

Understanding Multidimensional Data: Interactive Virtual Environments (IVE) for Data Visualisation

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This three-part session examines how interactive virtual environments can support the interpretation and communication of multidimensional research data. Through the Mirror XR Data Matrix case study, participants explore how complex behavioural systems can be translated into spatial environments where relationships between variables become perceptible beyond traditional charts and dashboards.

Session Segmentation

2.00-3.00 pm | Part 1: Keynote
3.00-3.45 pm | Part 2: Live VR Demo & Case Study
3.45-4.45 pm | Part 3: Workshop

Learning Outcomes

Out of this session, participants will:

- Understand the challenges of communicating complex multidimensional datasets.
- Learn how immersive environments can support intuitive interpretation of complex relationships within data.
- Explore conceptual frameworks for translating analytical insights into spatial representations.
- Identify opportunities to apply immersive visualisation approaches within their own research domains.

Part 1 - Keynote

Traditional data visualisation techniques such as charts, graphs, and dashboards are highly effective for analytical interpretation within specialised domains. However, many research findings remain difficult to communicate beyond expert audiences because the relationships they describe are multidimensional, dynamic, and often abstract. While researchers can interpret statistical models and visualisations with ease, these representations frequently fail to translate complex insights into forms that are intuitive for industry stakeholders, policymakers, or the public.

Recent developments in immersive analytics suggest that interactive virtual environments may provide new ways to represent complex datasets spatially and interactively. By situating data within navigable environments, users can explore relationships between variables through movement, interaction, and embodied perception rather than solely through static visual representations.

This keynote introduces the conceptual foundations behind translating multidimensional data into spatial environments, setting the stage for the Mirror XR Multidimensional Data Matrix demonstration that follows.

Time	Segment	Content	Audience Takeaway
2.00–2.10	Introduction	Introduce the challenge of communicating complex research data beyond expert audiences. The gap between analytical research outputs and broader understanding in industry and society.	Recognise limitations of traditional visualisation approaches for communicating complex research insights.
2.10–2.25	The Multidimensional Data Problem	Explain the nature of multidimensional datasets where multiple variables interact over time. Provide examples from behavioural systems, social systems, and cognitive environments.	Understand why certain research datasets are difficult to interpret through traditional charts and dashboards.
2.25–2.40	Interactive Virtual Environments (IVE)	Introduce immersive analytics and explain how spatial interaction and embodied perception can support interpretation of complex relationships within data.	Understand how interactive environments can support intuitive interpretation of multidimensional data.
2.40–3.00	Data to Spatial Representation	Introduce the conceptual framework for translating analytical insights into spatial environments: Data → Variable Relationships → Spatial Representation → Data Interaction	Gain a framework for conceptualising immersive data visualisation.

Part 2 – Case Study: Mirror XR Data Matrix

As a case study, the workshop introduces the Mirror XR Data Matrix, a conceptual framework that translates behavioural research data into spatial environments where relationships between variables are experienced rather than simply interpreted. In this model, complex research findings, such as interactions between cognitive load, digital engagement patterns, emotional states, and behavioural responses are represented within an interactive virtual environment. Participants navigate the environment as variables shift, densities increase, and spatial cues change, allowing users to perceive how multidimensional systems evolve and interact over time.

The Mirror XR Data Matrix illustrates how immersive environments can transform abstract analytical relationships into experiential representations. Rather than reading multidimensional relationships through regression tables or layered charts, users can observe and navigate the spatial consequences of interacting variables. This approach highlights how immersive environments can complement traditional visualisation techniques by enabling intuitive understanding of complex behavioural systems.

Time	Segment	Content	Audience Takeaway
3.00– 3.15	Live Demo: Mirror XR Data Matrix	Overview of the conceptual framework and demonstration of how behavioural research variables such as cognitive load, digital engagement, emotional state, and interaction patterns are translated into spatial conditions.	Understand how multidimensional data can be represented through spatial environments.
3.15– 3.45	VR Exhibition	Live demonstration of the Mirror XR immersive environment showing how interacting variables influence spatial density, sensory signals, and environmental conditions.	Experience how relationships between variables become visible through immersive interaction rather than static visualisation.

Part 3 - Workshop

This workshop segment invites participants to reflect on how interactive virtual environments can support the interpretation and communication of multidimensional research data. Building on the concepts introduced in the keynote and the Mirror XR Data Matrix case study, participants will explore how analytical insights can be translated into spatial environments where relationships between variables can be observed through interaction and environmental cues.

Participants will consider datasets from their own research domains and identify relationships that are difficult to communicate through traditional visualisation techniques such as charts, graphs, or statistical tables. Through guided discussion, the session explores how these relationships might instead be represented through interactive spatial systems where environmental conditions, spatial structures, or interactive behaviours reflect underlying data relationships.

Rather than replacing traditional visualisation methods, this session encourages researchers to expand how they think about representing complex systems. Interactive environments can complement analytical approaches by enabling audiences to navigate and experience relationships within multidimensional datasets, offering new possibilities for communicating research insights beyond conventional visualisation formats.

Time	Segment	Content	Audience Takeaway
3.45–4.05	Reflection Exercise	Participants identify a dataset from their own research and reflect on relationships or patterns that are difficult to communicate through traditional visualisation.	Reflect on challenges within their own research communication.
4.05–4.25	Group Discussion	Participants discuss how their research datasets could be translated into spatial or interactive environments using environmental metaphors, interaction design, or narrative structures.	Explore conceptual approaches for immersive data communication.
4.25–4.45	Wrap Up Discussion	Facilitated discussion on opportunities and limitations of immersive environments for communicating research insights.	Leave with new perspectives on communicating multidimensional research data.

As research datasets become increasingly complex and multidimensional, new approaches to communicating analytical insights are needed. Interactive virtual environments offer opportunities to complement traditional visualisation methods by enabling audiences to navigate and experience relationships within data. As research datasets become increasingly complex and multidimensional, immersive environments may offer complementary approaches for communicating analytical insights and enabling broader understanding of complex systems.

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Christel Cherryadi is a multi-award-winning XR AI innovator and founder of Creart Digital Media Pty Ltd, an Australian innovation studio and social enterprise developing research-informed technologies for preventive mental health. Her work focuses on translating complex research insights into interactive environments that support intuitive understanding of multidimensional systems, including their translation into immersive VR storyliving experiences.

As an emerging researcher, Christel leads industry research initiatives exploring immersive technologies for digital wellbeing, experiential learning, and responsible technology design. She is an international keynote speaker and a PhD candidate at the University of Adelaide, working across the Australian Institute for Machine Learning (AIML) and the Australian Research Centre for Interactive and Virtual Environments (IVE). Her work sits at the intersection of immersive technology implementation, applied AI, human-centred innovation, cognitive psychology, and experiential data visualisation.

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