



From top to bottom: a bird's-eye view of Te Rau Aroha marae in Motupōhue Bluff, Aotearoa New Zealand; a front view of its whareniui (ancestral meeting house); and a behind-the-scenes view when capturing 360-degree videos inside the whareniui (images by author, June 2022).



Virtual pūrākau: co-designing adaptive cinematic virtual reality for culturally responsive landscape interpretation at Te Rau Aroha

KRIS TONG

Landscapes hold cultural narratives, but conventional static interpretation struggles to communicate them. This research explored adaptive cinematic virtual reality (CVR) as a spatial storytelling tool, developed with *kaikōrero* (Māori storytellers) at Te Rau Aroha marae in Motupōhue Bluff, Aotearoa New Zealand. The results show that immersive storytelling must move beyond a one-size-fits-all model. By identifying viewer personas and adapting the narrative to them, CVR can support culturally responsive interpretation that respects place-based Indigenous knowledge. Immersive media should therefore be treated not as a technical tool but as a platform for communicating landscape narratives. For landscape architecture, adaptive digital storytelling offers a complementary and non-extractive method of interpretation. It also opens new options for community consultation, site interpretation and stakeholder engagement in the public realm.

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Introduction

Landscapes are more than physical environments. They also hold cultural narratives, memory and Indigenous knowledge. In Aotearoa New Zealand, these narratives are often expressed through *pūrākau* (oral traditions), which are active, spatial practices connecting *mana whenua* (people holding customary authority over the land) to their environment. Communicating such place-based stories to the public is difficult for designers and heritage planners. Conventional interpretive infrastructure, such as signage or plaques, cannot adapt to the different backgrounds and prior knowledge of visitors. It can also clutter sensitive heritage sites, and it freezes living, relational narratives in fixed text.

Immersive media, and cinematic virtual reality (CVR) in particular, have emerged as a way around these limits. CVR lets practitioners turn a physical landscape into narrative without building anything on site, and it keeps the sense of being in a space. Immersive environments are effective at building empathy and contextual understanding of complex environments (Young, O'Dwyer and Smolic, 2022). CVR in the public realm has its own constraints, however. Conventional digital storytelling treats visitors as a single uniform audience. It therefore misses the reciprocal quality of Indigenous storytelling, in which a storyteller reads the audience and adapts the account to keep it culturally safe and relevant. Narrative flow has to be guided carefully; otherwise, the storyteller's intent is lost (Winters and Zhu, 2014; Zagalo, Torres and Branco, 2005).

This paper asks how digital media, and CVR specifically, can be designed to adapt to diverse visitor backgrounds and prior knowledge, and to reveal place-based Indigenous narratives respectfully within cultural landscapes. To explore that question, it reflects on a collaborative project with *kaikōrero* (Māori storytellers) at Te Rau Aroha marae (communal meeting grounds) in Motupōhue Bluff, Aotearoa New Zealand (Tong et al, 2024) (figure 1). The project was grounded in Indigenous research principles (Walker, Eketone and Gibbs, 2006). It involved co-designing a CVR system that adapts what it tells based on the particular 'persona' of the viewer. I argue that adaptive digital storytelling gives landscape practice a culturally responsive tool for site interpretation, community consultation and stakeholder engagement.

KEY WORDS

cinematic virtual reality; CVR; landscape interpretation; cultural landscapes; digital storytelling; Māori heritage; co-design

