UNIVERSITY OF CAMBRIDGE

STEMM Libraries

Presents

WEST HUB
RESEARCH CAFÉ

INTELLIGENT, CREATIVE AND IMMERSIVE TECHNOLOGIES

Wednesday, 5th February 2025

Welcome

West Hub Library Services are a pioneering reimagining of traditional library resources, seamlessly integrated into the West Hub to support collaboration, creativity, and focused study. Unlike conventional libraries, these services are blended with dynamic and flexible workspaces, digital resources, and community-driven programming, creating an environment that caters to both individual research and group innovation.

With a strong emphasis on technology, study and work zones, and social areas, and library services, the West Hub provides a forward-thinking model that adapts to the evolving needs of modern learners, professionals, and the wider community.

A key feature of this new Library Services model is the Research Café programme, which promotes interdisciplinary collaboration and brings researchers from different fields and sectors together in an informal setting to exchange ideas and explore cutting-edge topics. Designed to make academic research more accessible and engaging, these sessions encourage open discussions and knowledge-sharing over coffee and pizza, creating opportunities for meaningful connections.

Collaborators:

PdOC
Postdocs of Cambridge

OSC
Office of Scholarly Communication

Cambridge Philosophical Society

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RESEARCH CAFÉ

PROGRAMME

Wednesday, 5th February 2025

11:15 Registration

11:30 - 12:00 Poster Session | Pages 2-7

12:00 - 12:05 Welcome

12:05 - 12:20 Keynote Talk | Page 1

12:20 - 13:00 Lighting Talks | Pages 8-13

13:05 Prize draw

13:10 - 14:30 Poster Session, Lunch and Networking

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KEYNOTE

Paul Driver

Paul is the Director of Simulation-based Learning in the Faculty of Health, Medicine and Social Care at Anglia Ruskin University in Cambridge.

Paul's current research interests span several fields, exploring immersive technology, applied game design, generative AI, embodied cognition, and pedagogic theory.

P1

The role of expertises in the intelligent age: Evidence from analytical and creative tasks Dequn Teng - University of Cambridge.

In the contemporary intelligent age, the significance of domain expertise has been widely debated. One perspective suggests that expertise may become less critical because artificial intelligence (AI) systems can function as instructors, rendering specialized knowledge more accessible and broadly available (Gaessler & Piezunka, 2023; Doshi et al., 2024). Conversely, others posit that the role of expertise has become even more essential, given that experts who collaborate with AI can substantially enhance their performance and thus secure a competitive advantage (Jia et al., 2024; Otis et al., 2023). To reconcile these divergent views, this research introduces a two-stage model.

In the first stage, domain expertise is pivotal for decomposing broad tasks into granular subtasks, thereby ensuring that large language models can execute them with high fidelity and reliability. In the second stage, once these subtasks are completed, they are reassembled into routinized workflows. At this juncture, individuals with relatively less specialized knowledge can effectively manage or even excel in these tasks, thus potentially outperforming domain experts. Preliminary experimental results supporting this two-stage approach in analytical and creative tasks are presented, shedding light on how human–machine collaboration can be structured to optimize outcomes in knowledge-intensive domains.

Doshi, A. R., Bell, J. J., Mirzayev, E., & Vanneste, B. S. (2024). Generative artificial intelligence and evaluating strategic decisions. Strategic Management Journal.
Gaessler, F., & Piezunka, H. (2023). Training with AI: Evidence from chess computers. Strategic Management Journal, 44(11), 2724–2750.
Jia, N., Luo, X., Fang, Z., & Liao, C. (2024). When and how artificial intelligence augments employee creativity. Academy of Management Journal, 67(1), 5–32.
Otis, N., Clarke, R. P., Delecourt, S., Holtz, D., & Koning, R. (2023). The uneven impact of generative AI on entrepreneurial performance. Available at SSRN 4671369.

P2

Creative technologies in education: Islamic/Quranic Engagement with Immersion and Interaction Syed Muhammad Sarim Gillani - Digital Humanities Computer Science and the English Department, University of Cambridge.

