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Empowering Marginalized Communities in and Through Virtual Environments: Principles and Frameworks Empowering Indigenous Digital Sovereignty

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This brief explores *digital sovereignty* and principles for practical application to empower marginalized communities in virtual environments. Examining Indigenous communities' participation and co-creation in virtual spaces highlights the potential of immersive technologies for cultural preservation, self-representation and equitable governance. The brief presents existing actionable principles, including OCAP®, CARE, and FAIR frameworks, alongside co-design methodologies. This work aims to inform ethical, inclusive and context-specific practices for fostering agency and equity in digital spaces.

As digital technologies continue to evolve, virtual environments (VEs) are emerging as transformative spaces that reshape how we connect, learn and experience the world. **Virtual environments** refer to spaces created using digital technologies where users can interact with virtual elements. **Immersive environments**, a subset of virtual environments, are spaces enabled by technologies such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR). Sala (2021) explains that Virtual Reality (VR) immerses users in a completely digital environment, disconnecting them from the physical world. Augmented Reality (AR) enhances the real world by layering virtual objects onto it, ensuring these objects remain fixed in their designated positions and orientations within the physical space. Mixed Reality (MR) takes this further by adding virtual objects and integrating them with physical objects, allowing users to interact with a combined digital and physical environment. These environments can be powered by artificial intelligence (AI) and advanced computational frameworks, enabling the creation of dynamic, multisensory and increasingly interactive spaces (Partarakis & Zabulis, 2024).

This brief examines digital sovereignty as a framework to empower marginalized communities within immersive environments and explores principles that can guide their application in concrete projects. Immersive environments, in particular, offer transformative potential for communities often excluded from mainstream digital participation, making them a powerful tool for representation and self-determination. However, cultural misappropriation, misrepresentation and systemic barriers in terms of access, participation in decision making and power imbalances risk undermining the positive impacts of immersive environments for marginalized communities. The impact on Indigenous communities offers a stark example of these potential benefits and risks.

Digital Sovereignty for Governing Virtual Environments

The concept of sovereignty has evolved over past decades and centuries, expanding beyond originally state-centric models to include individual

and collective agency, with frameworks like **Indigenous Data Sovereignty (IDS) and community sovereignty** focusing on community-driven control and self-determination. By applying a lens of digital sovereignty, communities may identify levers to reclaim power over how their data is managed, used and governed, addressing pressing concerns around privacy, representation and cultural integrity (Couture & Toupin, 2019).

Ideas of **sovereignty** have transitioned from early understanding as absolute state authority tied to territorial boundaries - as articulated in the Treaty of Westphalia from 1648 - to a more dynamic and multifaceted understanding (Bartelson, 1995). **Digital sovereignty** has been conceptualized along various notions of what constitutes the digital and what characterizes sovereignty and the sovereign. Frequently, it is defined as the ability of governments, communities or individuals to control different digital layers, including data, code and physical infrastructure (e.g., Floridi, 2020; Musiani, 2022). More specifically, IDS outlines the right of Indigenous peoples to govern the collection, ownership and use of data about their communities, ensuring that it reflects their values, priorities and perspectives (Rainie et al., 2019).

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Why Digital Sovereignty Matters for Marginalized and Indigenous Communities

Digital sovereignty is not merely a technical issue but a matter of participation, agency and self-determination. This may be especially true and relevant for marginalized communities facing systemic inequalities, discrimination and lack of access to resources and opportunities in the physical world. These same injustices may translate into virtual environments.

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While virtual environments can provide opportunities for emancipation and participation, they can also replicate or exacerbate existing inequities. Indigenous populations provide an important example of the relevance of digital sovereignty on a community level, as their cultural integrity and autonomy are at risk in emerging technological landscapes. For example, Indigenous populations possess unique cultural heritage, knowledge systems and intellectual traditions that are deeply tied to their identities and worldviews (Semali & Kincheloe, 1999). These elements, however, are vulnerable to exploitation in the digital realm, just as they have historically been in the physical realm, perpetuating historical injustices rooted in colonization (Smith, 2012) and replicating inequities.

