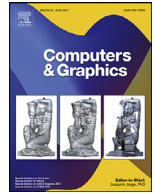


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## Editorial

# Foreword to the Special Section on the Reality-Virtuality Continuum and its Applications (RVCA)



We are delighted to present this special section of Computers and Graphics (C&G) on Reality-Virtuality Continuum and its Applications (RVCA). The Reality-Virtuality Continuum and its use in Applications is rapidly growing. The focus of this special section is to highlight innovation in industry and research in this field. This innovation has been spurred through massive commercial investments across the continuum of next generation applications and new fundamental methods.

From Virtual Reality (VR), Augmented Reality (AR), to Augmented Reality (AR), Mixed Reality (MR), Virtual Storytelling, Virtual Production and Extended-Reality (XR), the RVCA covers the full breadth of ways through which digital innovation is transforming and integrating with our physical world.

This special issue on RVCA attracted 13 paper submissions, from which only five were accepted to this special section of Computers and Graphics. All papers submitted received a rigorous review process, with each being sent for 3–4 external reviews, and revisions before acceptance decisions were made.

The accepted papers cover a diverse range of topics and demonstrate the variety of research directions in the Reality-Virtuality Continuum. The first of these papers from Gumilar et al. [1], describes a study on using hyperscanning with EEG measures to detect brain synchronisation in real and virtual environments. Brain synchronisation has been studied for over a decade in the real world, but this is one of the first studies to see if the same phenomena occurs in Virtual Reality and could have important implications for collaborative VR systems.

Machine learning is becoming popular for AR and VR applications. The work of Li et al. [2] shows how machine learning techniques can be used to generate 3D virtual avatars from a single image. This is extremely relevant for people wanting to have copies of themselves in social VR and AR experiences. The paper of Matulis and Harvey [3] describes an industrial application where reinforcement learning techniques are combined with training a robot arm in VR to control a digital twin in the real world. A virtual robot arm is trained to perform a task in VR and then this learnt behaviour is used to drive the real robot.

The final main theme was on interfaces and interaction. Pfeuffer et al. [4] describe ARtention, a design space for gaze interaction in AR based on the three dimensions of RV Continuum, Information Level, and Task Transitions. This is important as more AR head mounted displays have integrated eye-tracking in them,

and there is a need for better understanding of designing AR gaze interfaces. Bai et al. [5] shows how a fully-feature mobile phone can be brought into VR, enabling the user to see a virtual representation of their real phone, which they can interact with using normal hand gestures.

Overall, these papers highlight a number of interesting areas in the Reality-Virtuality Continuum and demonstrate that there are many possibilities for research in the field. Each of these papers also describe future work that they plan to further extend the work.

We are grateful to Prof. Joaquim Jorge and the Computers and Graphics journal staff for facilitating the publication of this special section. We would also like to thank the authors and the reviewers that helped us greatly with the revision of the manuscripts, for their contributions to the success of this special section.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Dr. Glencross is deputy discipline leader of the Human Centred Computing Discipline at the school of ITEE at the University of Queensland where she leads the Graphics and Visualisation research theme in the Centre for Energy Data Innovation. In this area, she directs research into tools and technologies to visualise and support decision making in Energy sector businesses. With a background in industrially focused research, her work in computer graphics, computer vision and visualisation has been supported through industry contracts, UK-EPSC and ARENA funding. Her work has had commercial impacts across computer games, visual effects, displays, mobile phones and image-based capture

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Edinburgh Napier University's professor Kenny Mitchell is a Technical Director of Rendering for Roblox Corp building the Metaverse. He is also co-founder of 3FINERY Ltd and non-executive director of Cobra Simulation Ltd. An ACM SIGGRAPH pioneer and IEEE Senior he has a wealth of recognized excellence across the highest levels of technology for video games, movie visual effects, consumer products and Theme Park attractions. Whilst an Imagineer, he founded Disney Research in the UK. He co-founded 3FINERY with patented Intermediated Reality communication technology and supports Cobra Simulation Ltd's software strategy for training simulation markets.



Mark Billinghurst is Professor of Human Computer Interaction at the University of South Australia in Adelaide, Australia. He earned a PhD in 2002 from the University of Washington and researches innovative computer interfaces that explore how virtual and real worlds can be merged, publishing over 300 papers in topics such as wearable computing, Augmented Reality and mobile interfaces. Prior to joining the University of South Australia he was Director of the HIT Lab NZ at the University of Canterbury and he has previously worked at British Telecom, Nokia, Google and the MIT Media Laboratory. His MagicBook project, was winner of the 2001 Discover award for best entertainment application, and he received

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