Islamic education has historically played a central role in shaping the intellectual and spiritual fabric of Muslim societies. However, across Asia, it has significantly declined due to the lasting impacts of colonialism and secular educational reforms, which have relegated Islamic studies to outdated methods of rote memorization and textual recall. To address these challenges, contemporary Islamic schools (CIS) are increasingly exploring the potential of intelligent, creative, and immersive technologies to revolutionize Islamic education.

This research investigates the transformative role of advanced digital tools such as Virtual Reality (VR) and Augmented Reality (AR) in Islamic education. It explores how these technologies can create immersive, interactive learning environments that foster deeper understanding, emotional engagement, and cognitive retention of Islamic teachings. By drawing on global examples such as VR simulations of Islamic history and AR-enhanced narratives in UK-based Islamic schools this study proposes a co-created, technology-driven curriculum tailored to Asia's diverse socio-cultural context.

Using collaborative workshops, ethnographic methods, and iterative prototyping, this research will develop and test immersive solutions that align modern technologies with Islamic pedagogical principles. The findings aim to showcase the potential of VR/AR to redefine Islamic education, making it relevant, engaging, and impactful for the digital-native generation in Asia.

POSTERS

P3

Biomechanical User Simulations for XR Applications Florian Fischer - Department of Engineering, University of Cambridge.

Automated biomechanical testing has great potential for the development of XR applications, as initial insights into user behaviour can be gained in silico early in the design process. In particular, it enables prediction of user movements and ergonomic variables, such as fatigue, prior to conducting user studies. In combination with mathematical methods, biomechanical models provide a powerful tool to simulate interaction movements in a time-continuous and holistic manner. We discuss the potential of these biomechanical user simulations for Human-Computer Interaction and interface optimisation, and present SIM2VR, a system that uses these methods to align user simulation with a given VR application. This system, for the first time, enables training simulated users directly in the same VR application that real users interact with, and constitutes a decisive step towards automated biomechanical testing in XR.

P4

Analyzing Multimodal Interaction Strategies for LLM-Assisted Manipulation of 3D Scenes Junlong Chen - Department of Engineering, University of Cambridge.

As more applications of large language models (LLMs) for 3D content for immersive environments emerge, it is crucial to study user behaviour to identify interaction patterns and potential barriers to guide the future design of immersive content creation and editing systems which involve LLMs. In an empirical user study with 12 participants, we combine quantitative usage data with post-experience questionnaire feedback to reveal common interaction patterns and key barriers in LLM-assisted 3D scene editing systems. We identify opportunities for improving natural language interfaces in 3D design tools and propose design recommendations. Through an empirical study, we demonstrate that LLM-assisted interactive systems can be used productively in immersive environments.

P5

Generating 360-Degree Videos for Immersive Therapeutic, Educational, and Tourism Experiences: Techniques and Challenges

Mahdi Maktabdar Oghaz and Mohammad Abdul Mughni - Faculty of Science and Engineering, Anglia Ruskin University.

The rapid advancement of immersive technologies has heightened interest in 360-degree media, particularly in text-to-video generation for Virtual and Augmented Reality applications in immersive therapy. This research introduces an innovative hybrid framework that addresses the computational and quality challenges of generating spherical-format videos from textual descriptions.

Our approach leverages transfer learning to uniquely combine pre-trained models such as CogVideoX (5B and 2B parameters), Mochi 1 Preview, and Pyramid Flow SD3 with specialised 360-degree video processing techniques. This is implemented through a comprehensive encoder-decoder architecture that bridges traditional 2D video generation with the unique requirements of spherical media.

The framework integrates multiple specialised components: a model-specific text encoder for text processing, pre-trained model layers for initial video generation, and a custom post-processing pipeline featuring trainable upscaling and ResNet chains to enhance spatial coherence. Building on the WEB360 and ODV360 datasets (Cao, Mou, Yu et al., 2024; Cao et al., 2023), we implement an efficient workflow that maintains spatio-temporal consistency using edge processing and various 2D-to-3D projection techniques.

Our experimental evaluations demonstrate significant improvements in temporal consistency and spatial coherence compared to baseline models, while achieving efficient inference on moderate computational resources (T4 and AG10 GPUs). This integrated approach not only advances the field of immersive content generation but also establishes a practical foundation for accessible 360-degree video synthesis in therapeutic and educational applications.