Indigenous communities, thus, face significant challenges that are deeply rooted in historical injustice in participating and being represented in virtual environments. Colonialism often disrupted the Indigenous populations' self-governance, cultural practices and connection to their lands (Alfred, 1999; Semali & Kincheloe, 1999). These disruptions have left lasting effects, including economic struggles, cultural fragmentation and limited access to resources (Smith, 2012).

Indigenous Cultures and the Transition to Virtual and Immersive Environments

Given the historic and continued challenges Indigenous communities face, several **potential risks** are associated with interaction with virtual and immersive environments. In digital spaces, just as in the physical realm, Indigenous cultures can face misrepresentation and exploitation. Sacred symbols, traditions and knowledge are sometimes used without permission or respect, often for profit or entertainment purposes. This is known as **cultural misappropriation** (Matthes, 2016; Lenard & Balint, 2019). For example, sacred rituals or designs might be featured in virtual environments like games or apps without honoring their true meaning, reducing them to mere objects of curiosity or aesthetic appeal.

Misrepresentation happens when Indigenous cultures are inaccurately or stereotypically portrayed. Without proper involvement from Indigenous voices, these portrayals often fail to reflect the richness and diversity of their traditions. **Tokenisation** further simplifies and stereotypes Indigenous identities, treating them as symbolic or decorative rather than

authentic and complex (Couture & Toupin, 2019). These practices not only disrespect Indigenous cultures but also reinforce harmful biases and contribute to cultural erasure.

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Systemic Barriers limit Indigenous participation and sovereignty in digital environments:

- *Access to Technology*: Indigenous communities often face significant gaps in access to broadband connectivity, immersive technologies like VR headsets and digital literacy resources. These disparities create a digital divide that restricts their ability to engage with emerging platforms and share their cultural narratives (Ball, 2022).

- *Exclusion from Decision-Making*: Indigenous voices are frequently absent from governance structures overseeing digital platforms and technologies. Decisions about how cultural assets are represented, shared and monetized are often made without meaningful consultation, leaving communities disempowered and excluded (Couture & Toupin, 2019).

- *Power Imbalances in Digital Infrastructures*: The platforms, algorithms and data repositories that shape digital representations are predominantly controlled by multinational corporations. This centralized power limits Indigenous communities' ability to influence or negotiate equitable terms for how their cultural assets are used, leaving them vulnerable to exploitation and misrepresentation (Floridi, 2020; Adams, 2024).

These barriers highlight the need for careful approaches to digital and data governance for marginalized communities, such as Indigenous populations. Addressing these challenges requires practical solutions and structural changes that empower Indigenous communities to (re)claim sovereignty and power in digital spaces.

In thinking about these challenges systemically, a **practical framework to empower Indigenous communities to govern the collection, ownership and use of data** from and about their communities can be implemented to capitalize upon the opportunities virtual and immersive environments present.

Under distinct conditions that promote participation and sovereignty, there are **significant opportunities** brought by virtual environments. For one, they offer the transformative potential for **cultural preservation**, providing dynamic and multi-sensory ways to engage with Indigenous cultures beyond static mediums like books or museums. For example, the Ātea Project in New Zealand uses VR to recreate Māori communal spaces, enabling Māori, including those in the diaspora, to experience cultural narratives through rituals, landscapes and oral histories (Regenbrecht et al., 2022). Similarly, OurWorlds, a Native American-owned platform, employs extended reality to digitally preserve and share Native American stories and arts, ensuring their accessibility and relevance (OurWorlds, n.d.). These technologies support **self-representation**, safeguarding against cultural erosion while fostering cross-cultural understanding and respect. Central to these technologies is **active participation** through, for instance, **co-design approaches**, where Indigenous stakeholders are involved throughout the project lifecycle. This ensures authenticity, respects cultural values and prevents misrepresentation and harmful stereotypes.

Beyond storytelling, virtual and immersive technologies empower Indigenous communities to reclaim **governance over digital assets**, allowing them to define how cultural data is collected, used and shared. This is essential in addressing the risks of **cultural commodification** and ensuring that Indigenous communities maintain control over their heritage while participating in the global digital economy on their terms (Adams, 2024).

