Beyond Virtual or Physical Environments: Building a Research Metaverse
A White Paper for NDRIO's Canadian Digital Research Needs Assessment
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Digital connectivity and physical connection are as never before preoccupations of our global society. As virtual is temporarily no longer just an option, but our only choice, there is a paradigm shift about its form and use. From our perspective, the Canadian research community has demonstrated incredible resilience and tenacity to maintain its functions in the abrupt transition to digital in 2020. As we emerge from this enforced reliance on digital, how can we encourage researchers to consider it an active choice of physical and/or digital participant engagement as what best suits the research question, its participants, and - as rarely considered as a measured part of the research process - its collaborators?

As researchers involving human participants, we are encountering specific questions regarding the 'where' of engaging with participants in a digital capacity. By harnessing this disruption, we are poised to both better ask, and ask better, questions about what opportunities lie in what has to date been a gradual shift in research collaborator and participant engagement. Specifically, the impact of this on the persistent lag and rate of return of the research to practice process.

This disruption can also address the 'when' and 'who' of research. When does research 'begin' when we work collaboratively? What is being considered as part of the process and thereby measurable impact of research? We are deeply moved by the NDRIO prioritization of collaboration and the recognition of this being a benchmark for objectives and key results. As social researchers, are we incorporating equitable processes for our collaborators as participants in the research, and all before we articulate a specific research question? How and what are we analyzing and interpreting those interactions as data? Where and when could we do this in a digital research infrastructure?

These are all ultimately questions that pertain to the interdisciplinary scholarship of collaborative knowledge mobilization: the nexus of knowledge between those who generate it, and those who use it. What can we aspire to implement in a digital research infrastructure, as the properties of: secure, ethical, and assistive; equitable, inclusive, diverse, accessible; collaborative, engaging, dynamic physical space in a digital sphere for generating, storing, and disseminating qualitative research data whose common purpose is for implementation and resounding impact?

What kind of space could we create that would provide researchers with a way to mindfully gather participants (through improved digital forms of traditional methods) and collaborators (such as funding agencies, social innovation organizations, government and policy makers, knowledge translators and disseminators) into the entirety of the research process? How can we shift social research to contextualize the movement of knowledge, from research to practice, and actively and iteratively engaging those most greatly impacted by and with influence on a contextualized contribution to a process for tackling our most pressing and complex social problems?

To position our work and purpose in the emerging future of NDRIO, this white paper proposes a Research Metaverse. The word metaverse first appeared in the OED in 2008, as "[a] computer-generated environment within which users can interact with one another and their surroundings, a virtual world; (more generally) the notional environment in which users of networked computers interact" ("Metaverse", 2008). An inexhaustive library database search finds its use creeping in about a decade earlier; but few references do more than give a nod to it as portmanteau coined by science fiction author Neal Stephenson (*Snow Crash*, 1992) as a successor to the internet, "which envisioned a future broadly shaped by virtual and 3D technologies"(Acceleration Studies Foundation, 2011). It is also known as AR Cloud, Mirrorworld (Grimshaw, 1994), or could well be a Digital Ecosphere: to point to the levels of organization within the metaverse: ecosphere, biome, ecosystem, community, population, organism, molecule. An ecosphere is the sum of all ecosystems (Lidicker, 2008).

A rose by any other name… the concept to which we pay homage and build upon with 'metaverse' is the convergence of 1) virtually-enhanced physical reality and 2) physically persistent virtual space (ASF, 2011). It is a fusion of both, while allowing users to experience it as either. Collaborative research represents microcosms of society, and society as an ecosystem. How we envision this in its emerging future is at a level of scale as an ecosphere; and, at the interface of virtual and physical as the metaverse.

So too is what we propose for the landscape of the emerging New Digital Research Infrastructure Organization: to not only be physical or virtual, but to be a field of 1s and 0s that persists in the physical reality. To more permanently expand research platforms for engaging participants and collaborators into the virtually enhanced and physically persistent digital field. For the purposes of focusing on both a visionary future and an actionable present as is the call within this needs assessment, we will briefly explore some of the properties identified above; and then, connect to a specific model of a Community of Practice for Collaborative Knowledge Mobilization that demonstrates an example of what is possible within such a network.