P6

VirtuLabs: Exploring Scientific Laboratories in Virtual Reality Tara Murphy - Immersive Technology Lab, Lucy Cavendish College.

Many students view science careers as unattainable or stereotypically linked to figures like Einstein, contributing to a decline in interest in STEM fields. For example, only 26% of students report engaging in practical science activities at least fortnightly—a sharp drop from 44% in 2016. [1]

Furthermore, research shows that stereotypical perceptions of STEM careers negatively affect students' confidence and expectations for success, further discouraging them from pursuing these fields. [2]

To challenge this misconception, VirtuLabs uses affordable Virtual Reality (VR) technology to open the doors of Cambridge science laboratories to a broad audience, particularly school students and underrepresented communities. We have created a library of prerecorded 360° tours featuring laboratories across the Departments of Physics, Chemistry, Biotechnology, and Materials—all open source and free to use on vrlabtours.com. Using just a smartphone and simple headset, students can immerse themselves in genuine research environments. Through these 360° video tours and interactive snapshots, learners explore cutting-edge work at the University of Cambridge, meet real scientists, and witness pioneering experiments firsthand.

By providing these free and immersive experiences, VirtuLabs makes scientific research more relatable and accessible, regardless of gender, race, or background. Students navigate equipment, learn key scientific concepts, and observe the practical impact of various breakthroughs, all within a user-friendly VR platform.

We hope to spark curiosity, reinforce the message that *anyone* can be a scientist, and bridge the gap between academic laboratories and communities worldwide—removing barriers and inspiring future STEM researchers.

[1] https://www.stem.org.uk/all-news/young-people-show-declining-aspirations
[2] https://stemeducationjournal.springeropen.com/articles/10.1186/s40594-021-00295-y

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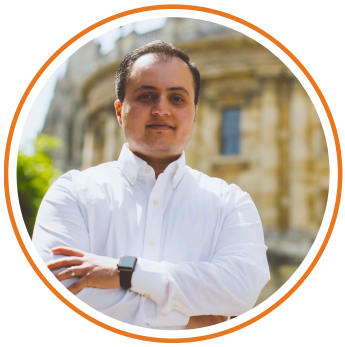
LIGHTNING TALKS

Overcome the fear of public speaking with virtual reality overexposure therapy Dr Chris Macdonald - Immersive Technology Lab, University of Cambridge.

Dr Chris Macdonald is the founder of a first-of-its-kind virtual reality platform where users transform into skilled and confident public speakers. Tailored course material develops core skills and virtual reality training environments accelerate learning and build confidence. Multiple technological firsts were achieved to make the platform uniquely accessible. To build further confidence, Chris developed the concept of 'Overexposure Therapy' (which involves training in extreme scenarios that one is unlikely to encounter in real life). For example, on the platform, users can practice a presentation inside of a virtual reality stadium in front of a noisy and hyper distracting animated audience of 10,000 spectators. The process provides the psychological equivalent of running with weights or at high altitude: it builds extra grit, adaptability, and resilience. Chris unveiled and evaluated the highly effective new protocol in a research paper published in Frontiers in Virtual Reality. Dr Macdonald has received multiple awards for his pioneering research including a Digital Health Award and the National Innovation Award. In 2024, Dr Macdonald was crowned the winner of the 40 Under 40 Award in the highly competitive Science and Innovation category.

LIGHTNING TALKS



XR Technologies (AR/VR) for Co-Creation of Sustainable Built Environments Dr Avar Almukhtar and Dr. Lakshmi Babu Saheer - School of the Built Environment, Oxford Brookes University.

The world faces an environmental crisis due to communities not effectively engaging in the design, planning and transformation of their neighbourhoods and cities. To address this challenge, innovative tools and processes that engage diverse stakeholders and address their concerns are crucial. This abstract highlights the potential of XR technologies in fostering sustainable urban environments for a better future.

