hollins (University of Bolton, United Kingdom (Great Britain)); Anna Merry and Aravella Zachariou (Frederick University, Cyprus)

This paper presents an initial report on the co-design processes between researchers and policy stakeholders in the GREAT (Games Realising Effective and Affective Transformation) project applied in the context of the climate emergency. The objective of piloting these co-design processes is to develop a methodology to support policy stakeholders in identifying and determining an urgent climate issue. We engage stakeholders in co-design of games-based activities, which can be instantiated for citizens and simultaneously be used to collect their attitudes towards climate policies. By piloting these co-design processes, we aim to support policy stakeholders in identifying an urgent climate issue they want to address. Based on this climate issue, we co-design games-based interventions which provide the opportunity for citizens to engage with policy issues, and to represent their attitudes and preferences relating to climate policies. We develop two types of game-based methods - a short quiz format embedded in a mobile game, and longer, collaborative serious games - for collecting, analyzing, and presenting data on citizens' attitudes to policymakers for improving climate policies. In this paper, we describe the pilot studies undertaken and discuss the lessons learnt.

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Study on the Impact of Lighting Design on User Interaction Behavior in Deciphering Games ☐ ☐
Chanyuan Yan (FuZhou University, China & Xiamen Academy of Arts & Design, China); Jun He (Fuzhou University, China); Qingyun Lin and Minmin Huang (FuZhou University, China)

Lighting design significantly influences the user's ability to gather environmental information. Excellent lighting design can provide users with a more comfortable environment for exploration, thereby enhancing the user's overall gaming experience, stimulating their curiosity, and encouraging their exploration. Drawing on James Gibson's Ecological Optics and B.J Fogg's Behavioral Model as theoretical foundations, this paper explores how lighting design influences user interaction behavior in deciphering games. This paper explores the effects of lighting design on games from different perspectives, which finally provides valuable insights to assist in the lighting design for deciphering games.

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Wednesday, June 5 14:15 - 15:00 (Europe/Rome)

TUT1-4T: Tutorial (Level Design w/ Unreal Engine) ☒
Davide Cavuoto (Ubisoft Milan)
Room: Classroom 4T

14:15 ***The Power of Shapes: how to create simple and sharp blockout to support game design during early stages of development***
Davide Cavuoto (Ubisoft, Italy)

Level design is one of the weirdest yet most fundamental discipline within the crazy game development workflows. Once a game is defined, level design is what permit the mechanics to be played and enjoyed, in order to convey the emotions that the game designers want the player to feel.

Easy blockouts and primitive shapes can help a lot in the early development stage of a game: during this talk, we'll see how the space can be easily prototyped in engine and how important it is to have a playable space as soon as the game mechanics are ready and implemented.

Presenter bio: Davide Cavuoto is a level designer at Ubisoft Milan (Italy). He studied game design and development in Turin, and approached the game industry in an italian indie software house. Then, he landed a job within the bigger AAA development, leading him to become first an AI Game designer and then a level designer. He now works placing cubes and creating virtual spaces, while giving lessons to wannabe game designers and helping them entering the industry, organizing events with the IGDA (International Game Developer Association) Italian section.

Wednesday, June 5 14:15 - 15:00 (Europe/Rome)

TUT3-LC: Tutorial (VR UX/UI Design for Neurodivergents) ☒
Room: Conference room "Luigi Ciminiera"

14:15 ***MoodMentor: Virtual Reality UI/UX Design Considerations for Neurodivergent Users***
Austin J Stanbury (Augmented Info Systems, USA); Ines Said (University of Florida, USA)

Our tutorial explores innovative approaches to enhancing user interaction within virtual reality (VR) applications tailored for neurodivergent individuals. The presentation will discuss the implementation of gaze-based user interfaces (UI), discussing both the challenges and limitations encountered. We will explore the contrast between module-based and integrated approaches for vocational skills training, highlighting their respective benefits and drawbacks. The talk will also discuss the use of "character" roles that enhance user connection and understanding with the content they experience. Additionally, it addresses the structured introduction of information to help users build their understanding of the scenario intuitively. The use of voice assistants as a complementary tool for enhancing interaction and accessibility within these applications will also be discussed, underscoring their potential to support more effective learning experiences.

Presenter bio: Austin Stanbury is co-founder and CEO of Augmented Info Systems (AIS), a digital health startup located at the University of Florida Innovate | Hub. At AIS, Austin collaborated with major industry stakeholders Road to Responsibility and South Shore Support Services to develop and distribute virtual reality software for mental health support. His work is currently being deployed in large healthcare networks to aid in autism and neurodiversity support. Austin's research in extended reality education has been featured globally at ACM's VRST, the Augmented World Expo, Games for Change, the Association for Community Health Improvement, The Global XR Conference, and several other venues.

Wednesday, June 5 14:30 - 15:45 (Europe/Rome)

S1-EC: Frameworks & Innovative Methodologies ☒
Room: Energy Center - Auditorium
Chair: Andrew Hogue (Ontario Tech University, Canada)

14:30 ***The Extended RoSA Conceptual Architecture for Managing Consumer-Grade Social Robot Surrogates***
Jens-Martin Loebel (Magdeburg-Stendal University of Applied Sciences, Germany); Curtis Gittens (The University of the West Indies, Cave Hill Campus, Barbados)

The use of a Robotic Surrogate Architecture (RoSA) has been suggested to improve the psychosocial aspects of the human-robot relationship when using companion robots. The Extended Robot Surrogate Architecture (eRoSA) builds on this framework by adding components for managing multiple robots and enhancing human-robot interactions through individualized state and personality management, thus facilitating the use of companion robots in real-world settings using a variety of commercially available robots. By integrating a Hardware Abstraction Layer, ReST Communication Module, Multi-Robot/Multi-User Management, and State and Personality Management within a scalable and modular framework, eRoSA enhances autonomy, emotional contagion, and psychosocial interaction in robotic systems. We propose this generic architecture to address the hardware limitations of individual robots while providing a novel approach to robot personality adaptation, state management, and behaviour generation. By leveraging ReSTful communication, the architecture facilitates dynamic and scalable integration of robot surrogates, allowing for flexible adaptation to various robot capabilities and user needs. This paper details the conceptualization, design, and potential applications of eRoSA, emphasizing its modular, scalable, and secure architecture, which addresses issues arising in real-world scenarios, specifically in the deployment, management, and day-to-day operation of companion robots.

Presenter bio: Jens-Martin Loebel is a Professor of Business Information Systems at Magdeburg-Stendal University of Applied Sciences. He holds a double degree in Computer Science and Psychology and a doctoral degree from Humboldt-University of Berlin. His research spans Human-Computer Interaction, Long-Term Preservation of Digital Cultural Heritage, Digital Media, and Computer Game Sciences. In his previous role as the Managing Director of bitGilde IT Solutions UG, he dedicated almost a decade to developing tailored software solutions and infrastructure for research, education, and cultural applications.

14:45 ***Advancing NASA-TLX: Automatic User Interaction Analysis for Workload Evaluation in XR Scenarios*** ☐
Aida Vidal-Balea, Paula Fraga-Lamas and Tiago M. Fernández-Caramés (University of A Coruña, Spain)

Calculating the effort required to complete a task has always been somewhat difficult, as it depends on each person and becomes very subjective. For this reason, different methodologies were developed to try to standardize these procedures. This article addresses some of the problems that arise when applying NASA-Task Load Index (NASA-TLX), a methodology to calculate the mental workload of tasks performed in industrial environments. In addition, an improvement of this methodology is proposed to adapt it to the new times and to emerging Extended Reality (XR) technologies. Finally, a system is proposed for automatic collection of user performance metrics, providing an autonomous method that collects this information and does not depend on the users' willingness to fill in a feedback questionnaire.

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15:00 ***A Method to Formalise Game Design Praxis*** ☐
Maura Mengoni and Laura Cormio (Polytechnic University of Marche, Italy); Tommaso Santilli and Catia Giaconi (University of Macerata, Italy)

The present study employs the qualitative method of Grounded Theory to analyse insights from interviews with 11 game design professionals, with the aim of investigating possible shared approaches and practices. The paper establishes a theoretical framework centred on the core category "Balancing permanence and change", revealing designers' nuanced approach to simultaneously maintaining stability and flexibility. Collaborative and iterative methods allow them to construct and sustain stable elements while preserving adaptability to potential constraints. The framework can deepen comprehension of game design practices, offering insights into designers' decision-making processes. Future works should evaluate framework applicability across genres and different cultural contexts.

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15:15 ***A Universal Method for Performance Assessment of Meta Quest XR Devices*** ☐
Volodymyr Bondarenko (Dresden Technical University, Germany); Jiajing Zhang (Technische Universität Dresden & Centre for Tactile Internet with Human-in-the-loop, Germany); Giang T. Nguyen (Technische Universität Dresden, Germany); Frank H.P. Fitzek (Technische Universität Dresden & ComNets - Communication Networks Group, Germany)

Every year, companies release new XR devices with different technical characteristics without standard information that can be used to analyze the possibility of using specific headsets for concrete XR solutions or digital twins. Companies cover important product specifications by marketing data focused on the average consumer. That doesn't allow for getting the data required to evaluate headsets and the possibility of using them for concrete XR cases or digital twins. In this paper, we present a solution that allows the evaluation of any XR headset for compatibility with the technical requirements of concrete XR applications. We have already collected data for Meta Quest 2, Meta Quest Pro, and Meta Quest 3 headsets using our solution, which will allow us to use data for evaluation in the future. Information that we gathered from headsets showed that, in the current stage of XR solutions, some critical issues still allow headsets to be used only in a minority of use cases. This paper highlights the main current issues in XR headsets that limit the effective application use of XR solutions.

Presenter bio: Volodymyr Bondarenko is a Ph.D. researcher at Deutsche Telekom Chair for Communication Networks at TU Dresden. He has earned his bachelor's and master's degrees in Informatics from Kyiv Polytechnic University in Kyiv and his second master's degree in Informatics from Dresden Technical University. He is working on the "6G-Access, Network of Networks, Automation & Simplification (6G-ANNA)" project. The 6G-ANNA project aims to develop a holistic design for the sixth generation of mobile communications, which includes a closed end-to-end architecture. His current research focus is digital twins and data compression.

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15:30 ***Developing a Media Watcher Through Business Intelligence Tools: An Approach for Emerging Media Industries*** ☐
Kevin Mejía Rivera (Universidad Tecnológica Centroamericana, Honduras)

Research and monitoring are two driving forces in the development of media industries. In this sense, media watchers can be essential in emerging countries where media companies face budgetary constraints and lack of access to technology for decision making. This paper presents an experience carried out in Honduras for the development of a radio watcher with the support of Information and Communication Technologies (ICT) focused on Business Intelligence (BI). To achieve this goal, a Canvas Business Model was applied to conceptualize the project and Microsoft Power BI was used to build a dynamic dashboard for data management. Data was collected through two methods; literature review and a survey completed by 166 people to measure their radio consumption. The results allowed to categorize, analyze, and show the information in an online media tool that provides data from the radio on four areas: general overview, billing, audience, and trends. These indicators of the radio industry allow decision making for content programming and business strategies.

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Wednesday, June 5 15:00 - 15:45 (Europe/Rome)

TUT2-4T: Tutorial (Blender BIM for Virtual Worlds) ☒
(Blender Italy)
Room: Classroom 4T

15:00 ***Blender BIM for Virtual Worlds and Digital Twins***
Filippo Zorgno (Blender Italia aps & BoffaPetrone&Partners of Gruppo Building, Italy); Piercarlo Stori (Italy)

One of the main languages of architecture has always been representation, which over time has evolved from what were once 2D drawings on paper sheets to become digital and physical three-dimensional representations.

Digital representation today is firmly tied to architecture, playing a fundamental role in various phases of a building's lifecycle, from the design phase to construction, and even extending to subsequent phases such as building maintenance and potential sales.

In some mechanisms of this process, the use of Blender, an open-source software, is gaining ground. Despite Blender originating from an animation environment, thanks to its high versatility, it has begun to spread into other sectors such as architecture in recent years. Today, it is capable of meeting a significant portion of the needs required in architecture, particularly with the recent development of the Blender BIM add-on and the ongoing implementation of features aimed at creating photorealistic environments.

Blender offers several economic and functional advantages over other industry-standard software. These include the ability to use a single software for many functions, minimal or reduced costs, as well as high flexibility and ease of integration with other software for developing applications such as Virtual Tours, AR, and Configurators, which cannot currently be developed internally. This digital material could be the driving force behind Digital Twin systems, capable of extending the integration of physical and virtual realms even in managing a building throughout its lifecycle, interacting with professional figures for its maintenance or with the people who inhabit it.

Presenter bio: Architetto e docente di scuola secondaria superiore, con esperienza in progettazione (anche esecutiva) di allestimenti locali pubblici , esperto di modellazione 3d con svariati programmi (in particolare Blender) .

Wednesday, June 5 15:00 - 15:45 (Europe/Rome)

TUT4-LC: Tutorial (Semantic Communication for Multimedia) ☒
Room: Conference room "Luigi Ciminiera"

15:00 ***Semantic Communication for Multimedia Applications***
Warnakulasuriya Fernando and Yasith Ganearachchi (University of Strathclyde, United Kingdom (Great Britain))

Semantic communication was first discussed by Claude E Shannon and Warren Weaver in 1949, when they classified communications as a problem with three levels: physical, semantic, and effectiveness. The physical problem concerns itself with accurate transmission of the data content of a message and led to the birth of information theory, while the semantic problem deals with ensuring the meaning (or semantic) of a message is delivered, and the effectiveness problem is whether the intended action by the message was achieved. Although physical communications evolved at an exponential pace from the early days of information theory, creating the foundation on which the current gaming, entertainment, and media ecosystems are built, semantic communication was not explored further, mainly due to the lack of appropriate tools for its implementation. However, with recent advancements in deep learning and computer performance, developing semantic communication as a useful paradigm to improve the capacity and reliability of communication systems has become a possibility. We explore how the concepts behind semantic communications can be used to complement conventional multimedia communication systems, with special focus on image compression and transmission and video compression and transmission. The early results show promise in achieving better quality reconstructions of images and video for a given bandwidth compared to state-of-the-art image and video compression techniques, but also have several key challenges to be overcome to be commercially adapted. We present the background, current state, and future roadmap for using semantic communications for multimedia applications.

Wednesday, June 5 15:45 - 16:15 (Europe/Rome)

CF2: Coffee Break ☒
Room: Energy Center - Hall & Foyer

Wednesday, June 5 16:15 - 18:05 (Europe/Rome)

S2-4T: Game Studies, Sociology & Psychology of Play(ers) ☒
Room: Classroom 4T
Chair: Hannes Mareen (Ghent University - Imec & IDLab, Belgium)

16:15 ***Integrating the Time Travel Mechanic in VR Serious Games to Enhance Causal Reasoning*** ☐
Alessandro Visconti, Marina Nadalin, Federico De Lorenzis, Filippo Gabriele Pratticò and Fabrizio Lamberti (Politecnico di Torino, Italy)

Serious games (SGs) have demonstrated effectiveness in improving individuals' knowledge, skills, and attitudes through training. In particular, many studies showed how the combination of SGs and Virtual Reality (VR) can further improve learning and training methods in the context of practical learning. Based on this consideration, during the design phase, choosing the appropriate game mechanics could have a significant impact on the learning outcome of the experience. A game mechanic that appears to have great potential for learning is the time travel one. By means of repeated time travels this mechanic allows the learner to empirically investigate the causal relationships between choices or actions and their consequences, thus stimulating causal reasoning, rather than proceeding linearly in the narrative. This type of mechanic could be particularly useful in the context of risk management, where each action performed by the user is critical and consequences could compromise the whole experience. The aim of this paper is to evaluate the effectiveness of an immersive VR SG that incorporates a time travel mechanic to enhance causal reasoning, using a hydrogeological risk-management scenario as a case study. The evaluation of the devised SG was conducted through a user study leveraging both subjective and objective evaluations.

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16:30 ***Exploring the Time Dilation Gameplay in VR, and Its Effect on Presence, VR Sickness, and Performance*** ☐ ☐
Louis Nisiotis, Panayiotis Hadjidemetriou and Nicolas Nouhi (University of Central Lancashire Cyprus, Cyprus)

This study explores the effect of Time Dilation gameplay mechanic in a VR game and its impact on players' subjective feeling of Presence, symptoms of VR sickness, and to their gaming performance. A comparative study was conducted using a VR First Person Shooter game prototype under two experimental conditions: Normal Gameplay and with Time Dilation, manipulating the in-game time to almost complete standstill when the player stops moving. The results revealed that the Time Dilation mechanic did not affect the players feeling of Presence, and yielded relatively lower VR sickness, highlighting the need for further investigation on its potential impact on the domain. The mechanic did not affect players' in-game performance, but it impacted the way they were navigating and spatially exploring the environment, hence, considerations need to be made in the way tasks, levels, and interactions are designed. The main contributions of this paper are: i) insights on how Time Dilation affects players' feeling of Presence in a VR game; ii) the impact of the mechanic on VR Sickness; and iii) its influence on player performance, providing valuable information for game developers and designers.

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16:45 ***The Effect of Educational Video Game Perceptual Realism on Learning Outcomes and Motivation*** ☐
Alberto Rojas-Salazar (Universidad de Costa Rica, Costa Rica); Mads Haahr (Trinity College Dublin, Ireland)

This paper presents a study of the effect of the level of perceptual realism of the game world's dimensionality, graphics, and physics on learning outcomes and motivation. An evaluation of two versions of an educational video game that differ in the level of realism was performed. Descriptive and inferential analysis results show that both versions are effective learning tools and equally motivating, suggesting that 3D educational games do not cause a higher cognitive load than 2D educational games.

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17:00 ***Pupil Dilation Dynamics in Serious Game Emotional Activation*** ☐
Federico Calà (Università degli Studi di Firenze, Italy); Can Gursesli (Tampere University, Finland); Pietro Tarchi, Lorenzo Frassineti and Andrea Guazzini (Università degli Studi di Firenze, Italy); Antonio Lanata (University of Florence, Italy)

Gaming is becoming a beneficial context in educational and therapeutic applications. Serious game development aims to propose innovative, dynamic biofeedback-engaging games that integrate cognitive information. In this context, pupillometry represents a non-invasive, cost-effective methodology to analyse the activity of the autonomic nervous system and indirectly measure arousal and cognitive load. This study proposes the investigation of pupillometry signal dynamics acquired from a group of healthy subjects during a matching pairs card game session. Lyapunov's theory has been applied to evaluate the nonlinear content of pupillometry dynamic. The emotional states of involved subjects have been assessed through the PANAS scale. Statistical analysis showed that game playing significantly increased positive emotions and, concurrently, decreased negative ones. Spearman correlation analyses showed a significant relationship between arousal and Large Lyapunov Exponent, negative emotions and standard deviation of pupil diameter. Moreover, the latency of the maximum pupil dilation significantly differed in players with high-performance scores compared to low-performance subjects. This outcome seems to validate the use of serious games for future investigation of memory skills and deficits and emotion regulation strategies in both clinical and consumer applications

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17:10 ***Design Strategies for Creating Empathy-Arousing VR Warfare Content Across Various Demographic Groups and Levels of VR Experience*** ☐
Hua-Hsiang Chen and Hsiao-Yue Tsao (National Taipei University of Technology, Taiwan)

This study explores how VR can enhance viewers' empathy towards war-related topics, as well as the variation in empathy enhancement among different demographic groups. The research involved interviewing six participants aged 20 to 40 with diverse backgrounds, including audiences without VR creation experience, VR content creators, and VR expert scholars. The results indicate that viewers without VR creation experience place more emphasis on self-projection and understanding the story background. VR content creators, on the other hand, focus on the interactivity and verisimilitude of the virtual world and props, while VR expert scholars prioritize the sense of agency and multisensory stimulation. Ultimately, this study categorizes these three types of viewers into "Embodied Sensory Needs," "Visceral Sensory Needs," and "Agential Sensory Needs." Based on these findings, VR filmmakers can tailor their works to different sensory needs based on the identified viewer demographics.

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17:20 ***Oral Storytelling in the Digital Future: Implications for Distraction, Time Perception and Immersion*** ☐
Subrata Dey (Jagran Lake City University & University of Adelaide, India); Sal Humphreys (University of Adelaide, Australia)

Oral storytelling remained the most popular storytelling format throughout the history of humanity until it was replaced by books, and thereafter by their digital versions (i.e. e-books). However, in congruity with the predictions of the medium theorists, the recent times have seen a resurgence of orality through the remediated forms of audio books or digital storytelling. This paper does a comparative study between the immersive capabilities of a 3D digital animated oral storyteller and the normal audio-book style narration. We present an initial prototype of a 3D digital animated oral storyteller with certain elementary quasi-human capabilities and measure the degree of immersion experienced by the user in comparison to the immersion experienced through a normal audio narration. Immersion has been gauged through objective measures including eye-tracking, and subjective measures (questionnaires). The results from the objective eye tracking data suggest that the viewers tend to be less distracted by unrelated visuals in an interface with a 3D digital animated oral storyteller than the one without it and therefore have a higher degree of immersion. But certain contradicting conclusions arise out of the subjective narrative engagement scale or self-reporting. While the study shows that the presence or absence of a 3D virtual storyteller significantly alters the experience of story consumption, there is scope for further study that looks into the anomalies for the measurement of immersion or distraction and retrospective time estimation.