We conceive of the transition to digital as more than just improving efficiencies of existing platforms. The disruption to the ways in which we meet, gather, and interact 'in the time of COVID' represents not just a temporary inconvenience, but an opportunity to consider how we can do more than focus on how to shift existing systems online, and conceive of how we can make this transition one that serves the 21st century research landscape. Each and every aspect we shift to digital must not only do so by first asking: physical, digital, or both, as what is appropriate to serve the shared purpose of the research. It must also ask how we can be innovative in either sphere.

We foresee incredible opportunity to engage with existing resources that can be a bridge to the future metaverse: specifically, demonstrating the transferability of the ISED-supported CanCOVID framework of Rapid Evidence Access Link for Knowledge Mobilization Framework (REAL) and its coordination model (REAL, 2020); and the CANARIE-supported work from The Canadian Writing Research Collaboratory (CWRC) and two main features: its online dynamic repository; and its architecture designed to provide first points of access for collaborators (CWRC, 2016).

Similarly, the implications and applications for a digital metaverse would be substantive across multiple sectors. By engaging an interdisciplinary and interprovincial perspective, we can envision a more comprehensive whole, taking incremental steps from the existing app and portal platforms that address symptoms and systems efficiencies and improvements, and building from that work to consider substantive paradigmatic level transition of the ways in which academics engage with collaborators as participants to be a measured, managed, stored, shared, and acknowledged as part of the research process. The implications of this scope and scale are precisely the sort of emerging future we as a national research community can collaborate to bring into reality - virtual and physical.

The exploration of incorporating Artificial Intelligence (AI) into research processes is its own vast research field (ISED, 2020). In this incremental development, we put forward the need to conceive of how AI can be a servant for ethical, secure, and assistive efficiency: for modernization, privacy, and security, across the spectrum of time-consuming research tasks. For example, real-time and automatically generated audio transcriptions; for researcher verification; official language and differently-abled translation.

To this last point, when we consider the broader realm of inclusivity, diversity, equity, and access (IDEA), we have a responsibility to embed it in order to normalize it across every aspect of NDRIO and its partners. Related to the metaverse, at the moment, we are doing remarkably well to cobble together platforms and processes that offer some of these above-noted services; however, the maintenance of these and their constraints are cumbersome and time away from the research, to say nothing of the lack of focus and attention paid to creating engaging and dynamic connections between self and others that is more contentious when gathering digitally rather than physically. Further, how can we provide ease of

access to ensure they are conducted in ways that meet institutional ethics and privacy guidelines (for example, no 'Zoom bombs' or provincial health agencies not permitting use of Cloud Technology).

From another perspective, we consider the capacities of Open Source. These would be curated by Principal Investigator's affiliate institution (e.g., university), and consist of node-based networks. From an ecosphere organizational perspective, a node or organism can be a user, an idea, a piece of data, a collection of data, a tool, a published paper, an unpublished paper, etc. Every node in a metaverse has a purpose and is linked to another node in some manner. Ties can be added, dropped, alive, dead, strengthened by users' activities. These nodes are Immersive (e.g. 3D sandbox, virtual reality); Accessible (e.g. desktop/mobile client, web-browser, text-based terminals); Synthesized (all collection and analysis tools in one place (like in Github repositories); Multi-layered (used to access a university's library holdings, research repositories, recruit/collaborate with new participants/individuals/groups, collect data (e.g. survey, interview, observation, etc.), analyze data, publish, and measure progress towards completion of project or agreed upon milestones). Finally, the metaverse enables innovating on the existing Preservation and Sharing in accordance with Tri-Agency priorities: to be preserved in a publicly accessible, secure and curated repository or other platform for discovery and reuse by others.

As a collaborative, research nodes can be picked up and advanced by anyone in the system as the ecosystem network understanding of the metaverse gives a more comprehensive scope of where each individual is within the levels of organization. This incorporates methods and principles of Citizen Science with emphasis on responsible use, time management, and usage restrictions that support the users' mental health (Stevens, 2019). We dovetail this with the exploration of Digital Citizen Research and the effects of Online Disinformation (SSHRC, Initiative for Digital Citizen Research, 2020).