XR (Extended Reality) technologies, encompassing Virtual Reality (VR) and Augmented Reality (AR), provide immersive and interactive visualisation capabilities that have the power to revolutionise urban planning and design. By leveraging XR technologies, stakeholders can virtually experience and assess proposed changes in their urban environments, offering a deeper understanding of critical challenges, including environmental impacts and urban sustainability. This enhanced visualisation fosters effective communication and collaboration among urban planners, policymakers, community representatives, and residents, enabling meaningful participation in the decision-making process.

This abstract explores the adoption of XR technologies through two funded research projects in Oxford, both of which focused on actively engaging participants in the co-creation of their built environment. These projects serve as case studies to demonstrate the promising role of XR technologies in advancing inclusive engagement, fostering collaboration, and promoting sustainable built environments tailored to the needs of diverse communities.

LIGHTNING TALKS

Generating 360-Degree Videos for Immersive Therapeutic, Educational, and Tourism Experiences: Techniques and Challenges Mahdi Maktabdar Oghaz - Faculty of Science and Engineering, Anglia Ruskin University.

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LIGHTNING TALKS

Cancer through the looking glass: integrating genomics and radiology in extended reality for multidisciplinary collaboration Tamsin Robb - Early Cancer Institute, Department of Oncology, University of Cambridge.

Interpreting genomic data in its spatial and temporal context is essential for making evidence-based treatment decisions for cancer patients. As genomic analysis on multiple tumour samples becomes routine in clinical care, appropriately interpreting these alongside each other, and in a collaborative multidisciplinary environment, becomes critical.

Here, I introduce a proof of concept extended reality (XR) environment that integrates genomic and clinical data alongside 3D tumour representations for exploration by multidisciplinary teams.

We invited clinical and cancer research experts to interact with the model and consider broad uses in oncology. We share their perspectives on the use of XR in real-world scenarios, where interdisciplinary communication is important, and no one specialist holds all the information required to reach a solution, challenges central to a molecular tumour board, alongside clinician-patient communication and clinical and scientific education. XR is optimally suited for multidisciplinary teams, with opportunities for clinical communication tools in the future.

LIGHTNING TALKS

Improving medical imaging AI models against adversarial attacks Farah - Anglia Ruskin University.

The integration of AI in healthcare has shown significant promise in improving patient outcomes, and enhancing diagnostic accuracy. AI technologies, such as machine learning algorithms and deep learning models, analyze vast amounts of healthcare data to provide valuable insights and support clinical decision-making. However, the increasing reliance on AI in healthcare also raises concerns about the security of AI systems, particularly in the face of adversarial attacks (planned manipulations of input data designed to deceive AI models and produce incorrect or misleading outputs). In healthcare, adversarial attacks can have severe consequences, including misdiagnosis, and incorrect treatment recommendations. These attacks make small, invisible modifications to medical images, intending to fool AI models into making wrong predictions in analyzing images from various modalities such as MRI, CT, and X-ray.

There is a critical need to improve the robustness of AI models against adversarial attacks in healthcare systems. These models need to be robust and accurate against adversarial manipulation. Although the problem of tackling adversarial noise in AI models has been researched using methods such as ensemble learning, and adversarial training, these methods work well against particular adversarial attacks. Additionally, existing defense mechanisms entail high computational costs and may not scale to large medical datasets or real-time clinical applications. Hence, there is a need for more efficient and scalable defense mechanisms easily integrated into clinical workflows without compromising quality of the medical images. Our study aims to enhance AI models' resilience to adversarial attacks through techniques such as frequency domain analysis.

LIGHTNING TALKS

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Upcoming Events:

6th February 2025

WHERE IS THE HUMAN IN THE DATA?

Join us for an event to explore the power of connecting the Arts and Humanities, and Social Sciences (AHSS), and STEM fields to create interdisciplinary collaborations and help create human-centred, innovative solutions.
The evening will feature two inspiring panel discussions, a briefing on interdisciplinary research funding, and a speed-dating networking activity. We hope the relaxed environment with food and drinks will spark creativity and encourage research that transcends disciplinary boundaries.

https://bit.ly/human-in-data

20th March 2025

RESEARCH CAFÉ ON TOUR @MOORE LIBRARY

https://bit.ly/research-cafe-moore

30th April 2025

RESEARCH CAFÉ - POVERTY AND COST OF LIVING

https://bit.ly/research-cafe

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