Presenter bio: Associate Dean of Jagran LAKECITY University, PhD from University of Adelaide, Australia, MA in Communication from Wake Forest University, MBA from IIM (Ahmedabad). Fellowship recipient from Wake Forest University.

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17:35 ***How the Emotional Content of Music Affects Player Behaviour and Experience in Video Games*** ☐
Joshua Roberts and Jason Wuertz (University of New Brunswick, Canada); Max V. Birk (Eindhoven University of Technology, The Netherlands); Scott Bateman and Daniel J. Rea (University of New Brunswick, Canada)

Previous research studying music's effect on video games has focused on musical properties, such as tempo, to create particular emotional player experiences. However, music is complex, and selecting music using a particular parameter may not guarantee that the music will be experienced in a particular way (e.g., higher-tempo music will not necessarily make a player feel more rushed, as previous work implies). Through a player study, we demonstrate that music labelled by its emotional content (e.g., peaceful or powerful) could provide a better means for designers to choose music for particular emotional effects. Our results show that powerful (rather than higher tempo) music can significantly increase experienced tension and risk-taking play style compared to peaceful music. We provide game designers and composers with critical new information about how music can be chosen and designed to target play experience and shape player behaviour, suggesting that music's effects in gameplay need to be studied more holistically.

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17:50 ***StudyVR: A Framework for Streamlining VR User Study Design***
Yaojie Li and Andrew Hogue (Ontario Tech University, Canada)

While Virtual Reality (VR) technology has rapidly matured into the consumer space, there exists a noticeable lag in user perceptual studies to empirically validate whether these new technologies genuinely enhance user experience or merely serve as marketing hype. This paper introduces StudyVR, a prototype system aimed at addressing this gap by streamlining the design and deployment of mixed-methods user experience research studies in VR. Our approach automates common administrative tasks, common study methodologies, and automatically synchronizes both the research design and the participant questionnaire in an online database. The goal is to enable researchers to rapidly move from the initial concept of research design to participant data collection and analysis, concentrating more on their research questions and hypotheses than on implementation details. StudyVR enables a rich range of research methodologies managed in a centralized database, simplifying data management, and facilitating interdisciplinary collaboration. Finally, we present a proof-of-concept study design using StudyVR.

Wednesday, June 5 16:15 - 18:05 (Europe/Rome)

S2-EC: Virtual Humans & Digital Twins ☒
Room: Energy Center - Auditorium
Chair: Davide Calandra (Politecnico di Torino, Italy)

16:15 ***A Method for Volumetric Video Streaming*** ☐
Yaojie Li and Andrew Hogue (Ontario Tech University, Canada)

n this paper, we present our work on the design and development of an open-source freely available streaming solution for streaming 4D volumetric video assets over a network. The aim of this work is to reduce the reliance on proprietary solutions to enhance interoperability of 4D assets that can be streamed between a server and client. Our work assumes that a 4D set of independent meshes are available and thus is applicable to any application that uses a dynamic set of animated 3D textured meshes that need to be streamed between devices to conserve storage space. Use of standard game engines enables our clients to be any mobile, desktop, or virtual reality device. We explain the tools and techniques used, show initial results of our quantitative evaluation and discuss future uses of this work.

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16:30 ***The Quest for Believability: Exploring FACS Adaptations for Emotion Facial Expressions in Virtual Humans*** ☐
Stefano Calzolari, Francesco Strada and Andrea Bottino (Politecnico di Torino, Italy)

In interactive computer graphics, FACS coding has been adapted to enhance the emotional expressiveness of VHs by associating certain AUs with corresponding facial blendshapes. In this way, animators can (theoretically) recreate any human emotion on a VH's face with precision and flexibility. However, conveying realistic and believable emotional expressions with this approach comes with some challenges. In particular, given a set of AUs representing a particular emotion, it is not straightforward to define the correct set of blendshape weights that can render the same realistic and believable emotion on all VHs, as even small differences in weight values can drastically change the perceived emotion. This complexity raises several critical questions for researchers and practitioners, such as: is there for each emotion a universal set of blendshape weights that can effectively convey that emotion across all VHs? How can this set be found? If such a universal set proves elusive, can optimal combinations be identified for specific subgroups based on specific facial features such as men and women? Answering these questions is critical to understanding the general applicability of FACS-based facial emotion coding, which allows designers and animators to easily develop VHs that are able to interact with users in a way that is both emotionally rich and authentic. This paper explores these issues through a preliminary investigation aimed at defining effective combinations for the realistic representation of happiness.

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16:45 ***Synthesising Emotional Expressions Based on Dynamic Environmental Transitions*** ☐
Hasindu Iduranga Ramanayake (Informatics Institute of Technology, Sri Lanka); Iresh Bandara (University of Oulu / UBICOMP, Finland)

This study aims to introduce a novel approach to synthesise emotional expressions on virtual characters' locomotion systems while adapting to the dynamic environmental changes in real-time. Emotions, a universal language, influence human motions to drive instantaneous for all time scales of reality. Over the past few years, emotional adaptation has ascended in the entertainment industry due to the unbelievable advancements in the realism of virtual characters and worlds. Replicating real-world properties leads to fascinating initiatives that attempt to give these virtual creations the ability to mimic, express, and evoke emotions in users. Despite recent studies on motion synthesis, there is still an elusive connection between virtual characters and environments to explore as much as the fidelity needs to grow in both digital and virtual worlds. In contrast, we propose a novel deep learning architecture that intends to perform multiple modalities and tasks with a single network simultaneously. The essential data were gathered through empirical analysis and an automated synthetic data generation mechanism in the utilised game engine. The final emotionally expressive locomotion system was evaluated through an observational study by considering appropriate criteria for motion synthesis. The conventional metrics were used to evaluate the performance of the proposed neural network, which achieved the desired performance and accuracy. Eventually, future approaches have been advocated in the context of multi-agent interactions to push the prevailing realism into the next generation. It has been concluded that research aims were fulfilled within a challenging process, producing promising results for future applications in this research domain.

Presenter bio: Undergraduate at Informatics Institute of Technology

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17:00 ***Semi-Automated Digital Human Production for Enhanced Media Broadcasting*** ☐ ☐
Miriana Martini and Valeria Valentini (Politecnico di Torino, Italy); Alberto Ciprian (RAI, Italy); Andrea Bottino (Politecnico di Torino, Italy); Roberto Iacoviello (Rai - Radiotelevisione Italiana, Italy); Maurizio Montagnuolo (RAI - Centre for Research and Technological Innovation, Italy); Alberto Messina (Radiotelevisiona Italiana (RAI), Italy); Francesco Strada (Politecnico di Torino, Italy); Davide Zappia (RAI, Italy)

In recent years, the application of synthetic humans in various fields has attracted considerable attention, leading to extensive exploration of their integration into the Metaverse and virtual production environments. This work presents a semi-automated approach that aims to find a fair trade-off between high-quality outputs and efficient production times. The project focuses on the Rai photo and video archives to find images of target characters for texturing and 3D reconstruction with the goal to revive Rai's 2D footage and enhance the media experience. A key aspect of this study is to minimize the human intervention, ensuring an efficient, flexible, and scalable creation process. In this work, the improvements have been distributed among different stages of the digital human creation process, starting with the generation of 3D head meshes from 2D images of the reference character and then moving on to the generation, using a Diffusion model, of suitable images for texture development. These assets are then integrated into the Unreal Engine, where a custom widget facilitates posing, rendering, and texturing of Synthetic Humans models. Finally, a thorough quantitative comparison was made between the characters' original images and the rendered Synthetic Humans to ensure an objective assessment of their similarity. In addition, subjective tests were performed to validate the chosen objective metric.

Presenter bio: Roberto Iacoviello is a Lead Research Engineer, graduated from the Politecnico di Torino. Since 2007 he has been working at the Rai R&D where he has developed the following skills: End to end video compression for broadcast, Computer Vision Algorithms, Augmented and Virtual Reality, Multimodal interfaces for TV, Smartphones and Head Mounted Display. His current research focuses on Artificial Intelligence (AI) applied to video compression and point clouds, next-generation TV Services, in particular Augmented Reality in broadcast television. He leads the Video Evaluation Group at European Broadcasting Union (EBU) and actively participates in MPEG (Moving Picture Experts Group) and MPAI (Moving Picture, Audio and Data Coding by Artificial Intelligence) meetings. He has established collaborations with national and international research institutions, in research projects and tutorship for students and he counts several publications in international journals and conferences.

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17:15 ***IMMERSE: IMMersive Environment for Representing Self-Avatar Easily*** ☐ ☐
Eros Viola, Matteo Martini, Fabio Solari and Manuela Chessa (University of Genoa, Italy)

Recently, the importance of having a representation of the users inside Virtual Reality (VR) by using avatars, which replicate the movements of real humans, has grown in several fields of application. Nowadays, developers can use many off-the-shelf devices for visualizations and tracking. Game engines like Unity 3D and Unreal allow to easily integrate packages to manage head-mounted displays and other tracking devices. However, it is still difficult to combine different solutions and achieve a full representation of the human body, e.g., combining full-body and hand tracking or switching among different tracking modalities in an easy way. This paper describes IMMERSE, an open-source framework based on Unity, the XR Interaction toolkit, and an inverse kinematics solver. IMMERSE allows developers to insert a VR avatar in a virtual environment, animate it through different sources of 6DOF tracking measurements, which are also interchangeable during the simulation, and finally record the movements to animate other avatars or input to motion analysis techniques.

Presenter bio: Matteo Martini is a first-year Ph.D. student in Computer Science at the University of Genoa. He completed his Bachelor's and Master's degrees in Computer Science in 2020 and 2023, respectively, both at the University of Genoa. Currently, he is working at the Perception and Interaction Laboratory (PILab) within the Department of Informatics, Bioengineering, Robotics, and Systems Engineering (DIBRIS). His current research interests include Virtual and Mixed Reality, with a focus on physical and cognitive rehabilitation through immersive and non-immersive solutions, as well as natural manipulation in mixed reality environments.

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17:30 ***Towards Reducing Latency Using Beam Search in an Interactive Conversational Speech Agent*** ☐
Nikolas Ott (RheinMain University of Applied Scioences, Germany); Robin Horst (RheinMain University of Applied Sciences, Germany); Ralf Dörner (Hochschule Rheinmain - University of Applied Sciences, Germany)

The rapid advancement of generative artificial intelligence (AI) has led to groundbreaking developments in large language models. As large language models generate textual sequences autoregressively, mitigating latency becomes imperative for providing a highly immersive interaction experience within a real-time conversation, for example, providing fast and accurate responses to users' questions. Current efforts focus on accelerating inference processes, yet often at the expense of model architecture alterations, leading to compromised quality. In this paper, we explore latency reduction in the case of speech-based conversational agents. We leverage mathematical functions based on Beam Search to analyze autoregressive textual sequences, enabling a nuanced evaluation of semantic quality during auditory interaction, for example, for use within interactive web podcasts. We implemented our concepts and used the software to evaluate the concepts within (1) an automated evaluation of 1000 question-answer pairs and (2) a user survey. The results show that the semantic quality of autoregressive textual sequences could be assessed successfully by our proposed mathematical terms.

Presenter bio: Dr. Robin Horst is a senior researcher at the RheinMain University of Applied Sciences and the Fraunhofer Institute for Computer Graphics Research

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17:45 ***Structural and Functional Fidelity of Virtual Humans in Immersive Virtual Learning Environments*** ☐
Thomas Gaudi, Bill Kapralos and Alvaro Uribe-Quevedo (Ontario Tech University, Canada)

Central to many immersive virtual learning environments (iVLEs) are virtual humans, or characters that are digital representations, which can serve as virtual instructors to facilitate learning. Current technology is allowing the production of photo-realistic (high fidelity/highly realistic) avatars, whether using traditional approaches relying on 3D modeling, or modern tools leveraging generative AI and virtual character creation tools. However, fidelity (i.e., level of realism) is complex as it can be analyzed from various points of view referring to its structure, function, interactivity, and behavior among others. Given its relevance, fidelity can influence various aspects of iVLEs including engagement and ultimately learning outcomes. In this work-in-progress paper, we propose a study that will examine the effect of structural and functional fidelity of a virtual human assistant on engagement within a virtual simulation designed to teach the cognitive aspects (e.g., the steps of a procedure) of the heart auscultation procedure.

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Wednesday, June 5 18:05 - 18:45 (Europe/Rome)

null-1: Nothing (Buffer Time) ☒

Wednesday, June 5 18:45 - 20:30 (Europe/Rome)

SC1: Social Activity (Exclusive Guided Visit to Royal Palace) ☒
No late participants will be allowed after 7:00p.m.

Wednesday, June 5 20:30 - 22:30 (Europe/Rome)

SC12: Dinner alltogheter (Extra Activity - Off Program) ☒
After the Royal Palace visit for those of you that may be interested in having dinner alltogheter will move to the "Mercato Centrale" (10 minutes walking distance from the Royal Palace). Mercato Centrale is a food court and lively gathering space hosted in a Liberty style location which offers plenty of different restaurants and fine wines tasting opportunities. Meal and drinks purchases not included in the conference registration.

Thursday, June 6

Thursday, June 6 8:00 - 10:00 (Europe/Rome)

REG2: Registration (8:00am-4:00pm) ☒
Room: Registration & Info Point (Energy Center - Entrance)

Thursday, June 6 8:15 - 10:00 (Europe/Rome)

S3-4T: Human-Machine Interaction & Haptics (1/2) ☒
Room: Classroom 4T
Chair: Lorenzo Valente (Politecnico di Torino, Italy)

8:15 ***Investigating Gaze-Directed Instantaneous Destination for VR Locomotion: Efficiency, Precision, and User Comfort*** ☐
Hsuan-Min Wang (National Yang Ming Chiao Tung University & Asia University, Taiwan); Hsuan Jen and Chuen-Tsai Sun (National Yang Ming Chiao Tung University, Taiwan)

In the realm of Virtual Reality (VR), the exploration of players' modes of free movement has persistently been a pivotal research focus. This study introduces a novel locomotion approach, specifically employing gaze-directed instantaneous destination selection, aiming to enhance the current methods of movement in VR games and elevate the overall user experience. Through the creation of corresponding game scenarios, we assess the instantaneous movement performance in terms of efficiency, precision, and comfort for both gaze-directed and controller-directed destination selection. Statistical analyses reveal that, in terms of efficiency, gaze-directed instantaneous destination selection outperforms controller-directed movement. However, in the evaluation of comfort, controller-directed movement surpasses gaze-directed instantaneous destination. The findings of this research not only present a viable alternative in movement methodology but also underscore the necessity of striking a balance between efficiency and comfort in VR game design to deliver an enhanced gaming experience.

Presenter bio: Hsuan-Min Wang received the B.S. degrees in computer science from the Chung Hua University, Hsinchu, Taiwan, in 2007 and the M.S. degree of Information Technology from Queensland University of Technology, Brisbane, Australia, in 2011. He is currently working toward the Ph.D. degree in computer science at the National Yang Ming Chiao Tung University. His main research interests are game AI, player modeling, game design and learning in games.

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8:30 ***Redirected Walking Within a VR Exergame for Return-To-Sports Screening*** ☐
To Cornelis (Ghent University, Belgium); Hannes Mareen (Ghent University - Imec & IDLab, Belgium); Robbe Capelleman, Joke Schuermans and Evi Wezenbeek (Ghent University, Belgium); Peter Lambert (Ghent University - imec & IDLab, Belgium); Glenn Van Wallendael (Ghent University - Imec, Belgium)

Sports rehabilitation exercises and return-to-sports screening are typically conducted in confined spaces that lack the highly motivating environments found in stadiums filled with people. Virtual Reality (VR) can be employed to virtually recreate those settings. A challenge in VR sports is that running exercises with six degrees of freedom can pose a risk due to potential collisions with obstacles. Redirected walking addresses this issue by utilizing techniques that adjust the user's virtual motion in relation to their physical motion. This study evaluates the established positive perceptual bounds of redirected walking and extends its application to a reaction-based exercise. In this proposed use case, the user must chase the ball from one point to another in the room. Our findings indicate that rotational manipulations impact user experience at +44% rotation, which is stricter than the established +49% rotation bound. For translational manipulations, our research shows that the established +26% translational bound can be extended to +41% without a significant difference in self-reported subjective experience. This study demonstrates that redirected walking manipulations do not lead to significant changes in participants' total reaction times. In conclusion, the findings of this study illustrate that redirected walking techniques, with careful consideration of the bounds on rotational and translational manipulations, can be effectively applied in a Virtual Reality exergame designed for return-to-sports screening. This offers a more engaging alternative to traditional rehabilitation environments.

Presenter bio: Hannes is a Postdoctoral Researcher at IDLab-MEDIA. Ghent University - imec Belgium. He obtained the M.Sc. degree and PhD Degree in Computer Science Engineering from Ghent University - imec, Belgium, in 2017 and 2021, respectively. His research interests cover multimedia compression, security, and forensics.

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8:45 ***The Development of a Data Glove-Based System for Assisting the Solution of Puzzles*** ☐ ☐
Kazuma Sato and Lei Jing (University of Aizu, Japan)

Over the past years, it has become possible to reconstruct real-world activity in the XR environment due to advanced wearable devices. In this paper, we aim to develop a human-interactive operation assistant system utilizing pressure distribution data gloves by employing 1DCNN. 1DCNN model showed 98.83% accuracy. A human-interactive operation assistant system proves that 1.52 times faster average solving time than without this system and improves the number of mistakes while doing the task. This study can help us develop more advanced tactile sensor data glove applications.

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9:00 ***Development of a Flexible and User-Friendly UI to Visualize the Invisible Pressure Distribution*** ☐
Keigo Minakawa, Kazuma Sato and Lei Jing (University of Aizu, Japan)

In this study, we propose a method to facilitate the observation and analysis of pressure data. In modern times, research utilizing pressure is advancing in various fields. However, the aspect of visualizing invisible pressure is often overlooked and not well-developed. Therefore, we have developed a pressure distribution visualization system that allows users to easily acquire and analyze pressure data transmitted from pressure sensors through a user interface (UI). The application is not limited to just one type of pressure sensor device with specific specifications. it needs to meet various requirements. The system is developed as a mobile application for mobile devices, capable of displaying pressure in both grid and hand-shaped modes. Furthermore, its versatility allows it to accommodate various requirements of pressure sensors. In the usability evaluation experiment conducted on the application developed in this study, an impressive score of 83.5 was achieved, indicating a high level of usability

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9:15 ***Exploring the Effects of Foveated Rendering on Virtual Reality Game Graphics*** ☐
Klara Andersson, Erik Landén and Prashant Goswami (Blekinge Institute of Technology, Sweden)

This study explores foveated rendering for its quality impact on players in virtual reality (VR) video game settings. Foveated rendering has the potential to decrease the performance cost by only rendering the part of the scene where the user is looking at a higher resolution, which it achieves with the use of an eye tracker. A user study is conducted to test the perceived visual quality by playing a fast-paced shooter game that requires many eye and head movements using a head-mounted display (HMD). The game is played with three different types of foveation: no foveation, static, and dynamic foveated rendering. Results show that the majority of participants did not notice a difference in the visual quality between the foveated and non-foveated game versions.

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9:30 ***Testing AREduX with HCPs and Caregivers of People Living with Dementia: A Work in Progress***
Gabrielle Hollaender (Ontario Tech University, Canada); Naida Graham (York University, Canada); Claire M. Culver (Ontario Tech University, Canada); Eva Hava Peisachovich (York University, Canada); Bill Kapralos (Ontario Tech University, Canada); Elizabeth Sombilon (York University, Canada); Adam Dubrowski (Ontario Tech University, Canada)

Given the lack of empathy training programs for healthcare providers (HCPs), our ongoing research is examining empathy and its role in caring for PLWD and as part of this research effort, recently introduced the Augmented Reality Education Experience (AREduX) virtual simulation prototype AREduX utilizes augmented reality to simulate the physical and cognitive symptoms of dementia, aiming to enhance empathy among HCPs and caregivers. Our ongoing research involves five phases and this paper outlines the outcome of Phase 3: usability testing of the AREduX prototype with end users, including HCPs and caregivers of PLWD, to examine the functionality, clarity of content, ease of use, and user interface. We anticipate that AREduX will contribute significantly to the scientific understanding of empathy development, address knowledge gaps, and offer recommendations for implementing AR in experiential education for HCPs and PLWD caregivers.