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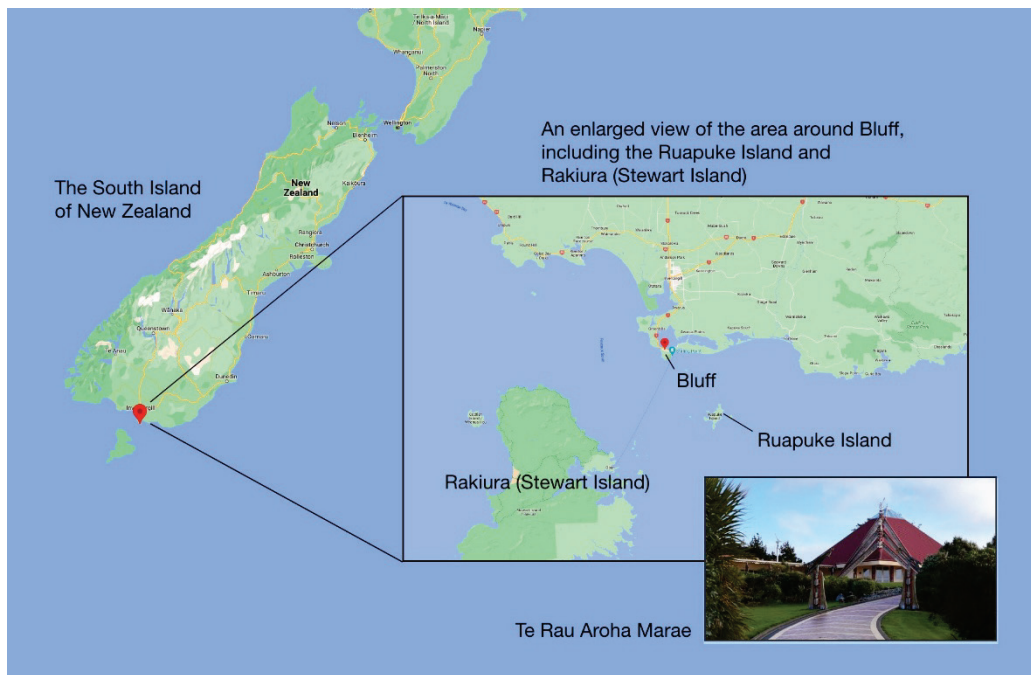


Figure 1. The location of the township of Motupōhue Bluff in the south of Te Waipounamu South Island, Aotearoa New Zealand, along with its immediate surroundings, including the islands off its coast. Te Rau Aroha marae is inset (map data: © 2026 Google; inset photo by author, October 2023).

Approach – part 1: Collaborative and interpretive co-design

To investigate how immersive media can communicate place-based narratives respectfully, this research used a participatory design approach. In that tradition, the people who will live with a system hold authority over its design, rather than being consulted about it (Simonsen and Robertson, 2012). In Aotearoa New Zealand, the tradition is increasingly practised inside Indigenous frameworks rather than alongside them (Harding et al, 2020; Harvey and McEntee, 2026). Specifically, kaupapa Māori principles governed this research (Walker et al, 2006). These principles hold research accountable to the community it concerns, and reject the practice of gathering knowledge from a community and then interpreting it elsewhere (Smith, 2021). Mana whenua kept authority over how their narratives were turned into digital form. The University of Canterbury’s Human Research Ethics Committee approved the research.

For a project like this, the decisive question is not which technology to use. Rather, the key questions are where the camera stands and who it is speaking to. Barclay (2003) drew a distinction between the camera on a ship’s deck, which records Indigenous people for an outside audience, and the ‘camera ashore’, held by the people for whom ‘ashore’ is home. What separates the two approaches is not who operates the equipment but whose conventions decide framing, sequence and disclosure, and who the audience of the work is assumed to be (Hokowhitu, 2013). Putting a 360-degree camera inside a wharenui (ancestral meeting house) makes answering those questions unavoidable. A marae is not a neutral setting, and a recording made there carries the authority of the place whether or not its makers intended it. Treating the system as a camera ashore meant that decisions normally left to a production team – about what is shown, in what order and to whom – stayed with the storytellers.

The collaboration began in 2019, within the wider Ātea programme of Māori-led immersive media research (Regenbrecht et al, 2022). Whanaungatanga (relationships between people) was established long before any recording was proposed, and video capture did not take place until August 2022. Two co-design sessions were held, each with

around eight participants: two kaikōrero from Te Rau Aroha marae, two Māori cultural advisors and the research team.

Both sessions ran as online video conferences under pandemic restrictions. That constraint drew attention to the central problem rather than hiding it, because the reciprocity of face-to-face storytelling is exactly what a video call removes. The first session established what the kaikōrero themselves consider when they tell a story. The second session reviewed and corrected the interaction prototype and persona framework developed from the first session. Only then was the recording made on site, inside the wharenui.

