

Locally Contingent and Community-Dependent

Tools and Technologies for Indigenous Language Mobilization

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The Context

The vitality and expression of language within communities is a key aspect of the technoscape. Within Canada the concept of Indigenous communities is complex and dynamic, reflecting intricate relationships between familial, geographical, and political groups.¹ The legacy of suppression of Indigenous languages and knowledge is embedded within policy and legislation intended to break family and community cohesion. Technology has had a role in work undertaken by individuals and communities to maintain and restore these relationships.

In ways that challenge conventional representations of the “digital divide” as a split between the “technology haves and have-nots,” Elders and youth in Indigenous communities are actively using and appropriating emerging technologies to strengthen their traditions and languages.² While technological efforts in the 1970s included specially modified typewriters and custom-made fonts to represent Indigenous writing systems, communities are now making use of online digital tools, internet radio, and mobile devices to nurture the continued development of Indigenous languages and cultures. Significantly undermined by colonial institutions and processes, Indigenous cultures have suffered systemic harm and marginalization. In Canada the documentation and revitalization of Indigenous languages and cultural knowledge are increasingly cited as priorities in support of well-being in Indigenous communities.³

Yet such interventions are not without risks and consequences for individuals, community organizations, and the Indigenous knowledge systems that are being mobilized. There is little agreement about what form an ideal presentation and dissemination platform for Indigenous cultural heritage organizations should take, and how it might work and be maintained and migrated over time. At the same time, Indigenous experiences with—and expectations of—technology can productively challenge normative Western understandings. While many research councils and libraries view the move toward open-access publishing to be of scientific and public benefit, Indigenous cultural and linguistic knowledge is often location-specific and community-internal, and not to be shared through an open portal.⁴ Indigenous understandings of the responsibilities that accompany traditional knowledge offer rich insights into the different ways that intellectual property and ownership can function.⁵

Addressing the needs of policy makers within (and beyond) government for reliable data, this chapter aims to deepen the institutional understanding of the history of Canadian-Indigenous relations and expand the possibilities for new conversations that prioritize voices of Indigenous community members as creators, synthesizers, and mobilizers of emerging technologies. The experience of Indigenous and community-based scholars is not well reflected in the existing academic literature. Our environmental scan and knowledge synthesis establish that Indigenous cultural heritage organizations have sophisticated, complex, and multimodal technical needs that no single out-of-the-box solution has yet been able to address. Overall, Indigenous scholars and organizations are creators and innovators (and not just recipients or clients) of new technologies, particularly in the domain of cultural and linguistic heritage.

Heiltsuk First Nation Language and Culture Initiatives

The Heiltsuk Nation in Bella Bella, British Columbia, offers a compelling example of how Indigenous communities have long made use of emergent technologies to support language mobilization. Heiltsuk use of technology builds upon all of the front-line work Heiltsuk have done to document and reinvigorate their language in the face of oppressive forces, including refusing to be silent and speaking Heiltsuk to grandchildren;

taking advantage of (analog) recording devices to preserve these voices; bringing a linguist into the community and supporting him to stay for over a decade; collaboratively participating in creating dictionaries and grammatical instructions; recording autobiographies in Heiltsuk as a special project initiated by the Band Council; creating bilingual texts of transcripts and translations of audio recordings; modifying first typewriters and then computer fonts; and creating digital dictionaries with accompanying sound files. This is the story of all that Heiltsuk have initiated themselves—the wealth of voices and documents that they wish to make available to, first of all, the Heiltsuk Nation, to foster language learning, pride, and Heiltsuk worldviews.

The Heiltsuk Nation initiated extensive language research and documentation starting in 1973. Through its Heiltsuk Language Studies program, the Heiltsuk Cultural Education Centre has a mandate to continue the documentation and revitalization of the Heiltsuk language and has created and compiled extensive resources in the following focus areas:

- Developing* a practical orthography (alphabet) for writing down the Heiltsuk language; recording and analyzing words in order to produce comprehensive word lists, bilingual dictionaries, and taxonomies; analyzing and identifying the basic structure of the Heiltsuk language; recording an extensive body of oral traditions, narratives, and discourses, as well as transcribing and translating these into English;
- Assisting* and promoting the understanding and interpretation of Heiltsuk culture through linguistic analysis of information recorded or transmitted in Heiltsuk;
- Promoting* and assisting in the development of Heiltsuk language instruction programs;
- Maximizing* use of available and emerging technologies to promote the preservation of and access to Heiltsuk language materials.

In 1978 the Bella Bella Community School instituted Heiltsuk Language Instruction as a formal part of school curriculum and, since then, has focused its attention on curriculum development, Heiltsuk-language teacher certification, and the pursuit of effective language teaching strategies.

Through a memorandum of understanding signed in 2016, the Heiltsuk Cultural Education Centre, Bella Bella Community School, and the First Nations and Endangered Languages Program at the University of British Columbia (UBC) are partnering in an effort to collaboratively create new opportunities for speaking, writing, and reading Híłzaqv̄la (the Heiltsuk language) by expanding existing community language revitalization and cultural documentation in a digital environment.⁶ This collaborative mobilization of existing language recordings and archival and cultural resources has resulted in the release of a cross-platform Híłzaqv̄la unicode keyboard and a beta version of a fully searchable online Híłzaqv̄la digital dictionary. Next steps include releasing the dictionary through Mother Tongues Dictionaries, a free, open-source language revitalization tool that visualizes lexical terms for community revitalization goals.⁷

The Digital Divide (Again)

Some of the earliest research in the emerging space around Indigenous uses of technologies explored how the internet could bring economic development to remote and rural areas. This early literature is often hopeful and speculative around the potential benefits and implications of internet access in Indigenous spaces.⁸ Similarly, conversations from the late 1990s and early 2000s presupposed that universal internet connectivity was both imminent and inevitable, and that the rollout of all future technology would be predicated on stable, high-speed broadband across the global North.