Thursday, June 6 8:15 - 10:00 (Europe/Rome)

S3-EC: SS01: Games for Health ☒
Room: Energy Center - Auditorium
Chair: Giacinto Barresi (University of the West of England, Italy)

8:15 ***Exploring the Potential of Mixed Reality for Functional Assessment in Multiple Sclerosis*** ☐
Anna Bucchieri and Andrea Lucaroni (Istituto Italiano di Tecnologia, Italy); Miriam Moschetta, Lorenzo Ricci and Etty Sabatino (Politecnico di Torino, Italy); Erica Grange (FISM, Italy); Andrea Tacchino and Jessica Podda (Italian Multiple Sclerosis Foundation, Italy); Elena De Momi (Politecnico di Milano, Italy); Carlo Ferraresi (Politecnico di Torino, Italy); Matteo Laffranchi and Lorenzo De Michieli (Istituto Italiano di Tecnologia, Italy); Giampaolo Brichetto (Italian Multiple Sclerosis Foundation, Italy); Giacinto Barresi (University of the West of England, Italy)

The functional recovery of upper limbs (UL) in motor and motor-cognitive tasks is a top priority in rehabilitation procedures for people with Multiple Sclerosis (PwMS). In this domain, virtual and augmented settings have proven to show promising effects on clinical compliance in executing motor tasks. However, there is clearly room for improvements in order to accomplish diagnostic activities through the same interactive environments. The present study explores the potentials of Microsoft HoloLens2 as a portable and cost-effective device for UL assessment of PwMS. Two novel mixed-reality applications are presented for the augmentation and evaluation of a pick-and-place task performed in the Sagittal plane (PICKapp) and in the Transversal plane (ROCKapp). The two exergames share the occurrence of physical object interactions that trigger digital events. ROCKapp and PICKapp were tested on two PwMS with the aim to explore the feasibility of HoloLens2 for consistent hand-tracking and eye-tracking recording during functional tasks. By discussing the advantages and the limitations of the proposed Mixed Reality (MR) setups, this preliminary study contributes to the debate on the effective integration on interactive settings into therapeutic exercises for PwMS with motor deficits.

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8:30 ***Responsive Teleoperation of a Robotic Arm via Wearable Inertial Sensors*** ☐
Alessandro Fornaro and Daniela D'Auria (University of Milan-Bicocca, Italy); Hamza Amrani (University of Milano-Bicocca, Italy); Paolo Napoletano (University of Milan Bicocca, Italy)

Human-in-the-loop teleoperation stands as a primary method for controlling robotic arms, offering significant practical and research applications across various fields such as industry, medicine, and home automation. In this paper, we propose a responsive system for the remote control of a robotic arm utilizing wearable inertial sensors. The system relies on three inertial units connected to low-cost wireless microcontrollers, which are placed on the user's arm. A server-side application, built on Robotic Operating System (ROS), orchestrates the interaction between these units and the robotic arm. The robotic arm's functionality is demonstrated within a simulated environment using Gazebo. To prove the efficacy of our proposed system, we conducted an experiment involving 16 users and evaluated their interaction using both objective measures (such as manipulation task execution time) and subjective metrics (including user satisfaction). Our experimentation reveals that users can teleoperate with longer times compared to real manipulation scenarios initially, but are able to gradually reduce these times as their experience increases. Furthermore, the majority of users rated the interaction as realistic, responsive, and usable.

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8:45 ***MetaRehab: Enhancing Parkinson's Disease Rehabilitation Through Gamified Virtual Reality, a Usability Study***
Fabrizio Sulpizio, Leonardo Giannantoni, Francesco Strada and Andrea Bottino (Politecnico di Torino, Italy)

Motor impairment and cognitive decline are the most relevant symptoms of Parkinson's disease (PD), a neurodegenerative syndrome that is usually treated with pharmacological and rehabilitation therapy. However, traditional physical and cognitive rehabilitation approaches require frequent visits to specialized centers and often lack engagement, leading to demotivation and non-compliance. The increasing prevalence of neurodegenerative syndromes highlights the need for innovative, more sustainable and entertaining rehabilitation strategies. This study explores the potential of immersive Virtual Reality (VR) in physical and cognitive at-home rehabilitation. By incorporating gamification elements, our approach aims to increase patient motivation and engagement, which are crucial for successful rehabilitation outcomes. The use of Natural User Interfaces in the application increases user engagement and the user experience by enabling intuitive interactions and thus promoting a sense of agency. In addition, the VR environment utilizes different communication channels to deliver instructions and feedback on activities, ensuring that the system is accessible to individuals with different needs and preferences. In this paper, we describe the experimental evaluation of the usability and perceived effort of MetaRehab, the proposed VR-based rehabilitation process, prior to its application in a therapeutic context. These preliminary results provide a solid foundation for future enhancements aimed at adding new features and further increasing system inclusivity and engagement.

9:00 ***Associations Between Perceived Discomfort, Postural Control Alterations and Disability in People with Multiple Sclerosis Exposed to Immersive Virtual Reality*** ☐
Massimiliano Pau (Università Degli Studi di Cagliari, Italy); Federico Arippa, Micaela Porta, Giulia Casu, Bruno Leban and Eleonora Cocco (University of Cagliari, Italy)

The current availability of low-cost immersive Virtual Reality (VR) systems, opens interesting perspectives for neurorehabilitation of people with Multiple Sclerosis (pwMS). However, it is known that immersive VR can trigger the onset of unpleasant effects such as dizziness, headache, nausea, disorientation and balance alterations. Since MS is associated with similar symptoms, it appears important to clarify the role of disability in exacerbating such possible negative effects. To this aim, we combined instrumental data on postural sway (using Center of Pressure COP data) and perceived discomfort in 56 pwMS and 33 unaffected individuals before and after a 10-minute session of immersive VR consisting in a simulated rollercoaster. The results indicate the presence of temporary impairments of postural control in terms of significantly increased sway area in presence of visual input. Interestingly, when the visual input was removed, a reduction of sway area and COP path length in pwMS with mild-moderate disability and unaffected individuals was observed, thus suggesting the existence of a sort of "balance training" effect. All participants complain about blurred vision and nausea after the VR session. In pwMS, changes in most postural sway parameters originated by the VR session were found moderately correlated with changes in SSQ symptoms scores, particularly those of the disorientation domain. Such findings seem to indicate that a short immersive VR session originates contrasting effects on postural control of pwMS, according to their disability level and to the presence of the visual sensory input. At the same time, participants relevant negative symptoms especially in the disorientation domain. Although immersive VR can be generally considered safe and tolerable, the use in pwMS requires the definition of specific guidelines on aspects like exposure time, posture to assume during use and assessment of possible adverse effects to guarantee efficacy of the treatment, safety and comfort.

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9:15 ***To Stand or to Sit? Examining the Influence of Player Posture on Balance Alterations Associated to Immersive Virtual Reality Exposure*** ☐
Federico Arippa, Micaela Porta, Giulia Casu and Bruno Leban (University of Cagliari, Italy); Massimiliano Pau (Università Degli Studi di Cagliari, Italy)

Due to reduced cost and improved performance, immersive Virtual Reality (VR) is spreading in different fields such as education, industry, and rehabilitation. However, while considered promising for improving health and well-being, there is evidence regarding the possibility to originate adverse effects in terms of motion sickness symptoms, which can be objectively assessed by means of balance alterations. Among other factors that influence this phenomenon (i.e., exposure time, optical flow, hardware type, etc.) player's posture is particularly important especially in the case of immersive VR administration for training or rehabilitation purposes in special populations. However, empirical data on how user's posture is associated to cybersickness during immersive VR experiences are limited. To this aim, we investigated the impact of seated and standing postures on postural control, measured by postural sway, in response to immersive VR. Seventy-six healthy participants underwent pre- and post-VR assessments following a 10-minute simulated rollercoaster experience. Results revealed that postural control is differently affected by standing or sitting position only when sway analysis is performed in absence of visual cues. Both sway area and COP path length significantly decreased for the sitting group, while no changes were observed for the standing position. These differences highlight the primary role of visual input in postural performance and elucidates distinct effects of VR player's posture on the postural control system. Standing during VR exposure posed challenges to balance maintenance due to conflicting sensory inputs, leading to temporary and slight increases in postural sway. Conversely, seated posture was characterized by decreased engagement of lower limbs, facilitating enhanced postural stability post-VR session, possibly due to VR training effect. Our study emphasizes the importance of considering user's posture in VR interventions, suggesting for customized approaches in therapeutic and training settings. Clinicians should carefully consider patients' postures during VR interventions to improve outcomes and safety.

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9:30 ***Adaptive Training in Virtual Reality Through Dynamic Alien Motion Support*** ☐
Vittorio Fiscale (University of Torino, Italy); Tetsunari Inamura (Tamagawa University, Japan); Agata Marta Soccini (University of Torino, Italy)

Serious games in virtual reality showed promising results when applied to medical therapy, both improving the motivation of the patients, and the outcomes of the training processes. This technology allows operators to have full control over the virtual environment, as well as over the virtual bodies of the users. An alien motion, i.e. an alteration of the simulation response to the actions of the users, can be introduced to provide them with false feedback about their performance without them being aware of it. These modifications can be adjusted to support them during the training by making them believe they are performing better than they are in the physical world. The goal of this project is to investigate in which extent the support influences the outcomes of a virtual training. In this work, we present a ball throwing virtual scenario in which users are assisted through aim motion. Our findings show that dynamically supporting people can have a positive impact on the outcomes.

9:45 Rehabilitative Exergaming in Multiple Sclerosis: Binaural Tasks in Mixed Reality
Mirjam Tanda and Filippo Gabriele Pratticò (Politecnico di Torino, Italy); Jessica Podda (Italian Multiple Sclerosis Foundation, Italy); Erica Grange (FISM, Italy); Giampaolo Brichetto (Italian Multiple Sclerosis Foundation, Italy); Lorenzo De Michieli (Istituto Italiano di Tecnologia, Italy); Fabrizio Lamberti (Politecnico di Torino, Italy); Giacinto Barresi (University of the West of England, Italy)
Exergames - i.e. games devised to promote exercising, to engage people in physical activities - demonstrated their potential in rehabilitation, especially for facing the challenges due to motor dysfunctions and cognitive impairments that significantly impact activities of daily living (ADLs). Through their gameful experience, exergames can help practicing rehabilitative exercises effectively managing symptoms and improving the individual autonomy and well-being. Accordingly, this paper presents an investigation of the potential of Mixed Reality (MR, when digital objects behave like physical ones in a real setting) in exercises for upper limbs. Such exercises were implemented into an exergame designed according to the rehabilitative needs of people with Multiple Sclerosis (MS), an inflammatory demyelinating disease of the central nervous system. The developed exergame requires the user to handle real objects that interact with virtual elements in MR. These physical objects are intended to be grasped by the subjects and manipulated in accordance with the game rules. In each game session, the goal is to manipulate the physical objects while keeping in balance a virtual object placed on top of it. The game focuses on repetitive movements towards specific target positions and provides two conditions, one involving the use of a single arm and the other requiring coordination of both arms. The final goal of proposing these two conditions is to assess the feasibility and potential of introducing binaural tasks (often requested to perform ADLs in daily life) in rehabilitation. The system has been preliminarily tested by people without MS in order to gather data for evaluating user experience. Current results show that binaural tasks are feasible in this MR setting, suggesting further improvements for extensive clinical tests.

Presenter bio: PhD in Robotics, Cognition and Interaction Technologies; MSc in Experimental Psychology and Cognitive Neuroscience. Professor at the Bristol Robotics Laboratory, University of the West of England, Bristol, UK.

Thursday, June 6 10:00 - 10:25 (Europe/Rome)

CF3: Coffee Break
Room: Energy Center - Hall & Foyer

Thursday, June 6 10:25 - 11:10 (Europe/Rome)

KN2: Keynote (M. L. Alcañiz Raya)
Mariano Luis Alcañiz Raya
Room: Energy Center - Auditorium
Chair: Chih-Peng Fan (National Chung Hsing University, Taiwan)

Thursday, June 6 11:10 - 11:20 (Europe/Rome)

AO: IEEE CTSoc Announcements
Room: Energy Center - Auditorium
Chair: Chih-Peng Fan (National Chung Hsing University, Taiwan)

Thursday, June 6 11:20 - 12:50 (Europe/Rome)

S4-ET: SSO3: Next-Gen Networked XR (NGNXR) | Advancing Multiplayer and Co-Located Gaming Experiences
Room: Classroom 4T
Chair: Xi Guo (Birmingham City University, United Kingdom (Great Britain))

11:20 DraftComPromise - an Draft Companion Recommendations in League of Legends
Robin Horst and Ferdinand Meyer (RheinMain University of Applied Sciences, Germany); Ralf Dörner (Hochschule RheinMain - University of Applied Sciences, Germany)
Multi-player online battle arena games constitute a highly popular category of online multiplayer strategy games. In League of Legends, a game with one of the most active player communities globally, ten players are divided into two teams, each selecting a unique champion-character after another during the so-called draft phase. With over 150 champions in the game to choose from and each possessing distinct synergies and abilities, choosing suitable champions for the respective team m changing draft situations can be challenging for players. In this paper, we explore how draft recommendation tools work and investigate a draft's key factors by means of statistical analysis of a potential champion's impact on the match. Based on the analyzed factors, we propose concepts for a draft recommendation. We implemented our concepts as a real-time recommendation software - DraftComPromise. We utilized DraftComPromise to evaluate our concepts by means of a comparative study using recommendations generated by our tool and comparing them to those generated by existing draft tools. The results of our study revealed that the established draft tools for LoL and also DraftComPromise were close together in terms of both statistical analysis re gions regarding the win rate but also the choice of champions that were recommended. DraftComPromise performed better than three and worse than one of the established tools within our study, however, the margin of error values indicate that none of the tools was able to recommend champions for a composition that will statistically win over 50% of the time.

Presenter bio: Dr. Robin Horst is a senior researcher at the RheinMain University of Applied Sciences and the Fraunhofer Institute for Computer Graphics Research

11:35 A Framework to Design Virtual Reality Mirror Therapy (VRMT) for Motor Rehabilitation in Post-Stroke Survivors: Dosage, Motivation, Task Difficulty, Feedback and Mechanism
Jiacheng Xiong, Biao Zeng and Wei Huang (University of South Wales, United Kingdom (Great Britain)); Mohammad Ali Roula (Co-Author, United Kingdom (Great Britain)); Liucheng Guo (Tango0 Ltd, United Kingdom (Great Britain) & Guangzhou University of Physical Education and Sports, China)
The primary goal of mirror therapy is to alleviate symptoms and improve motor function and perception. It involves the use of a mirror to create a visual illusion that the affected limb is moving in a regular and pain-free manner. Mirror therapy is often used in conjunction with traditional physical and occupational therapy methods. It has been studied for post-stroke rehabilitation. With the rise of virtual reality technology to enhance mirror therapy effectiveness can vary among individuals. Virtual reality mirror therapy (VRMT) is an advanced application of mirror therapy that utilizes virtual reality technology to enhance rehabilitation. While traditional mirror therapy uses a physical mirror to create the illusion of movement in the affected limb, VR mirror therapy takes advantage of immersive digital environments to provide a more engaging and customizable experience. This approach is particularly beneficial for stroke rehabilitation. The paper summarises four key factors in design. These factors include dosage, motivation, task difficulty and sensory feedback. In addition, it indicates the role of mirror neurons in both traditional mirror therapy and VRMT and highlights three areas in future VRMT studies.

11:50 Translating Cognitive Behavioural Therapy Strategies Through VR Interactions to Tackle Anxiety Symptoms in University Students
Swapnali Kulkarni (United Kingdom (Great Britain)); Kurtis Weir (Birmingham City University, United Kingdom (Great Britain))
Rising anxiety amongst university students not only adversely affects their academic performance but contributes towards a troubling decline in overall mental well-being. Existing psychotherapy such as Cognitive Behavioural Therapy (CBT) can work towards improving this, yet many barriers prevent CBT from being accessed, particularly from a student perspective. Our research proposes a modern solution utilising a Virtual Reality (VR) to help deliver digital CBT strategies, investigating their psychiatrists. Participants found that gamified VR interactions contributed towards greater visualisations of core CBT principles as well as improved engagement, but 3D environments and elements such as avatars must be believable to maintain a sense of realism. Feedback showed a keen interest towards the development of such applications, prompting further investigation.

12:05 A Case Study of Using Web 3D Game Technology for a Scalable Midwifery Training Simulation
Xi Guo (Birmingham City University, United Kingdom (Great Britain)); Alison Edwards (Visiting Lecturer Birmingham City University, United Kingdom (Great Britain))
Digital simulation offers numerous advantages for midwifery training and particularly enhancing decision-making skills. By providing realistic, risk-free learning experiences, fostering repetition and feedback, and offering a variety of scenarios, digital simulation stands out as an effective tool for preparing midwifery learners for the complexities of clinical practice. However, creating a 3D-based simulation system that supports scalable solutions poses challenges. Apart from the cost of 3D content, it is still a problem. This paper discusses a design and implementing case study of such a system using gamification methodologies, with a focus on scalability and flexible delivery. The system uses web-based digital media, including web 3D game technology, for educational simulation. It showcases how web game technology facilitates simulation design and concludes with future considerations.

12:20 User-Intent Aware Transport-Layer Intelligence for Frame Synchronisation in Multi-Party XR Application
Vu San Ha Huynh (University of Sydney, United Kingdom (Great Britain)); Peng Qian (University of Oxford, United Kingdom (Great Britain)); Ning Wang (University of Bristol, United Kingdom (Great Britain)); Carl Udora and Rahim Tafazolli (University of Surrey, United Kingdom (Great Britain))
Emerging immersive media applications demand tailored performance to accommodate diverse user intents, particularly in scenarios with multiple users with different intents and requiring frame synchronization. This paper introduces a novel transport-layer intelligence scheme that leverages a user intent-aware API. This API enables the application layer to communicate specific user intents and requirements to the transport layer, optimizing immersive application performance. Using deep reinforcement learning, our solution automatically selects the optimal transport protocol and configuration for each user intent across various immersive scenarios. Our evaluation focuses on a live volumetric content under different network conditions. Results demonstrate that our scheme accurately identifies suitable transport protocols and tailored configurations for a wide range of user intents, ensuring multi-user frame synchronization.

12:35 Decentralization of Gaming Server with P2P Service for the MMO
Minseok Doo (Maryland Institute College of Art, USA)
This study explores the role of ownership and socialization in MMO game playability. It discusses e-loyalty strategies like reducing operation fees and credible MMO operations. Allegations of probability manipulation in a 2016 event damaged trust in game operations. NFTs and blockchain can enhance trust and digital ownership. The paper proposes a method to decentralize game servers using blockchain and P2P systems, detailing various technical aspects. Practical experiments are needed before implementation. This innovative approach has potential applications beyond gaming, requiring thorough evaluation of stability, latency, data consistency, and security.

Presenter bio: Minseok Doo is currently pursuing a BFA in Interactive Art at the Maryland Institute College of Art. He previously studied at the Ringling College of Art and Design and was majoring in Game Art for his BFA, but withdrew in the spring of 2023.

Thursday, June 6 11:20 - 12:50 (Europe/Rome)

S4-EC: Human-Machine Interaction & Haptics (2/2)
Room: Energy Center - Auditorium
Chair: Andrea Bottino (Politecnico di Torino, Italy)

11:20 Comparison of Mouse, 6DoF Controller and Pen Interactions on a Glasses-Free 3D Display
Adriano Viegas Milani (Switzerland); Mario Gutierrez (Logitech, Switzerland); Ronan Boulic (EPFL, Switzerland); Mark McGill (University of Glasgow, United Kingdom (Great Britain)); Aidan Kehoe (Logitech, Ireland)
3D displays are becoming available to mainstream consumers, offering the ability to view and interact with 3D content. This study compared the performance of a range of different input devices for 3D object tasks on a 3D display. The first-time use performance of a mouse, a tracked 6DoF controller, and a pen on a graphics tablet (without display) are evaluated on a clicking task, a rotation task, and a tracking task... were evaluated in terms of speed, precision, and subjective... The main finding is that the three input modalities provide similar levels of precision, but for 3D sketching and docking, the 6DoF controller has significantly shorter execution times, fewer interactions, and is more enjoyable than other devices, at the cost of increased fatigue. For pointing and rotation, the mouse excelled, offering higher speed differences. Many participants reported the graphics tablet pen as being confusing or frustrating to use, frequently resulting in longer task times and more errors.