The first session identified the rigidity of conventional digital storytelling as the central obstacle. When guiding visitors through the marae, a kaikōrero reads the audience and adjusts the way they tell the story accordingly. The kaikōrero described this not as personalisation but as knowledge access control. To address this issue in the recording, the research team designed 'personas' for the range of different visitors to the marae. The kaikōrero then corrected our original design substantially.

Our categories proved culturally wrong in ways we had not foreseen. A 'first-time visitor' does not stand, because anyone hearing a story has already been welcomed through pōwhiri (the ceremony of formal welcome). 'No whakapapa' was rejected outright, because everyone has whakapapa (genealogy), and to deny it breaches manaakitanga (hospitality and care for others). The replacement categories became waewae tapu (newcomer) and, for genealogy, mana whenua and Ngā Hau e Whā (the four winds, everyone from afar). The corrected personas drove the adaptive playback control (APC) mechanism described in the next section.

Approach – part 2: Structuring the adaptive narrative and evaluating APC

Following the co-design sessions, building the CVR system meant turning continuous oral tradition into a flexible digital structure. A conventional 360-degree video runs on a fixed timeline, which rules out the adaptability that culturally safe storytelling needs. The solution came from the practice of the kaikōrero themselves. They described telling stories through a cascading three-block model (figure 2). Every group receives a **generic** block, the baseline account offered to any visitor. A **detailed** block is added where the group's access and the time available allow. An in-depth block follows for those entitled to it. Where the audience is known well in advance, such as a wānanga (a forum convened and led by Māori) or a formal delegation, they instead prepare a **special** version beforehand. The recorded pūrākau were therefore structured as a matrix of segments and takes rather than as one continuous file, with each take matching one persona group.

Two kaikōrero recorded stories about the whānau (extended family) wall inside the wharenui, and both accounts were used. Capture used an Insta360 Pro 2 at 8K and 30 fps, mounted on a tripod and kept still, with a separate lapel microphone. The footage was stitched and reduced to 5K in Insta360 Stitcher, before being edited in Adobe Premiere Pro. The camera, the kaikōrero and the wall were positioned so that a visitor can see both the kaikōrero and whatever the kaikōrero is pointing to (figure 3). The camera itself was left running unattended. This is the 'unmanned camera' Strickland (2013) identifies in Barclay's practice, where authorship sits with the people in front of the lens rather than behind it.

This modular repository formed the basis of the system’s underlying mechanism, the APC, built in Unity and delivered on an Oculus Quest 2 headset. The APC works as the digital equivalent of an interpretive guide. Rather than playing a fixed sequence, it checks the visitor’s persona against the available segments, then selects, orders and moves between them. A visitor whose persona shows existing knowledge of te reo Māori (the Māori language) and existing cultural ties receives segments carrying deeper whakapapa knowledge, and skips the introduction that a first-time international visitor would need. For landscape and heritage practitioners, this matrix approach to preparing content offers a sustainable model for digital interpretation. It maintains the digital landscape as a living, editable archive rather than making it a fixed record.