As we provide access to information for a more balanced approach to research, the metaverse also provides ways to establish incremental learning processes and collate credentials and certifications as suitable to particular specializations. This can leverage and mobilize existing research and resources (such as The Government of Canada's analytical tool Gender-Based Analysis+; and the co-created SSHRC, CIHR, NSERC, and CRC Unconscious Bias Peer Review Module), among a great variety of other existing resources that are in use and can be improved upon. The metaverse would track and collate researchers as they and their participants make use of various tools to provide feedback on what is most useful. This improves the metaverse, and also improves existing tools so knowledge does not repose but remains evergreen and current.

The improvement of existing tools is a key component to the research innovation. What cannot learn, cannot innovate. The infrastructures must be established in ways that embed iterative systems thinking processes, with methods such as rapid prototyping, into their capacities. The platform can be linked to and/or embedded within another project's metaverse.

From this constellation of explorations, we offer a specific example for the metaverse approach. The principles of design and operation behind a Research Metaverse for Collaborative Knowledge Mobilization are identified in DOCTalks Guide Version 1.0 (DeDecker, 2019). The research process is fundamentally collaborative, centred on community relationships: people who share a concern or a passion for something they do, and learn how to do it better as they interact (such as a Community of Practice - CoP).

A CoP ecosystem approach to creating a research metaverse provides a number of advantages. Three key aspects are how it is collaborative, contextualized, and useful. First, it turns the focus towards collaboration, defined by cross-sector collaborators engaged around a common interest to investigate and address the social concerns they face at local, national and international levels. All participants, peripheral as well as central members, are responsible for contributing to the final product. Second, this process of engagement prioritizes the CoP's members' experiences and specialized knowledge recognizes them as vital to the identity and goals of the entire group, and contextualizes their role within the

structure, system, and process of research to practice. Third, it views its members' interpretation of research knowledge or personal experience as important to the development of the emerging media project. The collective learning that takes place in a CoP becomes the focus of the research process, as it works to develop a common, meaningful, and useful narrative for the issues they seek to address.

The combination of a diverse group of cross-sector participants creates thresholds. These can either facilitate or inhibit the creation of knowledge and practices for communicating that knowledge as fundamentally connected to how we store and manage them as data. We will come to better understand this complexity by building from what V1.0 of the Guide establishes. A go-slow approach, with continued rapid prototyping to understand these barriers and develop strategies for transforming them into opportunity.

Who might the members of a CoP research metaverse be? In order to fund, conduct, and mobilize research processes, DOCTalks V1.0 identifies six cross-sector groups via primary research conducted through interviews and surveys as an example of how this type of collaborative can function: Academic Researchers (Canadian Association for University Teachers); Charities (Canada Revenue Agency registered charities/non-profit organizations); Governments (various levels of government as outlined by Immigration & Citizenship Canada); Documentary Producers (Documentary Organization of Canada); Broadcasters (licensed by Canadian Radio-Television & Telecommunications Commission under Canadian Broadcast Act).

For the process of identifying collaborators such as with the six identified above, we liken the step-wise process of collaborative research within the Metaverse by giving a nod to another 1980s fiction mania: the *Choose Your Own Adventure* model (Meifert-Menhard, 2013). The complex, multi-layered, and individualized aspects of research are made clear, without reducing it to a generalizability that misses the crux of the emerging landscape of scientific inquiry: contextualized complexity. Engaging a hybrid of human-curated and AI algorithmic process in which to engage researchers as a guide through the necessary components that build them toward their own identified goals and ensure they align with those of their collaborators. To provide two examples, this includes having an embedded Research Ethics Board or similar Institutional Review Board to ensure consistent and cohesive explanation and retention of participant consent; and, Knowledge Translation, Mobilization, Implementation, and assigning those within the collaborative to be accountable to the aspects of the research that are identified within this metaverse.

Through the transparent and collaborative model NDRIO is embodying as it takes shape, we see an emerging future of possibility within our national digital research infrastructure. When the entire scope and scale of what is being created is made clear to all within the process, each contributor has a better understanding of how they fit within the more comprehensive whole that is emerging. It is no longer siloed teamwork but becomes how high-performing collaborations function. A metaverse is the actioning of the conceptual values and priorities of the NDRIO ecosphere: the organization of ecosystems of its partners and their cohesive and interconnected relationships in a virtual world for researchers to explore; and, to create and hold space for collaborators, participants, and knowledge users and audiences to function as ethical and secure; equitable, inclusive, diverse, accessible; collaborative, engaging, dynamic spaces in a digital world.

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