11:35 Gamification of Breath Training for Wind Players
Lucie F Jones, Jeffrey Boyd, Hua Shen, Jeremy Brown and Matthew McConnell (University of Calgary, Canada)
This paper presents the gamification of the Abdominal-Thoracic-Expansion-Measurement prototype wearable device (ATEMP) and the subsequent study. The ATEMP is a newly developed wearable device for musicians that measures breathing-induced abdominal and ribcage expansion and contraction in real time. Flute Hero video game was developed as a side-scroller game that uses the ATEMP as input, and provides real-time biofeedback. The Flute Hero video game study (pretest, post-test, control group study design), gathered metrics from 41 flutists and analyzed whether playing Flute Hero improves breath technique more than those who did not play. Participants performed the same breathing exercises in the pretest and post-test. Response to the game was positive, participants were eager to play the game and remained engaged throughout the duration of the study. Participants commented that they felt playing Flute Hero improved their breath technique and sound production. The metrics showed significant improvement in the breath period of the treatment group, but did not show significant improvement in abdominal or thoracic expansion. Further research with changes to the experimental methodology, including longer treatment run time, might strengthen their results.

Presenter bio: Dutch born flutist Lucie Jones (Baldwin) is a professional flutist residing in Canada. Lucie is an orchestral and chamber musician, an instructor and adjudicator, and is on faculty at the Mount Royal University Conservatory and is a sessional instructor at the University of Calgary. Ms. Jones received a Bachelor of Music Degree in Performance from the University of Toronto, a Master of Music Degree in Performance, and a Bachelor of Science degree in Computer Science from the University of Calgary where she is currently a PhD candidate in the Computational Media Design Program, with a MITC specialization.

11:50 Impact of Physical Wind Simulation on the Player
Zeynep Burcu Kaya Alpan (Istinye University, Turkey & Bahçeşehir University, Turkey); Muhammed Javed Ramzan (Istinye University, Istanbul, Turkey); Alperen Şahoğlu (Istanbul Technical University, Turkey); Şenol Pişkin (Istinye University, Turkey)
In this paper, we share the results of a study investigating the impact of physical, dynamic wind simulation on player's perceived realism. Previously, results showed increased measurements of perceived realism on a diverse set of items of the scale "Perceived Realism in Games" and prompted the investigation of the impact of the physical wind simulator. This study aims to fill that gap through implementing a simple mechanical wind simulator and testing it in the lab environment.

12:05 Bioelectrical Measurements of Lenses Affect During Esports Training Sessions: Could the Yellow Lenses Enhance Gaming Performance?
Marco Bracaglia (Università IULM, Italy); Giacomo Fietta (Università IULM, Italy); Margherita Zito and Alessandro Fici (Università IULM, Italy); Fiamma Rivetti and Mara Bellati (Behaviour and Brain Lab IULM, Italy); Sebastiano Accardi (Università IULM, Italy); Siegfried Wahl (University of Tübingen, Italy); Luca Piovesan (Politecnico di Milano, Italy); Vincenzo Russo (Università IULM, Italy)
The study of neurophysiological processes during esports training is an essential topic in the purposes of enhancing the performance. This study investigates... With the previous studies investigating the effects of colours in enhancing both the performance and the overall... of the gaming performance... group of 68 participants were asked to play three different conditions: wearing no lenses (NoL), wearing yellow lenses (YL) and... wearing neutral lenses (NeL) and electroencephalographic and heart rate measurements... the arousal, the emotional valence and the workload were assessed by means of bioelectrical signals. In YL condition, the attention level, however, was lower... in YL condition, we found the highest correlation between the valence and the gaming score, as well as the lowest (in absolute value) correlation between the workload and the score. The workload showed a significant increase from NeL to YL and from NoL to YL, but the attention level showed a significant increase between NoL and YL. No differences between the conditions were found for arousal and emotions. The results seem to support a slightly positive effect of the yellow lens in improving gaming performance, qualifying them as a potential personal ergonomic tool for use during tournaments.

Presenter bio: Sebastiano Accardi is a psychologist and a PhD student in Communication, Markets and Society at IULM University, Milan. His research focuses on the application of Neuromarketing methodology in the gaming and Esports industry. After conducting scientific research at the University of Oslo for six months, he obtained his Master's Degree in Applied Cognitive Psychology from the University of Turin, with a thesis on "Neuropsychoeconomics of Women's Marketing", addressing... In 2022, he held a Research Fellowship at IRF Milan Studi di Lucca during which he co-authored the paper "Digital Escape Games in Educational Programs for Financial Literacy" presented at the 16th European Conference on Games Based Learning. This paper focused on the use of digital escape games as a tool in financial educational programs, utilizing eye-tracking technology. Additionally, he collaborated with Intesa Sanpaolo writing the report titled "New Frontiers in Gaming" in 2022. In this report, he analyzed the utilization of Virtual Reality in...

12:20 Hands Up! Towards Machine Learning Based Virtual Reality Arm Generation
Daniel Martinek and Patrick David Pazour (University of Vienna, Austria); David Mirk (Rainbow GmbH, Austria); Helmut Hlavacs (University of Vienna, Austria)
In this research paper we present a novel machine learning based approach for generating personalized arms for virtual reality use cases. The approach is fully automatic and not bound to expensive or specialized hardware. To overcome the big amount of data necessary to train machine learning models a synthetic data generation scheme is employed. We then show how an image to image machine learning model can be trained via this training data to extract personalized arm textures from two photographs. Finally we analyse the resulting virtual arms by conducting an experiment to measure the embodiment of test subjects using these personalized arms in a virtual reality setting. This work represents a notable advancement in the integration of personalized avatars in virtual reality. Our findings serve as a foundation for future research aimed at refining and expanding the applicability of personalized virtual environments.

12:35 Comparison of XR Game Controller Trigger Input Versus Isometric Thumb and Index Finger Pressure Input on a Stylus
Adriano Viegas Milani (Switzerland); Mario Gutierrez (Logitech, Switzerland); Ronan Boulic (EPFL, Switzerland); Mark McGill (University of Glasgow, United Kingdom (Great Britain)); Aidan Kehoe (Logitech, Ireland)
Pressure-sensitive inputs are an important feature for many XR designs and creativity applications. This is typically accomplished using the trigger input on the default platform 6DoF controller. This paper reports the findings of a pilot user study that compares the performance of the default platform 6DoF controller trigger with an isometric force sensor integrated into the barrel of a prototype stylus device. The force sensor on the stylus is activated with either the thumb or the index finger. The result of the 12-person pilot study shows that mean throughput of the stylus index finger interactions is higher than the stylus thumb usage and default controller trigger usage; These differences were not statistically significant, showcasing that both stylus inputs have no major disadvantage compared to the standard that is the controller. Subjectively, stylus index finger pressure control was the preferred interaction technique for most participants.

Thursday, June 6 12:50 - 14:15 (Europe/Rome)

L2: Posters B & Lunch
Room: Energy Center - Hall & Foyer
Chair: Stefano Calzoni (Politecnico di Torino, Italy)

Designing Sapinautas: An Educational Innovation Strategy for Learning in Honduran Public Schools Through Video Game Integration
Jose Escobar (Universidad Tecnológica Centroamericana, Honduras); Sandra Solano (Universidad Tecnológica Centroamericana, Honduras); Kevin Mejía,Rivera (Universidad Tecnológica Centroamericana, Honduras)
Traditional teaching methods often struggle to effectively engage students, especially in educational environments with limited resources. Recognizing the potential of gamification to address this challenge, Sapinautas emerges as an educational project aimed at harnessing video games to enhance learning engagement through immersive and interactive gaming experiences. This article describes the conceptualization of the educational content and student... and design, and implementation process of the first phase of the Sapinautas platform. The project has been developed under the guidance of former promoters in collaboration with students and professors from Universidad Tecnológica Centroamericana (UNITEC) in Honduras. The development of the educational content and needs. This led to the conceptualization and design of the video game, with students collaborating with educators to create characters, environments, and gameplay mechanics aligned with the National Basic Curriculum. The implementation phase included work in the Unreal Engine, where students were involved with programming and game logic. At this stage, the capabilities of the engine were leveraged to create an interactive and high-quality immersive environment. Sapinautas represents a promising approach to improving education through gamification. In the future, conducting pilot tests of the game and collaborating with education stakeholders will be crucial to scale the project and realize its full potential as a transformative tool for education.

Climate Survivors: A Bullet Heaven for Enhanced Climate Engagement
Ian Steinhauser (International Institute for Applied Systems Analysis & Ternagami, Austria); Doris Vollgruber (Ternagami, Austria)
The climate crisis is easily one of the most pressing issues humanity has to tackle. It is a wicked problem that requires a wide range of interventions, both top-down and bottom-up, and thus wide knowledge, support, and willingness to change by civil society. Video games have been identified as one possible communication channel with the potential to support this transition. However, despite this assessment, the medium seems to be underutilized. Based on a database of climate games released until 2019, the prevalence of climate themes has been low to begin with, and its growth has not kept pace with the market in general. Mixed-method approach... In this paper presents a framework for effective climate communication through games, this paper presents a game concept to fill this gap and function as example for similar projects in the future.

Empowering Marketing Management and Gaming Consumer Interaction Through AI and Citizen Science
Celestine Iwendi (University of Bolton, United Kingdom (Great Britain)); Chaitri Subba Lakshmi (MiTIM, Oman); Bala Dhandayuthapani Veerasamy (University of Technology and Applied Sciences, Oman); Paul Hollins, Damilare Adedotun Adeyemi Hewage and Adedokun A Adeyemi (University of Bolton, United Kingdom (Great Britain)); Piyush Kumar Shukla (University Institute of Technology, India)
The corporate landscape has undergone a significant transformation with the integration of AI into marketing management and customer engagement. This research explores the revolutionary impact of artificial intelligence (AI) across various industries. It examines how AI enhances customer satisfaction, facilitates real-time interactions through collaborative filtering, neural networks, and sentiment analysis. Its approaches optimize pricing techniques. Integration of Natural Language Processing (NLP) ensures rapid comprehension of customer sentiments. Through comprehensive analysis of diverse success metrics, this approach emerges as a flexible, tailored, and adaptable solution that redefines digital marketing strategies while enhancing consumer satisfaction.

MemoryGame: Decentralized P2E Game for Visual Working Memory Training
Camille Strolle, Sean Durkin, Alexander Olsen, Maylen Casal, Markus Santoso and Marko Suvajdzic (University of Florida, USA)
Visual Working Memory (VWM) is the ability to maintain task-relevant visual information over a brief delay after direct visual input has been removed and it is essential for learning new skills, solving tasks and acquiring new knowledge. Therefore, research has begun to explore potential ways to improve VWM. In this paper, authors presented MemoryGame: a decentralized Play-to-Earn (P2E) games that aim to train VWM. One of the existing concerns of the average player's engagement and maintain the sustainable retention rate. With this approach, the player has opportunity to earn real-world assets that has financial incentive to play the game. In addition, the player can earn real-world assets are rewarded as experience to the player.

Use of Different Learning Mechanisms to Design a Serious Game for Alcohol Use Disorder
Flavien Ethel (Université du Québec à Chicoutimi, Canada); Yannick Francillette (Université du Québec à Chicoutimi, Canada); Bob-Antoine Jerry Menelas (University of Quebec at Chicoutimi, Canada)
This text outlines the design and theoretical underpinnings of a serious game aimed at treating Alcohol Use Disorder (AUD) through the application of various learning theories. The game itself is designed based on operant conditioning, cognitivism, and constructivism to help users understand the negative effects of alcohol use and change their drinking behaviors. The gameplay involves tasks like finding and balancing alcohol bottles in a virtual environment and simulating coping mechanisms for managing cravings. This approach aims to provide an engaging and educational experience that not only increases awareness of AUD but also equips players with practical skills applicable in real life, facilitating long-term behavioral change.

Privacy-Preserving 3D Gaussian Splatting
Usman Ali (Sejong University, Korea (South))
In recent years, there has been notable progress in rendering techniques within the gaming industry, aiming to enhance the visual realism and immersion of gaming experiences. Among these advancements, 3D Gaussian Splatting (3DGS) has emerged as a prominent method for efficiently visualizing volumetric data in real-time. 3DGS is a powerful technique for reconstructing detailed geometric information from multiple images captured from different camera viewpoints. However, this approach raises serious privacy concerns due to the possible exploitation of the facial pictures of people. Using user data for lifelike avatars raises concerns about unauthorized access and data misuse. This paper explores the application of 3DGS in gaming, examining its fundamental principles, advantages, limitations, potential impact on game physics, and privacy. By employing a secure of identity-obscuring images, the proposed approach successfully creates facial geometry, safeguarding the privacy of the players, and gaming opportunity to ultimately enhancing the overall gaming experience for players.

"Alice in Codeland": A Gamified Approach to Web Programming Education
Daniele Zolezzi (University of Genoa, Italy); Saverio Iacono (Università Degli Studi di Genova, Italy); Gianni Vercelli (University of Genoa - DIBRIS, Italy)
"Alice in Codeland" is a gamified course designed to introduce web programming through HTML, CSS, JavaScript, and PHP, incorporating game mechanics inspired by Haro Aso's "Alice in Borderland". The course structure leverages gamification principles, integrating elements such as a standard deck of French playing cards linked to programming exercises, team collaboration, and a dynamic scoring system to foster a competitive yet collaborative learning atmosphere. Each card represents a different level of challenge and is associated with a specific web programming language, enabling students to progressively build their skills based on the card's difficulty. The Mad Hatter character, inspired by Carroll's "Alice's Adventures in Wonderland", serves as a mentor providing guidance and feedback to participants, facilitating the programming skills. The game incorporates a comprehensive evaluation system that not only assesses the correctness of submitted exercises but also factors in teamwork, adherence to deadlines, and the ability to tackle challenges of varying difficulty. This course integrates narrative elements and gamification to engage students in web development, emphasizing autonomous learning, creativity, and teamwork.

Presenter bio: Daniele Zolezzi is a Research Fellow in Digital Humanities at the University of Genoa, Italy. His research focuses on Gamification, Serious Games, Virtual Reality, and Generative Artificial Intelligence.

An Overview of Online Mahjong Game Industry in Japanese Internet Society
Yasunaga Yamaguchi (Sendai University, Japan)
This paper explores the transformation of Mahjong within Japanese internet society, tracing its evolution from a traditional board game to a dynamic digital phenomenon. With deep cultural ties to China, Mahjong has seamlessly integrated into Japanese society, adapting ... 20th century to the post-World War II era, marked by the assimilation of crucial rules like Riichi and Dora. The 1970s brought about a mahjong boom, attracting millions and solidifying its enduring popularity. Despite a temporary setback in 2020 during the COVID-19 pandemic, the paper reveals a noteworthy resurgence, with the Mahjong player population in Japan rebounding to 4.5 million in 2021. Contributing factors include the establishment of the professional Mahjong league (M-League) and increased accessibility through platforms like YouTube and internet TV, transforming Mahjong into a spectator sport. The discussion explores the influence of VTuber industry, showcasing collaborative efforts that positively shape the game's perception. This fusion of cultural elements and technological advancements breaks down traditional negative stereotypes, emphasizing Mahjong's adaptability and contemporary relevance. In conclusion, the paper offers a comprehensive analysis of Mahjong's journey in Japanese internet society, resurgence, significantly contributing to understanding the evolving landscape of online games.

Virtual Reality Training for Advanced Radiotherapy
Fulvio Damiano Chiesa (University of Turin & I-See Ltd, Italy); Fazia Bourhaleb and Claudia Pardi (I-See Ltd, Italy); Agata Marta Soccini (University of Torino, Italy)
Radiotherapy is one of the main approaches in treating cancer. Equipment and medical devices must be used with care, and it is currently available only in specialized centers and at high costs. Moreover, practitioners may not have access to LINACs in most countries. This creates the need of a novel approach to allow training all over the world at accessible costs. Several studies highlight the potential of virtual reality for training in several domains, and in this paper we propose a training methodology based on virtual reality for advanced radiotherapy. This work presents a VR evaluation of the system in terms of several factors of user experience. Results show the positive outcomes of the overall feedback was positive in terms of user experience and the sense of presence, as well as navigation and interaction design, describing the system as intuitive and easy to understand, and promising for the training of radiotherapy practitioners.

The Design of Eco-Mania: A Serious Game to Influence Positive Recycling Habits
Sagar Suman (Indian Institute of Technology Kharagpur, India); Mikhail Ola Adisa (LUT University, Finland); Victor Okpanachi and Ifeoma Adaji (The University of British Columbia, Canada)
Research suggests that recycling has various benefits to society including reducing waste, preventing pollution, and conserving natural resources and energy. For the recycling efforts of a country to be successful, the citizens of the country should correctly sort their garbage in the correct garbage bins so that items that should be recycled do not end up in landfills. Landfill sites can be responsible for the contamination of soil and groundwater. Thus, to ensure that items that can be recycled do not end up in landfills, there is an urgent need to teach people how to sort their waste. Serious games (games designed for other purposes besides entertainment) have been used in the past to teach important concepts such as nutrition education and computer programming. In the current paper, we developed a serious game, Eco-mania, to teach about recycling, particularly on how to sort household garbage for recycling. We present the design and development of the game which is based on the results of a systematic literature review previously carried out by the authors.

Performing a Throw in Mixed Reality: A Validation Study
Daria Gusegnova Petra, Martina Francesca Rizza, Andrada Pica, Sergio Mauro Gavino Solinas, Pietro Piciemo and Ugo Della Croce (University of Sassari, Italy)
Lately, the use of Virtual or Mixed reality (VR/MR) tools simulating altered gravity conditions has seen a dramatic increase due to their improved performance, able to partially address the effects of the elevated costs and technical difficulties of reproducing altered gravity environments. The evaluation of human performance in altered gravity conditions may therefore take advantage of the use of such tools. We developed a serious game to analyze the motor performance of subjects exposed to a MR simulating altered gravity scenarios. The serious game was user to throw a virtual ball towards a virtual target while exposed to an MR environment featuring different gravity conditions. In this paper, the accuracy of a virtual ball's trajectory reconstruction in the MR environment was validated against the trajectory reconstructed by a motion capture system used as a gold standard. Results on four subjects performing five non-consecutive throws showed, on average errors of -0.003 s in the identification of the instant of release, 6.5° and 0.18 m/s of difference in the initial direction and velocity of the ball at release, respectively, and -0.11 m of error in the (theoretical) landing distance. As an average the error on landing position falls within the diameter of the virtual target, the trajectory reconstruction can be considered suitable for the serious game's objectives.

Gamifying the Classroom: Bringing Videogames to Life Through Innovation in Education to Increase Student Engagement in STEM Subjects
Aldo Cortes (Tecnológico de Monterrey, Mexico)
A new era on education fostering genuine passion and engagement among students in STEM subjects possess an ongoing challenge. Following the studies of Mark Prensky and Kalin Dimitrov, this paper explores the integration of video game dynamics applied into a High School STEM subject. By taking out of one of the personality of a beloved Video Game, like Mario Kart and using its dynamics and game intricacies a storytelling narrative is created to guide an elective course on Robotics. The initiative aims to redefine the student-teacher relationship and how by using a video game a holistic and immersive environment that can be transformed to enhance motivation and transform the educational experience. The gamification blending virtual and hands-on applications. The study employs the Utrecht Work Engagement Scale-S (UWES-S) to measure student engagement, revealing sustained enthusiasm throughout the semester. The initiative not only offers a unique approach to teaching STEM but also provides valuable insights into the effective integration of video games for comprehensive education.

Presenter bio: Aldo Cortes is a visionary leader at the intersection of engineering education and industrial innovation. With a bachelor's degree in Mechatronics Engineering and a Master of Science in Manufacturing Systems at Tecnológico de Monterrey, Mexico, earned in 2009 and 2014 respectively, his expertise spans a wide gamut of digital manufacturing, commissioning and simulation of industrial processes, Robotics, and Manufacturing Automation. His journey through Tecnológico de Monterrey has been marked by significant contributions and leadership roles...

Digital Twin: Gamified VAR Training for Building Management
Jimmy Chi-ho Li (Hong Kong Metropolitan University); Tsun Sang David Lam (Hong Kong Metropolitan University, Hong Kong); Sai Yuen Chiang, Aaron and King Lok Lam, Pius (Hong Yip Service Company Limited, Hong Kong); Chi Kit Dickson Lo (Youth College International, Hong Kong)
The rapid advancements in Graphics Processing Units (GPUs) and Artificial Intelligence (AI) have fueled the emergence of Digital Twin (DT) and Virtual and Augmented Reality (VAR) technologies. The study analyses the growth of DT and VAR, driven by advancements in computing power, Big Data, and AI. The widespread of these technologies will lead to wider adoption for various purposes, with the industry being a key area of focus. DT involves creating virtual replicas of physical objects in a full-fledged simulation, enabling accurate digital representations for conceptualization, computation, and collaboration over the virtual models. The practical adoption of DT in manufacturing, aerospace, and health industries. However, the growth of Big Data and AI has led to an increase in interest and adoption of DT for various purposes. VAR systems provide users with interactive three-dimensional environments for education, entertainment, and social use. The paper focuses on the current development of DT and VAR applications in the industry, particularly in both training and assessment programmes, with the building management industry as the key case. The paper highlights both work and entertainment through providing more immersive virtual environments, and the use of said technology to address labour shortage issues in building management issues. By combining the latest digital technologies with gaming, the paper offers insights into the future of immersive and engaging experiences in personal level and the industrial level.