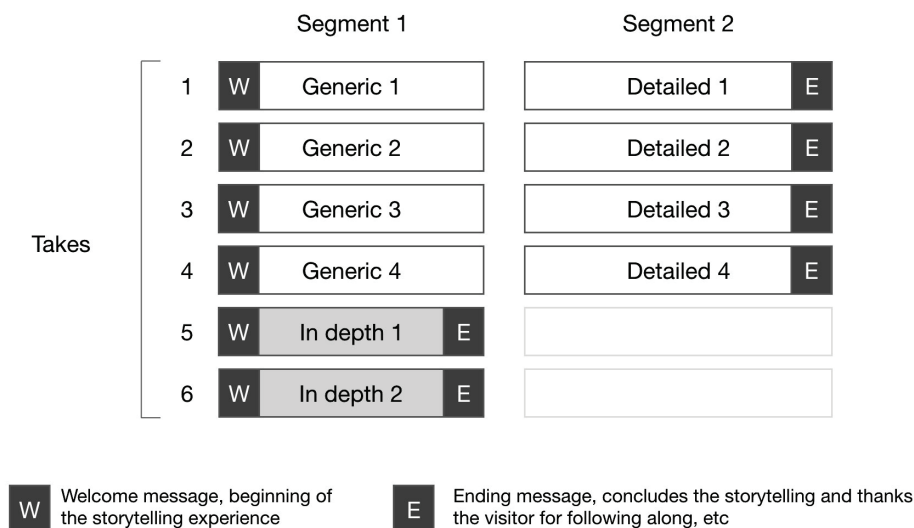


Figure 2. The layout of story bits showing how generic segments, detailed segments and two in-depth special segments were arranged around the six visiting groups. Welcome messages and ending messages were also captured and attached to the main content segments (image by author, January 2024).

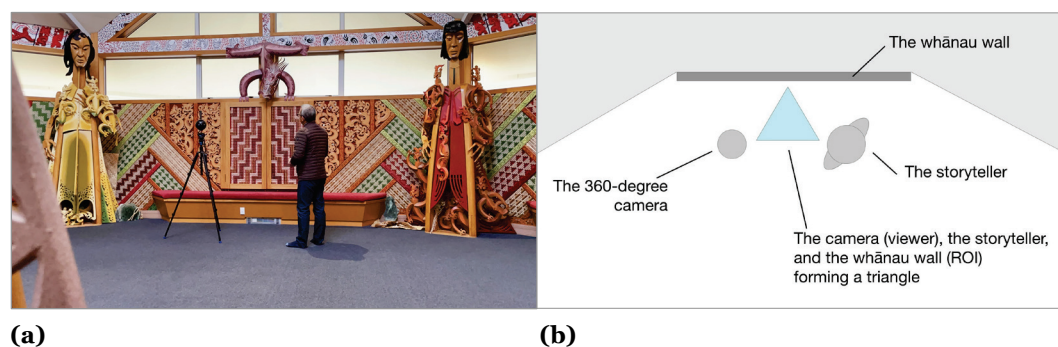


Figure 3. (a) Behind-the-scenes photo showing the capture work at Te Rau Aroha marae. The 360-degree camera and the kaikōrero are both in front of the whānau (extended family) wall. **(b)** Top-down view of the capture site. The camera, the storyteller, and the wall the kaikōrero is talking about are properly arranged so the visitor can later see both the kaikōrero and the wall and follow the gestures of the kaikōrero easily (image by author, January 2024).

After implementation, the adaptive experience was evaluated with the kaikōrero themselves. In landscape practice, post-implementation evaluation is what establishes whether a design meets its intended social function, and the same logic applies here. The session was held kanohi ki te kanohi (face to face) inside the wharehenui. Four kaikōrero each selected two persona groups and worked through the matching narratives. The headset view was

transferred to a monitor so the others could follow and talk while they waited. A semi-structured group discussion followed, covering pacing, cultural safety and spatial representation. This evaluation kept the technology from overshadowing the cultural narrative, so that it worked instead as a clear, culturally endorsed channel for interpretation.

Findings: Culturally responsive digital narratives

Evaluating the adaptive CVR system with *kaikōrero* produced several insights into how immersive media works within a cultural landscape. The main finding is that digital systems must move away from linear, broadcast-style media if they are to communicate *pūrākau* respectfully. They need instead to reproduce the give and take of face-to-face spatial storytelling.

1. Moving beyond a ‘one-size-fits-all’ interpretation

A core insight from the co-design and evaluation phases was that a single uniform narrative does not work. Applied to a sensitive space like Te Rau Aroha marae, conventional digital interpretation such as a standard 360-degree video treats the audience as one undifferentiated group. The *kaikōrero* pointed out that giving complex, culturally layered knowledge to an audience who do not have the necessary grounding is inappropriate, and contrary to *tikanga* Māori (customary practices).

The APC addressed this. By differentiating visitors based on a range of distinct personas, the system adjusted the visual and spoken narrative as it played (Tong et al, 2024). The qualitative findings showed that the digital media could act with judgement. It gave essential historical context to a first-time international visitor, and skipped that introduction to go straight to delivering deeper *whakapapa* knowledge to a viewer with established cultural ties. The key point is that the APC did not alter the truth of the landscape; instead, it altered how much of the narrative reached the visitor, and the depth of the information it conveyed, so that it was appropriate to each persona group.