Recommendations for Empowerment in and through Virtual Environments

Technologies enabling increasingly realistic virtual and immersive environments present risks and opportunities to indigenous and, more broadly, marginalized populations. To empower marginalized communities in virtual and immersive environments, established frameworks and best practices provide

actionable strategies for ethical engagement and inclusion. Frameworks such as OCAP®, CARE and FAIR, along with methodologies such as co-design and capacity building, are essential for fostering cultural preservation, self-representation and governance over digital assets.

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Key Frameworks

Developed by First Nations in Canada, OCAP® emphasises **ownership, control, access, and possession** (Box 1), ensuring Indigenous communities maintain authority over their digital assets. This framework supports community-led decision-making for collecting, using and storing cultural data, safeguarding cultural sovereignty (First Nations Information Governance Centre, 2014).

A second relevant framework is the CARE Framework, calling for **collective benefit, authority to control, responsibility, and ethics** (Box 2). It was developed by the Global Indigenous Data Alliance, which focuses on aligning digital initiatives with community values, ensuring ethical management of cultural resources (Carroll et al., 2020).

Box 1: OCAP®

Ownership: First Nations communities have ownership of their cultural knowledge, data and information, similar to how individuals own their personal information.

Control: First Nations have the right to control all aspects of research and information management processes that impact them, including resources, review processes and planning.

Access: First Nations must have access to information and data about themselves and their communities, regardless of where it is held. They also have the right to manage and make decisions regarding access to their collective information.

Possession: Possession refers to the physical control of data. It is the mechanism by which ownership can be asserted and protected.

Box 2: CARE Framework

Collective Benefit: Data ecosystems should be designed and function in ways that enable Indigenous Peoples to derive benefit from the data.

Authority to Control: Indigenous Peoples' rights and interests in governing the collection, access, analysis, interpretation, management, dissemination and reuse of data must be recognized and respected.

Responsibility: Those working with Indigenous data are responsible for sharing how data are used to support Indigenous Peoples' self-determination and collective benefit.

Ethics: Data should be used in ways that uphold the dignity of Indigenous Peoples, ensuring that data initiatives are conducted in accordance with Indigenous values and ethics.

Finally, the FAIR Principles - making data **findable, accessible, interoperable and reusable** (Box 3) - can ensure that data initiatives are transparent and accessible, while protecting cultural integrity when combined with CARE and OCAP® (Nicholson et al., 2023).

Co-Design and Quality Reporting

Co-design plays a key role in creating ethical virtual environments by ensuring that marginalized populations, such as Indigenous communities, are actively involved in shaping their narratives and processes. Engaging stakeholders at every stage—concept development, design, implementation and feedback—not only fosters cultural authenticity but also helps prevent misrepresentation and builds trust (Anderson et al., 2024). An essential aspect of effective co-design is **quality reporting**, which promotes transparency and accountability throughout the process. Frameworks like GRIPP2 emphasize the importance of documenting stakeholder roles, decision-making processes, and the tangible impact of community contributions (King et al., 2022).

Box 3: FAIR Principles

Findability: Data is easy to locate.

Accessibility: Data is available with proper authorization.

Interoperability: Data works with other systems.

Reusability: Data can be reused effectively.

Conclusion and Future Directions

While this brief has demonstrated some clear potentials of immersive environments to empower marginalized communities by enabling cultural preservation, self-representation and governance over digital assets, a critical next step is to focus on **capacity building**, ensuring marginalized communities have access to the skills, infrastructure and resources needed for meaningful participation. This includes technical training, investment in digital infrastructure and fostering knowledge-sharing platforms. These efforts will bridge the digital divide and empower communities to reclaim control over their narratives and cultural assets.

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Additionally, it is important to keep in mind that there are limitations to the lens of digital sovereignty. It is worth questioning whether the concept of sovereignty accurately reflects Indigenous worldviews or if alternative frameworks, such as digital community sovereignty or digital self-determination, may be more appropriate. Future work should explore these perspectives, considering the context-specific nature of governance and cultural values, to better align with Indigenous thinking and practices.

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