Presenter bio: Ir Dr. Li Chi-ho Jimmy is an Assistant Professor cum Programme Leader in the School of Science and Technology of Hong Kong Metropolitan University (HKMU). He obtained his Bachelor of Engineering (B.Eng) from City University of Hong Kong, Master of Engineering (M.Eng) from Hong Kong Polytechnic University, Master of Business Administration (MBA) from The University of Hong Kong and Doctor of Engineering (D.Eng) from Hong Kong Metropolitan University (Formerly The Open University of Hong Kong). Before joining HKMU, Ir Dr. Li has extensive experience in new product development (NPD) and production industry, innovation and technology strategy planning and key performance indicators (KPI) consultancy in manufacturing plants, multinational corporations and consultancy firm respectively for over 15 years.

Transforming Logistics Education by a Virtual Logistics Simulation Generator: UX Pilot Study
María Soledad Ramírez-Montoya and Virginia Rodés-Paragarino (Tecnológico de Monterrey, Mexico); Ernesto A. Pacheco-Velázquez (Tecnológico de Monterrey & Campus Ciudad de México, Mexico); Sergio Augusto Ramírez-Hoferich (EAFIT University, Colombia)
In the era of Industry 5.0 and the impact of the changes in the supply chain, educational institutions, SMEs, and the labor market are challenged by technological advancements. The "Simulations for Learning" (SsL) project responds to this challenge by introducing the Virtual Logistics Simulation Generator, a platform designed to transform logistics education through enhanced decision-making skills and customizable simulations. This tool allows students to design and adjust logistics networks, tailoring their educational experience to real-world logistics scenarios. A pilot study was conducted with 249 students from eight universities across five Latin American countries to assess the usability of this simulation generator in logistics education. The study revealed significant findings: (a) the simulation generator provides learners with flexible and tailored educational experiences; (b) the Interface and Performance and Effectiveness aspects of the Virtual Logistics were highly rated, achieving an "Excellent" usability level; (c) however, Content Organization and Navigation were perceived as slightly less effective, receiving a "Good" usability rating and highlighting areas in need of improvement. These results demonstrate student satisfaction, and therefore, the transformative potential of simulation-based learning tools in logistics education. By providing detailed insights into both the strengths and areas for enhancement of the Virtual Logistics Simulation Generator, this study offers valuable guidance for educators, policymakers, and industry leaders. It emphasizes the importance of aligning educational tools with dynamic environments, ensuring that future professionals are well-equipped to face the complexities of the modern logistics landscape.

Exploring the Concept of Mini Data Sprints as a Methodology to Assess Data Validity and Stimulate Climate Conversation
Paul W Watson (University of Bolton, United Kingdom (Great Britain)); Katharina Koller (Centre for Social Innovation, Austria); Celestine Iwendi (University of Bolton, United Kingdom (Great Britain)); Claudia Magdalena Fabian (Centre for Social Innovation, Austria); Paul Hollins (University of Bolton, United Kingdom (Great Britain)); Barbara Kieslinger (Centre for Social Innovation (ZSI), Austria)
The GAMES (Gaming Realities Effective and Affective Transformations) project explores new approaches that citizens have limited resources for participation, even though their engagement and contributions are crucial. To address this challenge, the authors present two studies that have deployed mini data sprints (MDS). The MDS approach uses interactive data applications and visualisations to provoke citizens' feelings, knowledge, and perspectives towards the climate conversation and presented data. These studies highlight how the MDS approach can provide data set recommendations, facilitate efficient and focused climate conversation, and improve the data literacy of the cohort.

The Application of Cyberpunk Style in the Costume Design of Chinese Martial Arts Game Characters
Qingyun Lin (FuZhou University, China); Jun He (Fuzhou University, China); Chaoyuan Yan (FuZhou University, China) & Xiamen Academy of Arts & Design, China)
As an important part of Chinese traditional culture, martial arts culture has found a new form of expression in the spirit of fighting against established rules. This resonance will provide the possibility of integrating Cyberpunk style in games, analyse the characteristics of costume design of characters in Chinese martial arts games, to provide players with Cyberpunk elements in costume design of characters in Chinese martial arts games, to provide players with interpreted and appreciated in a new way on a global scale, enhancing its vitality and influence.

Research on the Application of Game Rank Mechanism in the Evaluation of Skill Based Courses in Colleges and Universities
Xin Feng and Siyuan Liu (Xiamen Academy of Arts & Design, Fuzhou University, China); Jun He (Fuzhou University, China)
This study aims to explore the application of game rank mechanisms in the evaluation of skill-based courses in higher education, effectively evaluating students' learning outcomes has become a key issue. To address this, the game rank mechanism, an achievement and progress-based evaluation method, is considered due to its successful application in the gaming field. This study investigates the potential value of the game rank mechanism in university courses. By integrating this mechanism, the study suggests an evaluation framework that seeks to stimulate students' learning motivation and provide personalized feedback. The goal is to promote autonomous learning and growth among students. Moreover, the application of this mechanism encourages various classroom activities, including the design and implementation of evaluation criteria and assessing students' acceptance of the mechanism. This multifaceted approach offers a new perspective and method for evaluation of skill-based courses, aiming to enhance the effectiveness of evaluations and boost students' learning motivation.

Thursday, June 6 14:15 - 14:45 (Europe/Rome)

IP2: Industry Forum (AI Applied to Game Development)
Panel
Room: Energy Center - Auditorium
Chair: Kai Erenli (University of Applied Sciences - FH DES BFI Vienna & Arx Anima, Austria)

14:15 Integrating AI and Sustainable Development in Game Development: Industry Perspectives and Innovations
Kai Erenli (University of Applied Sciences - FH DES BFI Vienna & Arx Anima, Austria); Johanna Pirker (LMU & Graz University of Technology, Austria); Gabriela Chihan Stanley (VR/SCH & WiiHome, Women in Immersive Technologies Europe, Austria); Ross Smith (Microsoft Corporation, USA); Martin Filipp (PGDA, Austria); Karel Dietrich (VIVISCH, Austria)
The rapid evolution of Artificial Intelligence (AI) and growing concerns about sustainable development are reshaping the landscape of game development. This panel explores the dynamic intersection between AI technologies on one side and sustainable development practices within the gaming industry on the other. Our focus is on uncovering how game companies are integrating AI to not only enhance game creativity and efficiency but also to drive sustainable practices in game design, development, and distribution. We will delve into the current state of AI in game development, the industry's approach to sustainability, and how these efforts contribute to the broader goal of leveraging gaming for sustainable growth.

Presenter bio: Ross Smith, Director of Test for Microsoft Office Lync (Microsoft). Ross has been at Microsoft over 20 years... He has been in testing from Windows to Office... Presenter bio: Women in Immersive Technologies Europe... Martin Filipp... (small print)

Thursday, June 6 14:45 - 16:15 (Europe/Rome)

S5-ET: Game Design, Game Development & UX
Room: Classroom 4T
Chair: Elena Bertozzi (Quinnipiac University, USA)

14:45 Automated Difficulty Assessment Model for Comprehensive Difficulty in Games
Yannick Francillette (Université du Québec à Chicoutimi, Canada); Hugo Tremblay (University of Quebec at Chicoutimi, Canada); Bruno Bouchard (University of Quebec at Chicoutimi, Canada); Kevin Bouchard (Université du Québec à Chicoutimi, Canada)
Comprehensive difficulty in a game can be defined as the challenge presented by learning the game's system and mechanics. It is complex to evaluate because the difficulty level is crucial for a game's success. In the industry, rules and objectives are commonly designed using a Static Game Balance (SGB) system. This involves human designers handcrafting elements of the game, which can be tedious and might be biased... Furthermore, at some stages of game production, particularly during prototyping without access to player data, it becomes challenging to objectively assess the difficulty of these manually designed game elements. Limited research has addressed automatic difficulty assessment in the context of SGB, with most being studies focusing on executive difficulty, which pertains to a player's motor skills, such as dexterity. However, in the industry, there is a need of more automated software tools to optimize game production. In this paper, we propose a novel method for automatically measuring the comprehensive difficulty of enemies in a game. Our approach, owing to its generality and the standardization of the way of defining enemies using state machines, leverages the properties of states, transitions, cyclomatic complexity, etc.) to establish a standardized model for comprehensive difficulty assessment in games. We present this model along with the results of an initial exploratory experiment, demonstrating the potential of our approach and its feasibility for integration as a plugin in game engines like Unreal Engine 5.

15:00 A Tool for the Procedural Generation of Shaders Using Interactive Evolutionary Algorithms
Elio Sasso, Daniele Loiacono and Pier Luca Lanzi (Politecnico di Milano, Italy)
We present a tool for exploring the design space of shaders using an interactive evolutionary algorithm integrated with the Unity editor, a well-known commercial tool for video game development. Our framework leverages the underlying graph-based representation of recent shader editors and allows to explore the shaders' design space by interactively evolving a graph through the shader... shaders. Our tool enables... from existing shaders, and it extends the graph representation of a current shader as a chromosome used to seed the evolution of a shader population. It applies graph-based recombination and mutation with a set of heuristics to create feasible shaders. The framework is an extension of the Unity editor that seamlessly integrates into the Unity editor (and shader programming) can interact with the underlying evolutionary engine using the same visual interface used for working on scene scenes.

15:15 Enhancing Stealth Gameplay Through Procedural Generation: An Algorithmic Approach to Dynamic Guard Paths and Placement in Infiltration Games
Audren Bonnot (University of Quebec at Chicoutimi, Canada); Yannick Francillette (Université du Québec à Chicoutimi, Canada); Bob-Antoine J. Menelas (Université du Québec à Chicoutimi (UQAC), Canada); Bruno Bouchard (University of Quebec at Chicoutimi, Canada)
Stealth or infiltration games are a significant genre in the gaming industry, centered around undetected navigation through levels, avoiding guards, cameras, and other security measures. Level design for such games is a complex challenge, raising questions about guard placement, patrol routes, player visibility, level difficulty, and overall player experience. Despite its importance, very few scientific works addressed the challenges in the past. It is why this paper introduces a procedural generation approach that leverages a combination of existing techniques for automatically generating maps, positioning guards, determining their patrol paths and evaluating level difficulty with broad applicability across various stealth games. Implemented in Unity 3D, our method was validated by generating over five hundred maps, simultaneously... demonstrating their ability to generate varied levels.

15:25 The Correlation Between Quantitative Metrics and Subjective Assessment of Sequential and Scene Landscape in Ghost of Tsushima
Xiaotian Mei (Tokyo University of Agriculture, Japan); Yoichi Kunii (Tokyo University of Agriculture & Japanese Institute of Landscape Architecture, Japan)
With the development of technology, the construction of immersive and virtual reality has become a topic. In the virtual world, apart from virtual architecture, virtual landscapes also play an important role. However, the research on virtual landscape does not only constitute a vital part of virtual scape, but also is constructed by fractal dimension. There is fewer research about the analysis of virtual landscape in video game landscape. Nowadays, the beautiful landscape in the game of Ghost of Tsushima has widespread acclaim. Therefore, this study... analyze the correlation between both sequential and scene landscape of game landscape and subjective assessment. As a result, the goal of this research is to find the meaningful correlation between quantitative metrics (in this study it will be fractal dimension) and game landscape, to provide design recommendations for the construction of game or virtual landscape.

15:40 A Comparison of Performance on WebGPU and WebGL in the Godot Game Engine
Emil Fransson, Jonathan Hermansson and Yan Hu (Blekinge Institute of Technology, Sweden)
The introduction of a new web-based graphics API, called WebGPU, was released in 2023 and utilizes many of the novel rendering approaches and features common for the native modern graphics APIs, such as Vulkan. Currently, very limited research exists regarding WebGPU's restrictions capabilities. In particular, no research exists pertaining to its capabilities when used as a rendering backend in game engines. This paper aims to investigate performance differences between WebGL and WebGPU in terms of the CPU and GPU frame time. The results show that WebGPU performs faster than WebGL when used as a rendering backend in Godot, for both the games tests and the synthetic tests. The comparisons clearly show that WebGPU performs faster in mean CPU and GPU frame time.

15:55 Playing Games Without Sight: Sonic Play
Alexander Espeseth (Kristiania University College & Kristiania, Norway); Kjetil Raaen (Kristiania University College, Norway)
This paper presents a concept that will help make games available to visually impaired players. We show how sound that can provide navigational information without breaking immersion, as well as how to present knowledge about a virtual space to visually impaired people through sound. We create a tool for game developers to introduce visually impaired people through navigable interactive 3D game while maintaining immersion, and although we hope that this technology will result in a new generation of games that can be enjoyed equally in a new gaming... industry, both for AAA-studios and for indie studios.

Presenter bio: PhD candidate at Kristiania University College researching solutions to streamline and standardize the technology to make 3D games accessible for blind and visually impaired players. Background in contemporary music, ludomusicology, game design, sound design and applied technology.

Thursday, June 6 14:45 - 15:30 (Europe/Rome)

S5A-EC: Machine Learning & AI in Games
Room: Energy Center - Auditorium
Chair: Kai Erenli (University of Applied Sciences - FH DES BFI Vienna & Arx Anima, Austria)

14:45 AI Server-Side Prediction for Latency Mitigation and Cheating Detection: The MPAI-SPG Approach
Daniele Spina and Andrea Bottino (Politecnico di Torino, Italy); Davide Cavagnino (Università di Torino, Italy); Chiariglione (Digital Media Project, Italy); Maurizio Lucenteforte (University of Turin, Italy); Marco Mazzaglia and Francesco Strada (Politecnico di Torino, Italy)
This paper introduces MPAI-SPG, a novel approach to mitigate latency and detect cheating in online gaming through server-side prediction. The paper reports the implementation of this approach in an online racing game. Using machine learning, we developed a prediction model trained on a custom-built dataset, which is publicly available. Experimental sessions with real players were conducted to assess prediction accuracy and the sessions' evaluation of an online multiplayer game. Results demonstrate the MPAI-SPG potential to enhance the gaming experience amidst prediction accuracy, leveraging new training techniques.

15:00 A Reinforcement Learning System for Adaptive Gamification and Hexad User Profile Tracking
Ioannis Nikolopoulos (National Technical University of Athens, Greece); Paraskevi Tzouveli (Institute of Communication & Computer Systems, Greece & National Technical University of Athens, Greece); Kostas Karpouzis (Panteion University of Social and Political Sciences, Greece); Stefanos Kollias (University of Lincoln/NTUA, United Kingdom (Great Britain))
Gamification has become a widely used user motivation approach in modern apps, since it can adapt to the user's characteristics, such as the Hexad user type, to achieve better performance. Despite various machine learning techniques being employed and tested in gamification research, reinforcement learning has seen little use in gamification in order to assess its usefulness. Thus, in this paper we designed a customizable adaptive gamification reinforcement learning system that uses the user's profile to change the gamification elements shown to them and to observe the changes their profile undergoes over time. A prototype of the designed system was created using the design conventions of the Gymnasium library (formerly OpenAI Gym). The reinforcement learning system underwent preliminary tests regarding its accuracy and profile tracking using user answer simulation. Results indicate that the system functions satisfactorily in various use cases and that its accuracy is high when the system closely tracks the user's Hexad profile.

15:15 AI-Facilitated Selection of the Optimal Nondominated Solution for a Serious Gaming Information Fusion Module
Steve Chan (Harvard University, USA)
Fuzzy optimization problems play a substantial role in Information Fusion (ISO4: Inf Fusion) and related Multi-Criteria Decision Making (MCDM) problems. These problems are complex because of the criteria/objectives tend to conflict with each other. Researchers have utilized various methods to address these challenges, such as the obtaining of the Optimal Shapley-Nondominated Solution (OSNS) to contend with the Fuzzy Number (FN) coefficient issue, among others. The Optimization (PSO) metaheuristic approach is utilized along with a unique Lower Ambiguity, Higher Uncertainty (LAHU) and Higher Ambiguity, Lower Uncertainty (HALU) Module (LHM) for not only seeking the OSNS, but also an enhanced approximation of operational Gaussian Linear "T"-sided SFN form (OGSLSFN)-based membership function (via an Isomorphic Paradigm (IsoP)). The LHM seeks to ascertain whether an IsoP has already been arrived at...(historical data), e.g., the Bayesian Comparator Similarity Measure (ICSM) for FNs/SFNs/SFSs) that leverages OSNS and OCGLFN.

Presenter bio: Dr. Steve Chan has co-authored papers for various IEEE conference proceedings, including such as the International Conference on Information and Communication (ICOICC), 2019 IEEE International Conference on Informatics and Computing... IEEE International Conference on Information Communication Technology (ICOICT) 2023... Conference on Computing, Networking and Communications... (small print)

Thursday, June 6 14:45 - 15:30 (Europe/Rome)

WK2-1-LC: Workshop (Virtual Production w/ Unreal Engine)
Part 1
Room: Conference room "Luigi Cinimera"

14:45 Virtual Production with Unreal Engine
Nicola di Meo (UNSPACE, Italy); Daniele Barone (Education Advisor for Unreal Engine)
In this workshop we will explore the path that made the technologies used in the production of video games to become the core of "Virtual Production" in the modern cinema industry. In this context, Unreal Engine enabled the birth of a cinema technique named "In-Camera VFX", which represents a true revolution in modern Visual Effects domain and is adopted on a global scale from major studios.

Presenter bio: Daniele has been working in the field of CG for 20 years. He was an educational consultant representing Epic Games for Italy for 3 years, increasing the adoption of the Epic Games ecosystem across all vertical sectors (gaming, M&E, architecture and automotive) within schools, universities and industry. As well as forging strategic partnerships with major players in the technology sector. Recipient of an Epic Games MegaGrant dedicated to education, he has worked and provided training for many professional architectural firms and large technology companies for real-time applications... (small print)

Thursday, June 6 15:30 - 16:15 (Europe/Rome)

S5B-EC: Deepfakes & Privacy of Media
Room: Energy Center - Auditorium
Chair: Juan Arnedo-Moreno (Universitat Oberta de Catalunya, Spain)

15:30 Deepfake Video Detection Using Convolutional Vision Transformer
Deressa Wodajo Deressa (Ghent University, Belgium); Hannes Mareen (Ghent University - imec & IDLab, Belgium); Peter Lambert (Ghent University - imec & IDLab, Belgium); Glenn Van Wallendael (Ghent University - imec & IDLab, Belgium); Solomon Atnafu (Addis Ababa University, Ethiopia); Hannes Mareen (Ghent University - Imec & IDLab, Belgium)
Deepfakes are hyper-realistic videos in which the faces are replaced, swapped, or forged using deep-learning models. These powerful media manipulation methods have potential uses in many fields. However, they also pose a looming threat when used to commit identity theft, phishing, disinformation, and scams. In this work, we propose a novel and improved Deepfake video detector that uses a Convolutional Vision Transformer (CViT2), which builds on the concepts of our previous work (CViT). The CViT architecture consists of two components: a Convolutional Neural Network that extracts learnable features, and a Vision Transformer that categorizes these learned features using an attention mechanism. We trained and evaluated our model on 5 datasets, namely Deepfake Detection Challenge Dataset (DFDC), FaceForensics++ (FF++), Celeb-DF v2, DeepfakeTIMIT, and TrustedMedia. On the test sets unseen during training, we achieved an accuracy of 95%, 94.8%, 98.3% and 76.7% on the DFDC, FF++, Celeb-DF v2, and TIMIT datasets, respectively. In conclusion, our proposed Deepfake detector can be used in the battle against misinformation and other forensic use cases.

15:45 Collaborative Decentralized Learning for Detecting Deepfake Videos in Entertainment
Made Adi Paramartha Putra and Nengah Widya Utami (Primakara University, Indonesia); I Gede Juliana Eka Putra (STMIK Primakara, Indonesia); Nyoman Karna (Telkom University, Indonesia); Ahmad Zainudin (Politeknik Elektronika Negeri Surabaya, Indonesia); Gabriel Avelino R Sampedro (University of the Philippines Open University, Philippines & Kumoh National Institute of Technology, Korea (South))
In this paper, we present a collaborative decentralized learning system for detecting deepfake videos in entertainment. Most state-of-the-art works in this field utilize a centralized learning mechanism of Artificial Intelligence (AI), which poses privacy concerns for participants, as data needs to be forwarded to a central server. To mitigate this, Federated Learning (FL) has been introduced. In this work, the aggregation mechanism is performed in a decentralized manner for enhanced security. As a result, we propose a collaborative decentralized collaborative learning is trained by each participant using real and deepfake video datasets. The participants in the proposed collaborative system. Continual learning mechanisms are used in this work to reduce the communication overhead... videos with average duration of 10 seconds, were used for training and evaluation. The results indicate that the proposed decentralized collaborative learning is able to deliver satisfactory performance with an accuracy of 97.30%, while also preserving participant privacy and minimizing communication costs.