2. Cultural safety and reciprocal spatial practice

The evaluation showed the importance of cultural safety in digital landscape representation. The *kaikōrero* said the adaptive framework gave them a sense of security, because sensitive site knowledge was safeguarded and released only to appropriate personas.

This is where the ‘camera ashore’ question becomes practical rather than theoretical. The recording exists, so what matters is who decides its release. That is a question of data sovereignty as much as of interpretation, and it is answered here by leaving the decision with *mana whenua* rather than with the system’s designers (Kukutai and Taylor, 2016).

Through this capability, the CVR system reproduced the presence of a human guide in the physical landscape. On a guided visit, a local expert continually reads the questions, cues and prior understanding of the audience, and adjusts their pace and focus in response. When digital media is built to make that same assessment, it stops being a technical novelty and becomes an extension of Indigenous spatial practice. The immersive environment and the adaptive narrative together produced a strong sense of place. Digital tools can therefore uphold the integrity of oral traditions, provided the underlying framework puts the content owners’ protocols first.

Implications

The findings from Te Rau Aroha marae show that culturally responsive digital media moves from being a technological overlay to working as an effective tool for spatial interpretation. This innovation carries at least two major implications for landscape architects, heritage planners and spatial designers.

1. Complementary and non-extractive interpretation

Immersive storytelling offers a complementary method of interpretation for cultural landscapes. As heritage sites face growing pressure from tourism, practitioners have to provide educational experiences without damaging the physical or spiritual integrity of the site. Conventional interpretation often needs physical infrastructure such as pavilions, boardwalks and dense signage, which visually degrades the landscape it explains. Adaptive CVR embeds detailed, multi-sensory narrative into the site experience while leaving the physical environment untouched, so the landscape itself remains as the focus.

It also redefines the role of digital media in communicating place-based narratives. Digital interpretation in the public realm can no longer be a passive broadcast. Persona-driven adaptation of the kind used here requires digital media to take part in the reciprocal relationship between visitor and land. For landscape architecture, this means the digital landscape needs the same cultural consultation, and the same adherence to tikanga Māori, as the physical one.

2. Addressing gaps in professional education and research

Integrating physical and digital environments to form a hybrid approach will require a shift in professional education. Landscape architecture teaching emphasises spatial arrangement, ecology and materials. Using adaptive CVR also demands skill in building digital narrative, identifying visitor personas and designing for audience interaction. That includes structuring branching narratives that carry plural histories respectfully.

There is also a clear research gap. This study evaluated the judgements of the kaikōrero, who are the appropriate authority on cultural fidelity. How diverse public stakeholders – ranging from international visitors to governance bodies – interact with and learn from CVR in the public realm remains thinly evidenced in landscape architecture literature. Building that evidence is necessary to establish best practice for immersive media in statutory planning and public space design.

Conclusions

This paper has argued that immersive storytelling technologies should be seen not as technical novelties but as platforms for communicating landscape narratives and safeguarding cultural knowledge. The case study at Te Rau Aroha marae shows that CVR, coupled with an adaptive framework and co-designed with mana whenua, can address the ‘narrative paradox’ (Winters and Zhu, 2014). Matching what is disclosed to the prior knowledge of specific visitor personas allows the digital experience to respect tikanga Māori, and to preserve the reciprocity that face-to-face pūrākau depends on. For landscape interpretation, this is a shift towards non-extractive, culturally responsive spatial design.

Three limitations bound these claims. First, the analysis of the co-design sessions followed a general inductive approach, but it did not reach the scale of a full thematic analysis, given the time available and the small number of experts who could take part. Second, the evaluation drew on the judgement of the kaikōrero rather than of visiting members of the public. The former are the appropriate authority on cultural fidelity, but they are not a proxy for how a general audience would respond. Finally and most importantly, the persona categories are specific to Te Rau Aroha marae. The kaikōrero emphasised that their reading of whakapapa applies to this marae and would differ at another. What transfers is the method of deriving such categories with mana whenua, not the categories themselves (Harvey and McEntee, 2026).

Looking forward, CVR in landscape architecture should expand beyond heritage tourism into active spatial planning and scenario-based design. Future versions of adaptive CVR should explore both predetermined and real-time viewer interaction, to allow deeper exchange between the digital environment, storyteller and audience (Tong et al, 2024).

Adaptive immersive media also has potential for statutory planning and community engagement. One promising application is CVR in virtual environment court hearings, such as hearings by Resource Management Act 1991 commissioners in Aotearoa New

Zealand. Commissioners could use CVR to ask spatial questions, while proponents and submitters could give their perspectives on a proposed development from within a shared, multi-sensory understanding of the site. CVR also offers new options for community consultation, letting consultants and community members evaluate a site together before any physical work begins.

Finally, adaptive CVR need not be limited to interpretation during a visit. By engaging with users before they arrive or after they leave, practitioners can inform the public, encourage respectful visits, and manage the physical and ecological footprint on sensitive cultural landscapes. As the physical and digital public realms merge, landscape architects should champion adaptive, Indigenous-led digital media frameworks, so that future landscapes remain equitable, dynamic and connected to their cultural foundations.

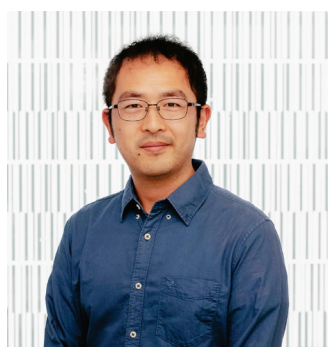
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Declaration of the use of generative AI

The author acknowledges that during the preparation of this work, he used Google Gemini to improve grammar and syntax, in turn improving the clarity and readability of the manuscript. After using this tool, he reviewed and edited the content as needed and he takes full responsibility for the content of the publication. The AI tool was not used in study planning, data processing and analysis, or the generation of original content and ideas.

About the author and collaborators



Author **Dr Lingwei (Kris) Tong** is a postdoctoral researcher at HIT Lab NZ, University of Canterbury who specialises in immersive storytelling. His research explores how emerging technologies like CVR can respectfully capture and present Indigenous narratives connected to place. Drawing on his experience of co-designing culturally responsive digital media alongside Māori communities in Motupōhue Bluff, Kris is passionate about bridging the gap between human–computer interaction and the built environment to craft socially meaningful, dynamic interpretations of cultural landscapes.

Collaborators

Professor Rob Lindeman is the Director of HIT Lab NZ, University of Canterbury. His research on virtual reality began in 1993, and focuses on immersive, multi-sensory feedback systems and the effective application of 360-degree video for environmental outreach. Rob is deeply passionate about democratising immersive technologies and empowering communities, particularly Māori storytellers, to share their narratives with confidence. His expertise in designing non-fatiguing, user-friendly VR immersion provides a critical technological foundation for the development of culturally responsive, place-based digital storytelling in the public realm.

Professor Hēmi Whaanga (Te Pūtahi-a-Toi) is a leading researcher in Indigenous digital innovation at Massey University. He leads the Ātea project, developing conceptual

frameworks for virtual and augmented realities, artificial intelligence, and Māori data sovereignty. Additionally, he co-leads the international *Abundant Intelligences* programme, advancing culturally grounded digital systems that empower Indigenous communities. His deep expertise in Indigenous data sovereignty and digital repositories is instrumental in ensuring that emerging immersive technologies respectfully safeguard, manage and communicate place-based cultural heritage and pūrākau.

Professor Heide Lukosch is a researcher and designer of applied games at HIT Lab NZ, University of Canterbury. She explores how games and virtual and augmented reality can extend the boundaries of the physical world. Heide is dedicated to using games and immersive media to empower people to understand complex spatial and social challenges. Her work frequently intersects with landscape interpretation, focusing on generative tourism, natural hazard preparedness and community resilience, always balancing technological advancement with a deep connection to natural environments and people.