16:00 Harnessing Foundation Models for Image Anonymization
Luca Piano (Politecnico di Torino, Italy); Pietro Basci (Politecnico di Torino, Italy); Fabrizio Lamberti and Lia Morra (Politecnico di Torino, Italy)
Traditional deep learning pipelines involve multiple intricate steps, from data acquisition to model training, fine-tuning, and deployment. However, recent advancements in foundation models, particularly in text-to-image generation, offer a paradigm shift in addressing tasks without the need for these conventional processes. In this paper, we explore how foundation models can be leveraged to solve tasks, specifically focusing on anonymization, without the requirement for training or fine-tuning. By bypassing traditional pipelines, we demonstrate the efficiency and effectiveness of this approach in achieving anonymization objectives directly from the foundation model's inherent knowledge. Our findings underscore the transformative potential of foundation models in simplifying and accelerating deep learning tasks, paving the way for novel applications in various domains.

Thursday, June 6 16:15 - 16:45 (Europe/Rome)

CF4: Coffee Break
Room: Energy Center - Hall & Foyer

Thursday, June 6 16:45 - 18:15 (Europe/Rome)

S6-ET: Serious Games for Education and Industry Applications
Room: Classroom 4T
Chair: Davide Calandra (Politecnico di Torino, Italy)

16:45 Evaluating "The Sustainable Port": A Serious Game to Study Decision-Making in Port-Related Environments
Gianluca Guglielmo, Michal Klincewicz, Elisabeth Huis in 't Veld and Pieter Spronck (Tilburg University, The Netherlands)
In this paper, we report on the development of the Sustainable Port video game, which aims to simulate the complex and diverse decisions the port area considering environmental aspects (CO2 emissions) and profit. To evaluate if this game fulfills its purpose, we asked 75 students and 34 employees at the Port of Rotterdam (PoR) to play The Sustainable Port. Our results show that PoR employees score higher than students suggesting a transfer between real-life experience of being an employee in the port and performance in the game. Furthermore, post-game participants reported that the Sustainable Port can be successfully used to start discussions about the future of the PoR and to raise awareness about the complexity characterizing the decision-making processes occurring in a port environment. Our results, taken together, provide evidence of the effectiveness of The Sustainable Port in simulating dynamics occurring in a port environment and give us optimism about future applications.

17:00 Anti-Plagiarism Adventure Game: Using Visual Novels for Feasible Game-Based Learning
Terence Govender (Universitat Oberta de Catalunya, Spain); Joan Arnedo-Moreno (Universitat Oberta de Catalunya, Spain)
In higher education, digital game-based learning has gained attention as an innovative and engaging approach to enhancing learning experiences. Game-based approaches can be used at all stages of education to provide practical applications and experiential learning instead of focusing solely on theoretical or conceptual learning. This paper explores the development of a visual novel as a low-barrier tool to promote plagiarism awareness in undergraduates. The voluntary study was broken into two parts: a pre- and post-test assessment to measure the game's impact on students' knowledge of plagiarism (n = 104) and a qualitative investigation (n = 104). The results demonstrated a statistically significant increase in test scores, supporting the potential to deliver educational content ... Furthermore, the quantitative data showed that the participants had a positive experience interacting with the game. Overall, visual novels may offer a new method for instruction - especially where budgets are limited.

Presenter bio: Terence Govender is a doctoral student at the Universitat Oberta de Catalunya...

17:15 Unlocking AI Literacy: The SMaILE-App Gaming Experience
Santiago Franco (Royal Holloway University of London, United Kingdom (Great Britain)); Maria Giulia Ballatore (Politecnico di Torino, Italy); Sara Bernardini (Royal Holloway University of London, United Kingdom (Great Britain)); Giacomo Cerra (Politecnico di Torino & Lund University, Italy); Luca Daniele (Politecnico di Torino, Italy); Alexandra Neale (Royal Holloway University of London, United Kingdom (Great Britain)); Martina Vanelli (Politecnico di Torino, Italy); Anita Tabacco (Politecnico di Torino, Italy)
AI's promise to become embedded in every aspect of modern life is quickly becoming a reality. However, a significant gap emerges in educational resources tailored for adolescents. This void often cultivates misconceptions about AI's capabilities and potential risks. To close this gap, we present SMaILE-App, a novel educational cross-platform app designed to foster AI literacy among individuals aged 10 to 18. Applying a construc- tionist educational framework, SMaILE-App promotes learning AI fundamentals through interactive gameplay, merging en- tertainment with personalized knowledge acquisition. SMaILE- App comprises a suite of minigames in an engaging narrative, each focusing on a different AI concept, as well as interactive creational and instructive modules. SMaILE-App rests on two key ideas: AI is not a singular, all-encompassing term but a spectrum of methodologies, each with its nuances, and AI is not without its limitations.

Presenter bio: Maria Giulia Ballatore, Ph.D. is a Research Fellow at the Department of Mathematical Sciences of the Politecnico di Torino, Italy. Her research interests lie in Engineering Education, the development and standardization of learning technology, spatial abilities, game-based learning, and gender issues.

17:30 Programming Games as Learning Tools: Using Empathic Design Principles to Engaging Experiences
Patrice Scerbo Marino (Universitat Oberta de Catalunya, Spain); Joan Arnedo-Moreno (Universitat Oberta de Catalunya, Spain)
As computational thinking (CT) emerges as a crucial skill in the modern era, the use of games for learning programming has been raised. This study focuses on empathic design to identify the users' learning and ... consideration of the user's needs and experiences is as important as the educational content in order to ensure that the learner can engage... explores the integration of Empathic Design principles into the user experience (UX) evaluation of several popular programming genre games aimed at cultivating CT. The findings indicate a partial misalignment with these principles, particularly in user-centric design, learning journey, and visual appeal, while improvement suggestions centered on enhancing interface depth, providing clearer instructions, and addressing challenges for beginners and scalability issues.

17:45 Evaluation of a Serious VR Game Designed to Promote the Sustainable Development Goals
Louis Nisiotis (University of Central Lancashire Cyprus, Cyprus); Andriani Piki and Panayiotis Theodorou (UCLan Cyprus, Cyprus); Susana Leal (Polytechnic Institute of Santarém, Portugal); Luís Claudio dos Santos Barradas (Instituto Politécnico de Santarém, Portugal); João AM Nascimento (Polytechnic Institute of Santarem, Portugal)
This paper presents an evaluation of a serious Virtual Reality (VR) game designed to promote awareness and understanding of the Sustainable Development Goals in Higher Education students. The evaluation assesses user experience in terms of usability/playability, player engagement, enjoyment, and visual aesthetics of the VR environment. It also explores the onset of VR Sickness symptoms among users after their experience with the VR game. Players positively evaluated the enjoyment and visuals. The results concerning VR sickness indicate that the game's usability, its ability to engross them in gameplay, and the environment's mitigate the reported symptoms and further improve the user experience. The findings can inform future game-based endeavours supporting education for sustainable development.

18:00 The Design of Food Villain, A Serious Game to Influence Healthy Eating Habits Among African International Students
Victor Okpanachi and Ifeoma Adaji (The University of British Columbia, Canada)
The transition from Africa to Western countries poses significant challenges for African international students. Factors such as the unavailability and high cost of familiar foods, coupled with sedentary habits influenced by increased health risks among this demographic. In response to these challenges, there is a growing interest in behaviors. This article explores the design and development of "Food Villain," a serious game aimed at influencing healthy eating habits among African international students in Western countries. We discuss the design of two versions of the game: a web based version that can be played on any device with a browser and a Virtual Reality version for people with access to VR headsets. By addressing the cultural, environmental, and behavioral factors influencing dietary choices, Food Villain seeks to motivate players towards healthier behaviors. Through an analysis of its design principles and educational content, this article highlights the potential of serious games as effective tools for health promotion and behavior change interventions targeting culturally diverse populations.

Thursday, June 6 16:45 - 18:15 (Europe/Rome)

S6-EC: Inspiration, Ethical Aspects, Research Insight & Trends
Room: Energy Center - Auditorium
Chair: Francesco Strada (Politecnico di Torino, Italy)

16:45 Know Your Bugs: A Survey of Issues in Automated Game Testing Literature
Riccardo Coppola, Tommaso Fulcini and Francesco Strada (Politecnico di Torino, Italy)
As the complexity of video games continues to evolve, so does the importance of effective game testing methodologies. To this end, automated game testing has emerged as a pivotal approach to ensure the quality and functionality of modern games. The objective of the present paper is to identify, through a literature review and the application of Open and Axial coding, the most commonly analysed and mentioned issues in automated game testing literature. The elicited taxonomy of 26 different issues that are assessed in the software engineering literature by automated game testing process, grouped in five higher-level categories. The elicited taxonomy can serve as an instrument for game testers, researchers and tool developers to evaluate testing approaches and techniques, enable comparability of research results, and investigate functional aspects of games in development.

17:00 Politics in Games - an Overview and Classification
Lisa Gutwenger (University of Graz, Austria); Stephan Keller (TU Graz, Austria); Martin Dolezal (Uni Graz, Austria); Bernhard Schnögl (TU Graz, Austria); Sebastian Rous (Uni Graz, Austria); Klaus Poier (University of Graz, Austria); Johanna Pirker (LMU & Graz University of Technology, Austria)
The representation of politics in media profoundly influences societal perceptions and attitudes. Video games, as a pervasive form of media, contribute significantly to this phenomenon. This study delves into the portrayal of political themes within video games, examining both overt and nuanced incorporations. Our research methodology involved analyzing a curated sample of politically-themed games, identified through keyword searches in their descriptions on the gaming platform Steam. In an additional step of the analysis, similar descriptions to identify prevalent trends and patterns. The findings from this study have led to the development of a taxonomy that serves as a foundation for analyzing political content in games and also sets a foundation for future research in this field.

17:10 The Current Situation and Debate on Gender Segregation in Esports Tournaments
Stefania Stamou and Konstantinos Cornelis Apostolakis (Foundation for Research and Technology - Hellas (FORTH), Greece); George Margetis (Foundation for Research and Technology - Hellas (FORTH), Greece); Stavroula Ntoa (ICS-FORTH, Greece); Constantine Stephanidis (FORTH, Greece)
Esports have grown to be a billion-dollar industry, with millions of players and viewers on a global level. Being neither dependant on athleticism, nor feats of physical exertion, esports enable players from all genders to compete on equal terms, however, gender-based division among male and female players remains (seemingly inexplicably) in practice. In this paper, we summarize related research work, and contribute insight to the ongoing discussion on gender discrimination in competitive esports tournaments. We highlight some of the most profound challenges that still need to be addressed for esports to become a more inclusive and esports industry stakeholder groups can leverage, to support equal participation of both genders in mixed-gender tournaments and competitions, thereby realizing esports true ubiquitous potential.

17:25 Learning Through Play How a Game Jam Developed Deeper Social Impact Understanding
Lindsay Grace (University of Miami, USA); Vijayendra Sekhon (Avant National University, USA)
While the value and benefits of game jams have been frequently documented for learning technology and design study, very few examine the effect of game jam participation on an understanding of the social impact topics. This paper outlines a game jam which examines how a population of game jammers shifted their understanding of both the game making process and social impact topics they had self-selected. Since it is common to employ game jams as an opportunity to practice the skills required of game design, this work reflects on the informing future game jams and employing game jammers as a means for encouraging further reflection on a myriad of social impact concerns. The goal is to explore game jams as a productive reflection process, similar in educational contexts to the value of writing papers, making videos or other more common education practices. The findings indicate that in a game jam naive population, of 76 participants with a female-identifying majority with a mean age of 21 years, the 48-hour game jam improved participant self-perceived understanding of game design and further their understanding of social impact topics. These findings help support the theory that the experience of game jams may extend participant depth of knowledge beyond game design and implementation.

17:35 Unleashing Generative Non-Player Characters in Video Games: An AI Act Perspective
Martin Sas (KU LEUVEN, CITIP, Belgium)
The increased integration of large language models and generative AI in non-player characters (NPCs) is radically transforming the industry. While these new technologies can enhance the immersiveness of the game experience, generative NPCs also introduce substantial risks of damaging misbehaviour. In this paper, we highlight the role of each actor along the supply chain of generative non-player characters (NPCs) and analyse how the forthcoming AI Act might apply vis-à-vis the allocation of responsibilities. Finally, we highlight unacceptable uses of generative NPCs.

17:45 The VR Chronicles: Insights From the VR Factsheet 2024
Moritz Albrecht and Magdalena Eder (FH BFI Wien, Austria); Kai Erenli (University of Applied Sciences - FH DES BFI Vienna & Arx Anima, Austria); Leonie Fankhauser, Maximilian Mayerl, Leonard Petek and Victoria Schachinger (FH BFI Wien, Austria)
As the size and relevance of the market for Virtual Reality (VR) content increases, so does the need for comprehensive datasets to study this market. This paper presents an update to our VR Factsheet first introduced in 2018. In its newly updated form, the VR Factsheet contains 2,523 pieces of VR media, along with a variety of attributes useful for studying the VR market. To highlight some aspects of the market, this paper also discusses three such attributes: length, platform and country of origin. Our analysis of these three attributes show a tendency towards shorter VR experiences, a fragmented, highly platformed market, as well as the global nature of the VR development ecosystem.

18:00 Exploring Taste Sensation in the Metaverse: A Literature Review
Matteo Atanasio (University of Pisa, Italy); Francesco Sansone (Institute of Clinical Physiology (IFC) National Research Council of Italy (CNR), Italy); Raffaele Conte (National Research Council of Italy (CNR), Italy); Alessandro Tonacci (Institute of Clinical Physiology (IFC) National Research Council of Italy (CNR), Italy)
Metaverse represents a hypothetical iteration of the Internet as a single immersive virtual world in which users can interact with each other. Nowadays, despite the efforts to embed sensory feedback in the metaverse scenarios, there is still a problem with doing that with chemical senses, therefore taste is not included in it. In our work, we present how the sense of taste could be implemented in a metaverse virtual world, analyzing currently developed and possible future devices eventually implementing digital taste, to induce virtual taste to users. Its hypothetical implementation would indeed break ground in global communication such as in the videogame empire, increasing the user experience and opening a completely new era of gaming, entertainment, and media, with a predictable bias in revenues for the related industry.

Presenter bio: Dr. Alessandro Tonacci (born in 1986) obtained his Master's Degree in Biomedical Engineering from the University of Pisa, Italy, in 2010, and was awarded with a PhD in Automatics, Robotics and Bioengineering from University of Pisa in 2015 and a Master in Machine Learning and Big Data in Precision Medicine and Biomedical Research from University of Padua, Italy, in 2021. Since 2011, he has been Research Fellow, and since 2020, he is Researcher at the Institute of Clinical Physiology of the National Research Council of Italy (IFC-CNR), Pisa, Italy. His research focuses on biomedical signal processing, sensors, Artificial and Artificial Intelligence in healthcare and well-being. He is co-author of more than 150 peer-reviewed scientific products. He is currently holding editorial positions for international journals, like Frontiers in Neuroscience, Frontiers in Physiology, IEEE Transactions on Consumer Electronics, and he serves as reviewer for national and international Calls for Grants in both European and extra-EU countries. He was also serving as Chair of the IEEE CTSoc Technical Committee on "Consumer Healthcare and Wellbeing".

Thursday, June 6 16:45 - 18:15 (Europe/Rome)

WK2-2-LC: Workshop (Virtual Production w/ Unreal Engine)
Part 2
Room: Conference room "Luigi Cinimera"

16:45 Virtual Production with Unreal Engine
Nicola di Meo (UNSPACE, Italy); Daniele Barone (Education Advisor for Unreal Engine)
In this workshop we will explore the path that made the technologies used in the production of video games to become the core of "Virtual Production" in the modern cinema industry. In this context, Unreal Engine enabled the birth of a cinema technique named "In-Camera VFX", which represents a true revolution in modern Visual Effects domain and is adopted on a global scale from major studios.

Presenter bio: Daniele has been working in the field of CG for 20 years. He was an educational consultant representing Epic Games for Italy for 3 years, increasing the adoption of the Epic Games ecosystem across all vertical sectors (gaming, M&E, architecture and automotive) within schools, universities and industry... (small print)

Thursday, June 6 18:15 - 18:30 (Europe/Rome)

null-2: (Buffer time)

Thursday, June 6 18:30 - 19:15 (Europe/Rome)

SC2: Shuttle Transfer to Gala Dinner

Thursday, June 6 19:15 - 24:30 (Europe/Rome)

SC2Z: Gala Dinner (& Shuttle Transfer Back)

Friday, June 7

Friday, June 7 8:15 - 9:00 (Europe/Rome)

REG3: Registration (8:15am-9:30am)
Room: Registration & Info Point (Energy Center - Entrance)

Friday, June 7 8:30 - 9:00 (Europe/Rome)

D-FF: Demos Fast Forward
Room: Energy Center - Auditorium, Classroom 4T, Conference room "Luigi Cinimera"

Friday, June 7 9:00 - 10:30 (Europe/Rome)

DEMO-ET: Demos (Serious & Mobile Gaming)
Room: Classroom 4T
Chair: Alberto Cannavò (Politecnico di Torino, Italy)

What's My Method? - Delivering Contraceptive Education and Increasing Reproductive Empowerment Through Play
Elena Bertozzi (Quinnipiac University, USA)
The What's My Method? (WMM) game teaches players how different birth control methods work and what the benefits and downsides of using them might be. Players are presented with several couples with different characteristics and challenged to see if they can find the right method for that family. This RCT seeks to determine if the WMM game improves contraceptive self-efficacy and uptake of modern contraceptive methods.

Unlocking AI Literacy: The SMaILE-App Gaming Experience
Santiago Franco (Royal Holloway University of London, United Kingdom (Great Britain)); Maria Giulia Ballatore (Politecnico di Torino, Italy); Sara Bernardini (Royal Holloway University of London, United Kingdom (Great Britain)); Giacomo Cerra (Politecnico di Torino & Lund University (LUSS), Italy); Alexandra Neale (Royal Holloway University of London, United Kingdom (Great Britain)); Martina Vanelli (Politecnico di Torino, Italy); Anita Tabacco (Politecnico di Torino, Italy)
AI's promise to become embedded in every aspect of modern life is quickly becoming a reality. However, a significant gap emerges in educational resources tailored for adolescents. This void often cultivates misconceptions about AI's capabilities and potential risks. To close this gap, we present SMaILE-App, a novel educational cross-platform app designed to foster AI literacy among individuals aged 10 to 18. Applying a construc- tionist educational framework, SMaILE-App promotes learning AI fundamentals through interactive gameplay, merging en- tertainment with personalized knowledge acquisition. SMaILE-App comprises a suite of minigames in an engaging narrative, each focusing on a different AI concept, as well as interactive creational and instructive modules. SMaILE-App rests on two key ideas: AI is not a singular, all-encompassing term but a spectrum of methodologies, each with its nuances, and AI is not without its limitations.

Presenter bio: Maria Giulia Ballatore, Ph.D. is a Research Fellow at the Department of Mathematical Sciences of the Politecnico di Torino, Italy. Her research interests lie in Engineering Education, the development and standardization of learning technology, spatial abilities, game-based learning, and gender issues.

Learner-Oriented Game Design: The Evolution of Cipher
Liang Xu (Dublin City University, Ireland); Jenny Thomson (University of Sheffield, United Kingdom (Great Britain)); Elaine Uí Dhonnchadha (Trinity College Dublin, Ireland); Monica Ward (Dublin City University, Ireland)
This paper explores the integration of a digital game, Cipher, into language learning. It emphasises the balance between maintaining a playful game approach and ensuring robust pedagogical foundations. Motivating learners, especially for endangered languages (in this case Irish), can be challenging, and game-based learning offers an effective solution. The game has evolved via a pragmatic, pedagogically informed, learner-oriented game design approach. The game includes key elements such as levels, player choice, and an overarching narrative designed to avoid the chocolate-covered broccoli scenario. The game framework, derived from an existing model, is designed to be modular and to be language independent. This adaptability to the local culture, language and content... Through the co-creation process, involving iterations, resulting in enhanced content and features. This semi-agile approach enabled the feedback and insights from teachers and learners, has driven the game's refinement through iterations, resulting in enhanced content and features. Cipher serves as a valuable asset for low-resourced languages, fostering inclusivity by catering to individual learning speeds and diverse learner needs. This paper outlines an approach centered on repurpose, pragmatism, and co-creation, which holds promise for similar application across various other contexts.

Presenter bio: Liang Xu is a doctoral researcher and a lecturer at Dublin City University, affiliated with the SFI Centre for Research Training in Digitally-Enhanced Reality. His research interests include Computer-Assisted Language Learning, Natural Language Processing, Human-Computer Interaction, games and Virtual Reality.

A Video Game About Gulag Archaeology and the Memoirs of Women Prisoners
Konstantinos Cornelis Apostolakis, Ntaris Papadimitriou and Anastasia Nikolaou and Stefania Stamou (Foundation for Research and Technology - Hellas, Greece); Stavroula Ntoa (ICS-FORTH, Greece); George Margetis (Foundation for Research and Technology - Hellas (FORTH), Greece); Constantine Stephanidis (FORTH, Greece)
Video games can be an effective medium for serious applications. They also offer people an opportunity to virtually explore past present sites of historic importance. With the growing popularity of video games comes the need for developing more inclusive and accessible content... offer-centered design, we demonstrate a collaborative and inclusive tools to facilitate the direct engagement of historians in video game development and human-computer interaction designers established a platform for exchanging knowledge and... historical argument, and the game features elected to convey it. Thus, in this paper, the resulting prototype itself, whereby we distill our experience into higher-level takeaways, with hopes of informing similar interdisciplinary game design undertakings.

The Introduction Regarding an Implementation of Local Revitalization RPG in Ishinomaki City
Yasunaga Yamaguchi (Sendai University); Yuta Mitsuhashi (Shizenkan University, Japan)
This study explores the symbiotic relationship between regional revitalization and smartphone game applications, focusing on their potential for sustainable development. Smartphone games, with their strategically integrated into local culture, serve as tools for catalyzing tourism and fostering local connections. This article the case of Ishinomaki City in Japan highlights the importance of tailoring game apps to specific regions through collaborative endeavors. The study underscores the role of smartphone game apps as act as educational tools and platforms addressing social issues, contributing to sustainable development. We conducted an exploratory experimental survey in this study and revealed that player improved players' attachment and interest in Ishinomaki City. The study delves into the Local Revitalization RPG in Ishinomaki City, showcasing its innovative approach and potential for both domestic and international tourism. The convergence of regional revitalization and smartphone gaming presents a promising frontier, intertwining economic prosperity, cultural preservation, and discover innovative approaches supporting sustainable development.

Friday, June 7 9:00 - 10:30 (Europe/Rome)

DEMO-EC: Demos (Machine Learning and HMI)
Room: Energy Center - Hall & Foyer
Chair: Alberto Cannavò (Politecnico di Torino, Italy)

COM-PRESS: Dashboard to Detect (AI-based) Image Manipulations
Hannes Mareen (Ghent University - Imec & IDLab, Belgium); Stephanie D'haeseleer; Kristin Van Damme and Tom Evens (Imec-Mict-UGent, Belgium); Peter Lambert (Ghent University - imec & IDLab, Belgium); Glenn Van Wallendael (Ghent University - Imec & IDLab, Belgium)
Manipulating images used to require some expertise using tools such as Photoshop, but has become easier using AI-based tools such as deepfake faceswap apps and Adobe's new Generative Fill. There is a growing concern that manipulated images will be used more frequently for disinformation purposes. Although manipulation detection methods have been proposed in the scientific literature, these are not accessible to non-technical people such as journalists, and often require expensive hardware.

To address this challenge, we designed the COM-PRESS dashboard, which provides easy access to image manipulation detection methods. As such, we aid journalists in fact-checking processes. Although fact-checkers are the main target group, the tool is publicly available such that anyone can investigate forged images, on **https://com-press.ilabt.imec.be**.

Users can upload images, after which they will be analyzed by 13 open-source detection methods on our server. The results are visualized on our website as heatmaps that aim to localize potential forgeries.

Several additional features are available. First, a transparency slider enables to overlay the heatmap on the original image to simplify visual inspection. Second, an embedded code button enables journalists to copy-and paste the heatmap and transparency slider in online articles. Third, factcheckers and experts can add comments to provide extra context and aid the interpretation when sharing the analysis results.

COM-PRESS is an interdisciplinary project, which fosters collaboration between computer and communication scientists, as well as the media, and received subsidies from the Flemish government's Department of Culture, Youth & Media.

In summary, COM-PRESS is a valuable tool to perform image verification and counter disinformation. By making open-source detection techniques publicly accessible, it empowers journalists with extra resources to confirm image authenticity and uphold the spread of truthful information amidst the rise of online disinformation.

Presenter bio: Hannes is a Postdoctoral Researcher at IDLab-MEDIA, Ghent University - imec, Belgium. He obtained the M.Sc. degree and PhD degree in Computer Science Engineering from Ghent University - imec, Belgium, in 2017 and 2021, respectively. His research interests include multimedia compression, security, and forensics.

Harnessing Foundation Models for Image Anonymization
Luca Piano (Politecnico di Torino, Italy); Pietro Basci (Politecnico di Torino, Italy); Fabrizio Lamberti and Lia Morra (Politecnico di Torino, Italy)
Traditional deep learning pipelines involve multiple intricate steps, from data acquisition to model training, fine-tuning, and deployment. However, recent advancements in foundation models, particularly in text-to-image generation, offer a paradigm shift in addressing tasks without the need for these conventional processes. In this paper, we explore how foundation models can be leveraged to solve tasks, specifically focusing on anonymization, without the requirement for training or fine-tuning. By bypassing traditional pipelines, we demonstrate the efficiency and effectiveness of this approach in achieving anonymization objectives directly from the foundation model's inherent knowledge. Our findings underscore the transformative potential of foundation models in simplifying and accelerating deep learning tasks, paving the way for novel applications in various domains.

IMMERSE: IMMersive Environment for Representing Self-Avatar Easily
Eros Viola, Matteo Martini, Fabio Solari and Manuela Chessa (University of Genoa, Italy)
Recently, the importance of having a representation of the users inside Virtual Reality (VR) by using avatars, which replicate the movements of real humans, has grown in several fields of application. Nowadays, developers can use many off-the-shelf devices for visualizations and tracking. Game engines like Unity 3D and Unreal allow to easily integrate packages to manage head-mounted displays and trackers. However, building an end-to-end VR application including the user's avatar... of tracking and switching among different tracking modalities is not an easy task. In this paper, we present IMMERSE, an open-source framework based on Unity, to achieve a full representation of the human body, e.g., combining full-body and hand kinematics solver. IMMERSE allows developers to create a VR avatar in a virtual environment, animate it through different sources of 6DOF tracking measurements, which are also interchangeable during the simulation, and providing a means to easily connect other avatars to output the analysis techniques.

Presenter bio: Fabio Solari's Matteo Martini is a first-year Ph.D. student in Computer Science at the University of Genoa. He obtained his Bachelor's and Master's degrees in Computer Science in 2020 and 2023, respectively, both at the University of Genoa. Currently, he is working at the Perception and Interaction Laboratory (PILab) within the Department of Informatics, Bioengineering, Robotics, and Systems Engineering (DIBRIS). His current research interests include Virtual and Mixed Reality, with a focus on physical and cognitive rehabilitation through immersive and non-immersive solutions, as well as natural manipulation in mixed reality.

The Development of a Data Glove-Based System for Assisting the Solution of Puzzles
Kazuma Sato and Lei Jing (University of Aizu, Japan)
Over the past years, it has become possible to reconstruct real-world activity in the XR environment due to advanced wearable devices. In this paper, we aim to develop a human-interactive operation assistant system utilizing pressure distribution data gloves by employing LDCNN. LDCNN model showed 98.83% accuracy. A human-interactive operation assistant system proves that 1.52 times faster average solving time than without this system and improves the number of mistakes while glove applications.

9:00 A Design of Handgrip Exergame System for Hypertension Prevention
Jin Ti Anggraeni, Yanqi Xiao and Nobuo Funabiki (Okayama University, Japan); Cheng-Liang Shih, Jun-You Liu and Chih-Peng Fan (National Chung Hsing University, Taiwan)
Currently, the high blood pressure or hypertension becomes the most serious risk for people around the world. According to the World Health Organization (WHO), approximately 1.28 billion people at 30-79 years old are estimated to suffer from hypertension. It is known that isometric handgrip exercise can reduce blood pressure if done... hypertension. Then, exercises using a foam ball can control the blood pressure. Then, a simple exergame system for performing handgrip exercises while playing video games is presented to motivate people, particularly seniors, to perform the handgrip exercise... one requiring only one standalone PC with a camera. The handgrip gestures for the game control are defined and will be recognized by Mediapipe. The preliminary implementation using one simple game is introduced. The implementation and evaluation of our proposal will be in future works.

Presenter bio: Chih-Peng Fan received the B.S., M.S., and, and Ph.D. degrees, all in electrical engineering, from the National Cheng Kung University, Tainan, Taiwan, R.O.C., in 1991, 1993 and 1998, respectively. During October 1998 to January 2003, he was a design engineer with N100, Computer and Communications Research Laboratories (CCL), Industrial Technology Research Institute (ITRI), Hsinchu, Taiwan. In 2003, he joined the faculty of the Department of Electrical Engineering, National Chung Hsing University, Taichung, Taiwan, where he is currently a full Professor. He has published more than 200 technical papers. His teaching and research interests include digital video coding, digital image processing, VLSI signal processing, and baseband transceiver design and implementation.

Level Up Lab projects' showcase
Leonardo Pieraccioli (Politecnico di Torino & Level Up Lab, Italy); Daniel Bologna, Gabriele Massimiani, Ilaria paoloni, Martina Piumani, Pietro Uras and Francesco Strada (Politecnico di Torino, Italy)
Level Up Lab (LUL) is a student team from Politecnico di Torino driven by a collective passion for video gaming. This student-led initiative seeks to elevate game development skills among the student body, preparing them for successful careers in the gaming industry while cultivating a vibrant community. The student team, focused on active development of video games by fostering a collaborative environment... team is crafting a game that features a compelling narrative and lifelike graphics, leveraging the power of Unreal Engine 5. Another is pioneering in the realm of XR gaming with a project designed for the Quest 3 device, exploring new interactive experiences. A third team draws inspiration from the iconic "Nintendo-style," aiming to replicate its classic game mechanics and visual appeal. Meanwhile, another group is delving into a mystery-themed game, and the last team is managing a game as a goal for the conference exhibit is to unveil the alpha versions of these games to the broadest possible audience, gathering valuable feedback to refine the projects further. Additionally, LUL members aim to present the overarching student team activities and vision to broaden the game development community within universities.

Presenter bio: I am a master student in Computer Science at Politecnico di Torino and Co-Founder of Level Up Lab, a student organization aimed to develop skills in the game development field.

Friday, June 7 9:00 - 10:30 (Europe/Rome)

DEMO-LC: Demos (VR)
Room: Conference room "Luigi Cinimera"
Chair: Alberto Cannavò (Politecnico di Torino, Italy)

Level Up Lab projects' showcase
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Presenter bio: I am a master student in Computer Science at Politecnico di Torino and Co-Founder of Level Up Lab, a student organization aimed to develop skills in the game development field.

Inviting Motion
Wobbe F Koning (Monmouth University & IdeeFIX, USA)
Interactive Virtual Reality (VR) experience with themes of enticing, luring, attention grabbing, and having to give something up when we give into attractions. It comes shrink wrapped, meaning the user is presented with terms and conditions which have to be approved to enter the experience. This mirrors many of our online interactions and foreshadows a hidden theme that is only revealed at the end. The start of main experience is built on the presumption that humans are extremely good at recognizing human motion. Standing on a platform floating in space, the user has to find the dots (points) representing the human figure in a cloud of similar points. And indeed, users are usually able to do so when a very limited amount of points is used for this figure. The human figure then invites the user over to the platform that appears under it, setting off a series of events where the user reacts to, and interacts with the human figure. Though one may argue that any interactive experience is a game, there is no specific goal. Creating an aesthetically pleasing world, albeit a pretty minimalistic one, was one of the goals for this project. At the end of the experience, the user is confronted with a hidden layer in the project. Has the user been watched all this time? An algorithm seems to have been gathering data, a data cloud has formed. The surveillance economy is based on harvesting the data we give consciously and unconsciously. Does being made aware of the algorithmic data sucking change your experience? The time spent in the virtual world of surveillance, is it worth it when in essence you are being manipulated?

Presenter bio: Wobbe F. Koning is an award-winning animator and digital artist often combining 3D Computer Animation and video with audio to create mostly linear single channel works. His work has been included in the SIGGRAPH Art Gallery and numerous animation festivals, and has received three awards from the ASIFA East Film Festival, among other recognitions. He has been exploring virtual (VR) and augmented reality (AR) as a medium, experimenting with different interaction methods in a set of computer and... He teaches animation at Monmouth University in New Jersey, U.S.A.

Translating Cognitive Behavioural Therapy Strategies Through VR Interactions to Tackle Anxiety Symptoms in University Students
Swapnali Kulkarni (United Kingdom (Great Britain)); Kurtis Weir (Birmingham City University, United Kingdom (Great Britain))
Rising anxiety amongst university students not only adversely affects their academic performance but contributes towards a troubling decline in overall mental well-being. Existing psychotherapy such as Cognitive Behavioural Therapy (CBT) can work towards improving this, yet many barriers prevent CBT from being accessed, particularly from a student perspective. Our research proposes a modern solution utilising a Virtual Reality (VR) to help deliver digital CBT strategies, investigating their suitability and effectiveness across a 30 student study alongside the guidance of psychiatrists. Participants found that gamified VR interactions contributed towards greater visualisations of core CBT principles as well as improved engagement, but 3D environments and elements such as avatars must be believable to maintain a sense of realism. Feedback showed a keen interest towards the development of such applications, prompting further investigation.

Exploring the Time Dilation Gameplay in VR, and Its Effect on Presence, VR Sickness, and Performance
Louis Nisiotis, Panayiotis Hadjiprocopiou and Nicholas Nouis (University of Central Lancashire Cyprus, Cyprus)
This study explores the effect of Time Dilation gameplay mechanic in a VR game and its impact on players' subjective feelings of Presence, symptoms of VR sickness, and to their gaming performance. A comparative study was conducted using a VR First Person Shooter game prototype involving two experimental conditions: Normal Gameplay and with Time Dilation, manipulating the in-game time to almost complete standstill when the player stops moving. The results revealed that the Time Dilation mechanic did not affect the players' feeling of Presence, and yielded relatively lower VR sickness, highlighting no need for further investigation. The mechanic did not affect players' in-game performance, but it impacted the way they were navigating and spatially exploring the environment, hence, considerations need to be made in the way such mechanics are designed for VR... The main contributions of this paper are: (i) insights on the impact of Time Dilation mechanic on players' Presence; ii) the impact of the mechanic on VR Sickness; and iii) its influence on player performance, providing valuable information for game developers and designers.

HiveVR: Enhance Realism Interaction in Virtual Reality Using Physics
James Price (Third Kind Games, United Kingdom (Great Britain)); Xi Guo (Birmingham City University, United Kingdom (Great Britain))
Beekeeping is good for the environment in the long run, but it needs a lot of training. Virtual Reality (VR) training simulations serve as an alternative teaching method when learning in the real-world environment is not suitable due to financial and physical constraints. HiveVR is a VR simulation allowing users to learn the process of beekeeping... Additionally, simulating realistic interaction, especially when interacting with virtual objects, presents challenges. The project contributed knowledge about how to design and implement physics-based interaction in VR. The user testing features in VR and achieving realistic interaction using game physics. The result is a... facilitate beekeeping training. The level of realism including visual, audio, and interaction aspects, aligns well with the learning content and allows learners to immerse themselves in the training.

Semi-Automated Digital Human Production for Enhanced Media Broadcasting
Miriana Martini and Valeria Valentini (Politecnico di Torino, Italy); Roberto Iacoviello (Rai - Radiotelevisione Italiana, Italy); Maurizio Montagnuolo (RAI - Radiotelevisione Italiana, Italy); Alberto Cannavò (Politecnico di Torino, Italy); Andrea Bottino (Politecnico di Torino, Italy); Francesco Strada (Politecnico di Torino, Italy); Davide Zappia (RAI, Italy)
In recent years, the application of synthetic humans in various fields has attracted considerable attention, leading to extensive exploration of their integration into the Metaverse and virtual production environments. This work presents a semi-automated pipeline that aims to find a fair trade-off between high-quality outputs and efficient production times. The project focuses on the creation of a Digital Rai photo and video archives to find images of target characters for training and 3D reconstruction with the goal to revive Rai's 2D footage and enhance the media experience. A key aspect of the pipeline is that it aims to minimize the human intervention, ensuring an efficient, flexible, and scalable creation process. In this work, the improvements have been distributed among different stages of the process: digital human creation, starting with the generation of 3D head meshes from 2D images of the reference character and then moving on to the generation, using a Diffusion model, of a realistic subject image for texture development. These assets are then integrated into the Unreal Engine, where a set of custom widget facilitates posing, rendering, and texturing of Synthetic Humans models. Finally, a thorough quantitative comparison made between the characters' original images and the rendered Synthetic Humans to ensure an objective assessment of their similarity. In addition, subjective tests were performed to validate the chosen objective metric.

Presenter bio: Roberto Iacoviello is a Research Engineer, graduated from Politecnico di Torino. Since 2007 he has been working at the Rai R&D where he has developed the following skills: End-to-end video compression for broadcast, Computer Vision, Augmented and Virtual Reality, Professional interfaces for TV, Smartphone and Head Mounted Displays. His current research focuses on AR and immersive media technologies. He has been involved in several European projects, and he is a member of the Moving Picture Experts Group (MPEG) and Moving Picture, Audio and Data Coding by Artificial Intelligence (MPAI). He has established collaborations with national and international research institutions, in research projects and tutorship for students and he counts several publications in international journals and conferences.

Friday, June 7 9:00 - 10:00 (Europe/Rome)

S7-EC: Cultural Heritage & Engagement
Room: Energy Center - Auditorium
Chair: Alessandro Visconti (Politecnico di Torino, Italy)

9:00 Is Loot Box Presence in Video Games Being Correctly and Consistently Labelled? Comparing All Age Rating Decisions Made by the German USK, the American ESRB, and the European PEGI in 2023
Leon Y. Xiao (IT University of Copenhagen, Denmark)
Loot boxes in video games that provide random rewards in exchange for real-world money have been identified as gambling-like and potentially harmful. Many stakeholders are concerned. One regulatory approach is to label games with loot boxes with a presence warning. This has been adopted by the age rating organizations of Germany (the USK), North America (the ESRB), and Europe (PEGI). Previous research, by cross-checking the historical age rating decisions of the ESRB and PEGI, failed to label certain games with loot boxes as containing them. The USK only started identifying loot box presence from 2023 and so could not previously be studied. All age rating decisions concerning games with loot boxes made in 2023 by the USK, the ESRB, and PEGI were compared. This process identified how the USK has seemingly (i) failed to label two games as containing

loot boxes and (ii) adopted an unspoken policy of giving games with loot boxes a USK 12 (i.e., ‘approved for children aged 12 and above') at a minimum. Confirmation of the above has been sought from the USK, and an official reply has been promised and is expected imminently. In addition, the ESRB and PEGI have correctly labelled all games with loot boxes that they assessed in 2023 as containing them, thus giving the public more confidence in the reliability of their age rating information and demonstrating an improvement from their performance in previous years.

9:15 ***Exploring Methodologies to Create a Unified VR User-Experience in the Field of Virtual Museum Experiences*** ☐
Rojin Bayat and Elios De Maio (Fondazione LINKS, Italy); Jacopo Fiorenza (Politecnico di Torino, Italy); Massimo Migliorini (Fondazione LINKS, Italy); Fabrizio Lamberti (Politecnico di Torino, Italy)
The emergence of Virtual Reality (VR) and metaverse have opened doors to new research opportunities and frontiers in User-Experience (UX). When it comes to the cultural heritage domain, one of the key concepts is that of the Virtual Museums (VMs), whose definition has been extended through time by many researches and applications. However, most of the studies performed so far focused on only one application, and studied its UX without taking into account the experience with other VR experiences possibly available in the VM.The purpose of this work is to give a contribution for an optimal design to create a unified UX across multiple VR experiences. More specifically, the research included the development of two applications, respectively a VM in a metaverse platform and a virtual learning workshop as an individual application. With this premise, the study will also consider two fundamental elements for an effective UX design: Virtual Environment (VE) and Intelligent Virtual Avatar (IVA). In particular, the latest was developed following current trends about generative AI, integrating an IVA powered by a Large Language Model (LLM).

Presenter bio: Jacopo Fiorenza received the B.Sc. and M.Sc. degrees in Cinema and Media Engineering from Politecnico di Torino University, Italy, in 2019 and 2022. He is a Ph.D. student at Politecnico di Torino, with interests in interactive graphics applications, virtual and augmented reality, and cultural heritage VR experiences.