REFERENCES

- Barclay, B. (2003) Celebrating fourth cinema. *Illusions*, 35, pp 7–11.
- Harding, T.; Oetzel, J.; Foote, J.; Hepi, M. (2020) Perceptions of co-designing health promotion interventions with Indigenous communities in New Zealand. *Health Promotion International*, 36(4), pp 964–975. DOI: [10.1093/heapro/daaa128](https://doi.org/10.1093/heapro/daaa128).
- Harvey, M.; McEntee, M. (2026) Mahitahi me te Taiao: co-designing in Māori, te Tiriti, transdisciplinary and Aotearoa native forest contexts. *AlterNative: An International Journal of Indigenous Peoples*, online first. DOI: [10.1177/11771801251413241](https://doi.org/10.1177/11771801251413241).
- Hokowhitu, B. (2013) Theorizing Indigenous media. In *The Fourth Eye: Māori Media in Aotearoa New Zealand*, B. Hokowhitu, V. Devadas, Eds.; Minneapolis, MN: University of Minnesota Press, pp 101–123. DOI: [10.5749/minnesota/9780816681037.003.0006](https://doi.org/10.5749/minnesota/9780816681037.003.0006).
- Kukutai, T.; Taylor, J., Eds. (2016) *Indigenous Data Sovereignty: Toward an Agenda*, Canberra: ANU Press. DOI: [10.22459/CAEPR38.11.2016](https://doi.org/10.22459/CAEPR38.11.2016).
- Regenbrecht, H.; Park, N.; Duncan, S.; Mills, S.; Lutz, R.; Lloyd-Jones, L.; et al. (2022) Ātea presence – enabling virtual storytelling, presence, and tele-co-presence in an Indigenous setting. *IEEE Technology and Society Magazine*, 41(1), pp 32–42. DOI: [10.1109/MTS.2022.3147525](https://doi.org/10.1109/MTS.2022.3147525).
- Simonsen, J.; Robertson, T. (Eds.) (2012) *Routledge International Handbook of Participatory Design*, New York, NY: Routledge. DOI: [10.4324/9780203108543](https://doi.org/10.4324/9780203108543).
- Smith, L.T. (2021) *Decolonizing Methodologies: Research and Indigenous Peoples*, 3rd ed., London: Zed Books. DOI: [10.5040/9781350225282](https://doi.org/10.5040/9781350225282).
- Strickland, A. (2013) Barry Barclay's *Te Rua*: the unmanned camera and Māori political activism. In *The Fourth Eye: Māori Media in Aotearoa New Zealand*, B. Hokowhitu, V. Devadas, Eds.; Minneapolis, MN: University of Minnesota Press, pp 143–161. DOI: [10.5749/minnesota/9780816681037.003.0008](https://doi.org/10.5749/minnesota/9780816681037.003.0008).
- Tong, L.; Lindeman, R.W.; Lukosch, H.; Clifford, R.; Regenbrecht, H. (2024) Applying cinematic virtual reality with adaptability to Indigenous storytelling. *Journal on Computing and Cultural Heritage*, 17(2), pp 1–25. DOI: [10.1145/3647996](https://doi.org/10.1145/3647996).
- Walker, S.; Eketone, A.; Gibbs, A. (2006) An exploration of kaupapa Maori research, its principles, processes and applications. *International Journal of Social Research Methodology*, 9(4), pp 331–344. DOI: [10.1080/13645570600916049](https://doi.org/10.1080/13645570600916049).
- Winters, G.J.; Zhu, J. (2014) Guiding players through structural composition patterns in 3D adventure games. *Foundations of Digital Games – Conference Proceedings*. Accessed 10 August 2026, http://www.fdg2014.org/papers/fdg2014_paper_35.pdf.
- Young, G.W.; O'Dwyer, N.; Smolic, A. (2022) Exploring virtual reality for quality immersive empathy building experiences. *Behaviour & Information Technology*, 41(16), pp 3415–3431. DOI: [10.1080/0144929X.2021.1993336](https://doi.org/10.1080/0144929X.2021.1993336).
- Zagalo, N.; Torres, A.; Branco, V. (2005) Emotional spectrum developed by virtual storytelling. In *Lecture Notes in Computer Science*, Berlin: Springer, pp 105–114. DOI: [10.1007/11590361_12](https://doi.org/10.1007/11590361_12).