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9:25 ***Deeply Digging in Serious Games for Archaeology*** ☐
Vittorio Murtas and Vincenzo Lombardo (University of Turin, Italy)
Over the years, serious games (SGs) - the games whose main objective is not only entertainment - have become a useful tool for teaching, informing, and drawing awareness to significant research topics. A popular application domain is archaeology. Archaeology raises interest in its core activities involving the application of methodologies like excavations and the production of interpretations, which are crucial in reconstructing the culture of ancient civilizations. In the interpretive process, connections with anthropological and historical theories are essential, ensuring the accuracy and authenticity of hypotheses. Archaeological topics can be addressed in the diverse components of serious game architecture: game mechanics, feedback, challenges, narrative, and game setting, with similarities and differences between approaches in similar situations, giving rise to myriad solutions to engage players with archaeological findings and practices. Through a comprehensive analysis of the mapping between archaeological features and game components, the paper contributes to providing insightful information for game design and game studies. In particular, it addresses how space and time are treated in serious games for archaeology and the different roles assumed by the players while engaged in them.

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9:40 ***From Entertainment to Mental Health Awareness: The "Debris" Case*** ☐
Dalila Martins (University of Aveiro & DeCA, Portugal); Nelson Zagalo and Ana Patricia Oliveira (University of Aveiro, Portugal)
Digital games are increasingly being used as support and treatment tools in the field of mental health. Platforms such as Steam and Playstation already offer game options aimed at mental health, in which developers and consultants work together to convey the reality of patients and reduce stigma. The article presents an analysis of the video game "Debris" in order to understand how the game was designed methodologically and how the story is presented and the "serious" message conveyed. In addition, all the comments on Steam were analyzed to see which dimensions of game design have the most impact on player satisfaction. The analysis showed that "Debris" was designed using a participatory methodology in which the story contains a plot twist at the end, at which point the player understands the game's serious message. In terms of the reviews of the comments, the story and aesthetic dimensions had the most positive comments, while the technology only had negative comments.

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Friday, June 7 10:30 - 11:00 (Europe/Rome)

IF3: Industry Forum (Pindarica) ☒
Paolo Arlenghi, Matteo Ciondini, Oscar Rositani (Compagnia Pindarica)
Room: Energy Center - Auditorium
Chair: Filippo Gabriele Pratticò (Politecnico di Torino, Italy)

10:30 ***Technology and Performing Arts: a human-based approach***
Paolo Arlenghi (Compagnia Pindarica, Italy)
How can Technology improve a live experience in the field of performing arts? How can it be a tool and not the goal of the artistic work? In a human-based approach the starting point of the creative process is the experience lived by the audience, not the goal. :-Pindarica is a multimedia theatre company based in Turin; its research is focused on using technology to enhance the possibilities of human experiences, above all for the youngest generations and in urban and street shows.

CASE STUDY: VisibiLords. A street theatre performance in which a hidden projection system allows performers to make images appears on walls and any surfaces like magic. This generates a "wonder effect" on audience, that is part of the artistic experience. As Arthur Clarke said in "Profiles of the Future: An Inquiry into the Limits of the Possible" (1962): "Any sufficiently advanced technology is indistinguishable from magic"

Friday, June 7 11:00 - 11:30 (Europe/Rome)

CF5: Brunch (Coffee Break) ☒
Room: Energy Center - Hall & Foyer

Friday, June 7 11:30 - 12:15 (Europe/Rome)

KN3: Keynote (M. Zuffo) ☒
Marcelo Zuffo
Room: Energy Center - Auditorium
Chair: Filippo Gabriele Pratticò (Politecnico di Torino, Italy)

Friday, June 7 12:15 - 13:20 (Europe/Rome)

S8-4T: SS05 (AI Beyond Boundaries) ☒
SS05 | Beyond Boundaries: Exploring Advanced Image Processing and Al's Impact on Data and Life Sciences
Room: Classroom 4T
Chair: Thi Thi Zin (University of Miyazaki, Japan)

12:15 ***Designing an Image Classification-Based Mobile Learning App About Fruits and Vegetables for Children*** ☐ ☐
Intan Syazwani Abdul Rahim (Universiti Putra Malaysia, Malaysia); Auzi Asfarian (Bogor Agricultural University, Indonesia); Nurul Amelina Nasharuddin (Universiti Putra Malaysia, Malaysia)
Most people are aware that fruits and vegetables are healthy, but not many are familiar with the differences between them, especially among children. There are considerable differences between fruits and vegetables in terms of size, colour and shape. Mobile apps that can automatically identify Malaysian fruits and vegetables based on images are scarce, and a comprehensive yet children-friendly mobile app that can help children differentiate and identify fruits and vegetables is also limited. This proposed mobile learning app includes a practical and functional interface that will help, especially the younger generations, classify fruits and vegetables based on the uploaded or captured images. Users will be able to read the information about the fruits and vegetables and play mini-games to test what they perceive from this app. There will be more than 30 types of fruits and vegetables that will be classified, and this app will mostly focus on Malaysian fruits and vegetables. A human-computer interaction expert will review the proposed user interface designs to make sure they are appropriate for children after gathering the target users' expectations for the app using a checklist. This app differs from other existing mobile apps in that it focuses more on children, and its development will provide children with convenience by allowing them to learn about eating healthy at any time.

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12:25 ***Saliency Map Generation Based on Human Level Performance*** ☐
Ehsan Amini (Science and Research Branch, Islamic Azad University, unknown); Saleh Javadi and Siamak Khatibi (Blekinge Institute of Technology, Sweden)
Generating precise saliency maps from eye tracker fixation points is a challenging task influenced by environmental factors and the choice of evaluation metrics. This paper presents a novel, sustainable, scale-invariant, and sampling-independent method for converting fixation points into saliency maps. Leveraging the inherent predictability of human behavior, the proposed method ensures the highest compatibility with the chosen evaluation metric. Moreover, it introduces a mechanism to calculate the maximum achievable similarity score for each conversion. In addition, it offers crucial insights for both saliency map evaluation and the training of machine learning systems dedicated to saliency map generation. Experimental results demonstrate the method's efficacy in producing saliency maps that align seamlessly with diverse evaluation metrics, showcasing its adaptability and predictive capabilities. This approach contributes not only to the refinement of saliency map generation but also to the broader understanding of the intricacies involved in converting eye tracker data into meaningful ground truths.

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12:40 ***A Framework for Individual-First and Public-First Planning Considering Individual Preferences in Theme Park Problem*** ☐
Atsushi Ueno (Osaka Metropolitan University, Japan); Sho Yoshioka and Tomohito Takubo (Osaka City University, Japan)
The theme park problem is one of the benchmarks for mass user support in dynamic resource allocation problems, where the goal is to increase overall utility. The Statement-based Cost Estimate (SCE), which predicts future queues, is a powerful approach to this problem, but it only aims to minimize the total time spent by all users in the park. The Pareto optimal plans and Statement-based Cost Estimate (P-SCE) relaxes the individual optimality in the SCE and performs global optimization at a central server to further improve the total time, but some visitors tolerate unfair solutions. In the past, we proposed the Weighted-utility and Statement-based Cost Estimate (W-SCE) as a framework for attempting direct optimization of individual visitors, who may have different utilities besides time spent. By incorporating the idea of overall adjustment in the P-SCE into individual optimization of the W-SCE, we can expect further optimization of the overall utility. The framework proposed in this paper aims to further increase the overall utility of the theme park without sacrificing the individual utilities. The framework increases the overall utility by choosing quasi-optimal plans rather than some unfair plans. This maintains a balance between the global and individual optimization. Computer experiments confirm that a plan that takes individual preferences into account is selected. As a result, the overall utility increases, and the total time spent is shortened in many settings.

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12:55 ***A Markovian Game Theoretic Framework for Analysing a Queueing System With Multiple Servers*** ☐
Pyke Tin and Thi Thi Zin (University of Miyazaki, Japan)
This paper introduces a Markov game theoretic framework designed to analyze a Markovian queueing system equipped with multiple servers. Our focus lies in modelling a message transmission system, where messages traverse various transmission options, each associated with a cost and governed by a decision process. The primary objective is to investigate the impact of cooperation and communication, or their absence, among servers. The inherent uncertainty regarding the characteristics of the available transmission alternatives is mathematically captured through a Markovian game formulation. Within this framework, we quantify the inefficiency resulting from the self-interested management of individual servers and the associated loss attributed to the decision-making process. Our analysis encompasses diverse scenarios of signaling exchange among servers, providing valuable insights into the system's behavior under varying conditions.

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13:05 ***A Stochastics Branching Process Model for Analyzing Rumor Spreading in Social Media Networks*** ☐
Thi Thi Zin and Pyke Tin (University of Miyazaki, Japan); Hiromitsu Hama (Osaka City University, Japan)
This paper introduces a stochastics branching process model as an analytical tool to study the dynamics of rumor spreading in social media networks. Employing a specialized first-order conditional probability generating function method, we derive a second-order linear regressive equation to characterize the intricate dynamics of rumor propagation. The validation of our model's accuracy is established through a comparative analysis between numerical computations and Monte Carlo simulations. Additionally, we present a derived threshold condition for the spread control factor, also known as the reproduction rate. Numerical simulation results demonstrate that the interactions and responses within social platforms contribute to the rapid onset of rumors while simultaneously diminishing the maximum density of spreaders and the overall scale of the rumors. To provide further insights, we explore analogies between rumor-spreading models and epidemic models. In conclusion, our proposed stochastics branching process model not only enhances our understanding of rumor spreading in social media networks but also offers a valuable framework for investigating the interplay between various factors influencing the dynamics of information diffusion.

Presenter bio: Thi Thi Zin received the B.Sc. degree (with honor) in Mathematics in 1995 from Yangon University, Myanmar and the M.I.Sc. degree in Computational Mathematics in 1999 from University of Computer Studies, Yangon, Myanmar. She received her Master and Ph.D. degrees in Information Engineering from Osaka City University, Osaka, Japan, in 2004 and 2007, respectively. From 2007 to 2009, she was a Postdoctoral Research Fellow of Japan Society for the Promotion of Science (JSPS). She is now a Professor of Faculty of Engineering, University of Miyazaki, Japan. Her research interests include human behavior understanding, ITS, and image recognition. She is a member of IEEE.

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Friday, June 7 12:15 - 13:45 (Europe/Rome)

S8-EC: Serious & Applied Games for Health and Wellness ☒
Room: Energy Center - Auditorium
Chair: Alessandro Tonacci (Institute of Clinical Physiology (IFC) National Research Council of Italy (CNR), Italy)

12:15 ***Difficulty Evaluation of Yoga Poses by Angular Velocity and Body Area Calculation for GPU-Based Yoga Self-Practice System*** ☐
Cheng-Liang Shih and Jun-You Liu (National Chung Hsing University, Taiwan); Irin Tri Anggraini, Yanqi Xiao and Nobuo Funabiki (Okayama University, Japan); Chih-Peng Fan (National Chung Hsing University, Taiwan)
In this study, an extended difficulty evaluation functions of Yoga self-practice system, which is based on OpenPose, is developed by using human skeleton detection. The Yoga self-practice system implements on the NVIDIA GPU-based embedded platform and utilizes the output results for subsequent Yoga self-practice applications. In addition to providing user's Yoga motion guidance, practice options, and user's feedbacks, the self-practice system also offers a difficulty selection function. In this work, two different difficulty assessment methods are proposed in comparison with previous designs, and two indicators for evaluating the difficulty of Yoga poses are introduced. Firstly, angular velocity calculations are used to perform the dynamic and static regions of each instructor's Yoga motion by assessing the magnitude of pose changes in terms of angles during dynamic and static regions. This facilitates the evaluation of difficulty based on angular and temporal analyses. Secondly, the body area enclosed by four key joints of the upper and lower body is calculated to enhance the credibility of the difficulty analysis through the area comparisons. The research provides a series of difficulty analysis and experimental results for instructor's Yoga poses.

Presenter bio: Chih-Peng Fan received the B.S., M.S., and, and Ph.D. degrees, all in electrical engineering, from the National Cheng Kung University, Taiwan, R.O.C., in 1991, 1993 and 1998, respectively. During October 1998 to January 2003, he was a design engineer with N100, Computer and Communications Research Laboratories (CCL), Industrial Technology Research Institute (ITRI), Hsinchu, Taiwan. In 2003, he joined the faculty of the Department of Electrical Engineering, National Chung Hsing University, Tai-chung, Taiwan, where he is currently a full Professor. He has published more than 80 technical journals and conference papers. His teaching and research interests include digital video coding, digital image processing, VLSI signal processing, and baseband transceiver design and implementation.

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12:30 ***A Gamified Framework to Assist Therapists With the ABA Therapy for Autism*** ☐ ☐ ☐
Matteo Cordioli (Politecnico di Milano, Italy); Laura Delfino, Alessia Romani and Elisa Mortini (Spazio Autismo Cooperativa Sinergie, Italy); Pier Luca Lanzi (Politecnico di Milano, Italy)
We present a framework to assist therapists and children with autism spectrum disorder in their Applied Behavioral Analysis (ABA) therapy. The framework was designed in collaboration with Spazio Autismo, an autism center in Mantova, Italy. The framework is a first step toward transitioning from the current paper-based to fully digital-supported therapy. We evaluated the framework over four months with 18 children diagnosed with classic autism, ranging from 4 to 7 years old. The framework integrates a mobile app that children and therapists use during the sessions with a backend for managing therapy workflow and monitoring progress. Our preliminary results show that the framework can improve the efficacy of the therapy sessions, reducing non-therapeutic time, increasing patient focus, and quickening the completion of the assigned objectives. It can also support therapists in preparing learning materials, data acquisition, and reporting. Finally, the framework demonstrated improved privacy and security of patients' data while maintaining reliability.

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12:45 ***A Design of Handgrip Exergame System for Hypertension Prevention*** ☐ ☐
Irin Tri Anggraini, Yanqi Xiao and Nobuo Funabiki (Okayama University, Japan); Cheng-Liang Shih, Jun-You Liu and Chih-Peng Fan (National Chung Hsing University, Taiwan)
Currently, the high blood pressure or hypertension becomes the most serious risk for people around the world. According to the World Health Organization (WHO), approximately 1.28 billion people at 30-79 years old are estimated to suffer from hypertension. It is known that isometric handgrip exercises using a foam ball can control the blood pressure. Then, a simple exergame system of performing exercises while playing video games is essential to motivate people, particularly seniors, for their health. In this paper, we design a handgrip exergame system as a low cost one requiring only one standalone PC with a camera. The handgrip gestures for the game control are defined and will be recognized by Mediapipe. The preliminary implementation using one simple game is also presented. The practical implementation and evaluation of our proposal will be in future works.

Presenter bio: Chih-Peng Fan received the B.S., M.S., and, and Ph.D. degrees, all in electrical engineering, from the National Cheng Kung University, Taiwan, R.O.C., in 1991, 1993 and 1998, respectively. During October 1998 to January 2003, he was a design engineer with N100, Computer and Communications Research Laboratories (CCL), Industrial Technology Research Institute (ITRI), Hsinchu, Taiwan. In 2003, he joined the faculty of the Department of Electrical Engineering, National Chung Hsing University, Tai-chung, Taiwan, where he is currently a full Professor. He has published more than 80 technical journals and conference papers. His teaching and research interests include digital video coding, digital image processing, VLSI signal processing, and baseband transceiver design and implementation.

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12:55 ***Virtual Rehabilitation: XR Design for Senior Users in Immersive Exergame Environments***
Vassilis Charissis (Edinburgh Napier University, United Kingdom (Great Britain)); Soheeb Khan (University of the West of Scotland, United Kingdom (Great Britain)); Samar Altarteer (Dar Al-Hekma University, Saudi Arabia); Ramesh Lagoo (Core Lab plus Ltd, United Kingdom (Great Britain))
The global ageing population presents significant challenges, with healthcare systems strained to meet the needs of an increasingly elderly demographic. Societies face issues related to healthcare costs, caregiving, and maintaining quality of life for seniors. This paper investigates the impact of a prototype Virtual Reality (VR) exergame application designed for musculoskeletal exercise and rehabilitation of senior users. The XR system employs an omnidirectional treadmill that combines VR with physical activity, offering immersive experiences while engaging in therapeutic exercises. This application provides an opportunity to senior users, to stay active whilst in the comfort of their home. The application has been evaluated by ten users providing encouraging results. The paper concludes with the presentation of the results and a future plan to further explore the immersive nature of VR and its impact on enhancing motivation and promoting better overall well-being for the senior population.

Presenter bio: Professor Vassilis Charissis BSc (Hons), MPhil, PhD, MIET, FBCS, FRSA, FDSRI, SFHEA, is currently a Professor of Creative Technologies (VR/AR, AI, UX, UI) at Edinburgh Napier University. Prof Charissis was previously the Director and Founder of the Virtual Reality and Simulation Laboratory (VRS Lab), Virtual Reality Driving Simulation Laboratory VRDS (Lab) and Research Leader of the Visual Affective and Pervasive Research Group (VAPS). His research interests are in the areas of HCI, VR, AR, HUD, AI, Simulation, Human Factors, User Experience Modelling, Serious Games and User Behaviour. During his research career, Prof Charissis has developed systems for QinetiQ, Ford, FIAT Group, Lancia, Alfa Romeo, Opel, Fisher Defense Submarines, NES, NHS Trusts, RCSEd and RCPSG amongst others. His research produced an extensive track record of international scientific publications.

13:10 ***Virtual Reality Multiplayer Experiential Training: Guiding People with Autism Towards New Habits*** ☐
Nicolò Fumero, Vittorio Fiscale, Alessandro Clocchiatti and Agata Marta Soccini (University of Torino, Italy)
Individuals with Autism Spectrum Disorder, at a certain point in their lives, may spend their days in Day Activity Centers. Approaching this habit for the first time is an everyday life change that can often be confusing and overwhelming. To support people during this transition, we propose a virtual reality application based on an immersive and interactive digital twin of an existing center in the city of Torino, Italy. In the virtual environment, users can try several times the experience before facing it in the physical world, following an experiential training approach, with the goal of making the adaptation smoother and alleviating anxiety. In virtual reality, users can explore the space and perform some of the activities available in the center, guided by a virtual avatar, that is controlled by a caregiver. In the current work, we report a preliminary system validation to assess usability by considering several factors, including user experience, sense of presence and negative effects. Our findings suggests positive scores for all the considered parameters.

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13:25 ***Extended Reality & Virtual Reality for Return-To-Sports Screening*** ☐
Glenn Van Wallendael (Ghent University - Imec, Belgium); Julie Artois (Ghent University - imec, Belgium); Hannes Mareen (Ghent University - Imec & IDLab, Belgium); Robbe Capelleman, Joke Schuermans and Evi Wezenbeek (Ghent University, Belgium); Peter Lambert (Ghent University - imec & IDLab, Belgium)
Anterior cruciate ligament (ACL) injuries are common in sports such as soccer, often requiring extensive rehabilitation post-surgery. Return-to-sport (RTS) rehabilitation protocols typically involve clinical and kinematic evaluations to ensure safety. This study investigates the added value of Extended Reality (XR) and Virtual Reality (VR) on movement quality during RTS assessment of male soccer players post ACL reconstruction, compared to healthy control players. Our XR tests were performed using a projection on a big screen on 11 male soccer players with a soccer-related ACL tear. Additionally, our VR tests were performed using a Head Mounted Display (HMD) on 31 male soccer players, including 14 with ACL reconstruction and 17 healthy control players. We performed clinical tests and kinematic analyses with statistical comparisons between testing conditions. The utilization of XR seems to elicit the mechanism associated with ACL rupture more significantly, suggesting its potential value in incorporating XR into RTS screening and rehabilitation protocols. Analysis of the VR-results revealed greater knee flexion and valgus range compared to non-VR, demonstrating VR's potential for enhanced kinematic sensitivity. As such, VR-based kinematic analysis may improve sensitivity in detecting movement deviations during RTS evaluations post-ACLR. Further research is needed across diverse athletic populations. In conclusion, this study highlights the potential for both XR and VR applications in identifying ACLR-related deficits, and motivates their integration with conventional clinical RTS screening batteries.

Presenter bio: Hannes is a Postdoctoral Researcher at IDLab-MEDIA. Ghent University - imec Belgium. He obtained the M.Sc. degree and PhD Degree in Computer Science Engineering from Ghent University - imec, Belgium, in 2017 and 2021, respectively. His research interests cover multimedia compression, security, and forensics.

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Friday, June 7 13:45 - 14:15 (Europe/Rome)

CO: Awards & Closing Ceremony ☒
Room: Energy Center - Auditorium
Chair: Fabrizio Lamberti (Politecnico di Torino, Italy)

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