Almost two decades later, many communities in Canada, the United States, and beyond are still waiting for the promised infrastructure backbone that will make affordable, stable high-speed broadband connectivity possible. While a presumed lack of proficiency in English was previously stated as a barrier to internet use for Indigenous people in Canada, in the interim (rather paradoxically) the conversation has shifted to explore how a more multivocal and multilingual internet can be tasked to support the revitalization of endangered and Indigenous languages that relies less on English.⁹

Indigenizing Colonial Thinking

This contribution demonstrates that Indigenous communities have always engaged with and made use of appropriate technologies to further community aims. Twenty years since the birth of the term “digital divide,” an emphasis on simply providing and ensuring “access” has drawn criticism for the emptiness of its rhetoric and its enduringly paternalistic tone.¹⁰ The underlying assumption that it is in the hands (and at the grace) of richer societies to initiate technological development on the other side of the divide fails to address the deeper, systemic social injustices that are embedded in technological developments. Moreover, the trickle-down model (from top to bottom, rather than anything more horizontal, let alone bottom to top) remains an inappropriate and unfortunate metaphor to describe how community development actually works.

Embedded at the core of such technologized ideologies lies an entrenched belief that Indigenous people always have been and always will be late to catch on to technological developments. For the greater part, “government agencies have taken on the servicing of Indigenous needs rather than encouraging communities to participate themselves,” write Katina Michael and Leone Dunn, with remarkable restraint.¹¹

Indigenous communities have long been engaged in the process of ensuring that technology platforms reflect and respond to their traditional ways, cultures, and languages. This fact is not well known by the wider public or government agencies. In large part this ignorance is the legacy of legislation that made Indigenous language and cultural practices illegal. However, some recent examples are better known, such as the work of language revitalization proponents in Hawaii that were quick to recognize the potential of ICTs to support, develop, and further strengthen the Hawaiian language. The 1993 deployment of Leokī is widely cited as the first electronic bulletin board system that was delivered entirely in an Indigenous language.¹² Since early advancements and uses of ICTs, Hawaiian has moved rapidly into cyberspace through negotiations and partnerships with Microsoft and Apple. The language is now offered as an option on most major operating systems, helping to normalize and

in some ways equalize the language and increase its uptake, usability, and functionality in everyday life.¹³

Heartening examples aside, such work is almost by definition never-ending and requires constant resourcing and vigilance to ensure that hard-won gains are not quickly lost. The path is long and the journey inevitably uphill, rooted in historical and institutional efforts to permanently eradicate Indigenous languages from everyday use. The irony of the new funding landscape has not escaped Indigenous scholars and activists who have spent years resisting punitive and racist government legislation designed to extinguish their languages and cultures, but who are now being courted by those very same agencies who—in the spirit of reconciliation—have pivoted to fund and support that which they earlier set out to destroy.

To that end, when the Social Sciences and Humanities Research Council of Canada (SSHRC) poses the question “How are First Nations, Inuit and Métis cultural heritage organizations responding to the opportunities and challenges of emerging technologies?,” our response may be to invert and rather ask, “How are emerging technologies responding to the opportunities and needs of First Nations, Inuit and Métis cultural heritage organizations?”

Methodology

Technology-assisted language mobilization is a rapidly evolving field moving faster than most peer-reviewed journals can keep up with. Through collating knowledge and experiences over the last decade, including some very recent developments, we have looked beyond academic publications to more instant and sometimes ephemeral forms of information, as well as case studies and findings from community-based projects. To that end, we drew upon:

Published research findings in the somewhat limited scholarly literature; “Grey literature”: information produced and circulating outside of conventional academic distribution channels, such as projects within Indigenous communities;¹⁴

Critical assessments and evaluations of a range of recent technical interventions.

In our search, we have considered the emerging technoscape both within and beyond Canada and have reflected on specific community-level tools as well as larger organizations that host, support, or promote multiple platforms and initiatives. By reviewing examples of relevant and recent technologically oriented projects in the area of language mobilization, we hope to have identified trends and successes alongside gaps in knowledge and attention.

Our methodology was necessarily flexible. We located published literature through database searches, reviewing recent publications and searching through promising citations. Grey literature and examples of technological interventions were more difficult to locate systematically, to which end we cast our net wider, using online resources, personal networks, and email fora—such as the excellent and active Indigenous Languages and Technology (ILAT) discussion list—to learn of projects that have so far escaped the attention of academic journals and scholarly publications.

Our approach was by no means comprehensive. We have not attempted to document every project, technology, or initiative. Instead, we have aimed for this chapter to be illustrative, representative, and generative. We document promising processes and approaches, successes and challenges, that may have traction beyond a special location, community, or time.

The emergent nature of the field entails that an inherent paradox is built into this document. As soon as this chapter is published it will cease to be current. It offers a glimpse into the technoscape of language revitalization in 2016, and all that we can hope—just like many of the publications that we have benefited from reading—is that this document will serve as a historical snapshot of the lay of the land at this time.

How can such diverse information best be organized, collated, and shared? We first thought to structure our findings according to the specific technology or platform being used, whether that was a mobile app, an interactive website, or an audio feed. Yet we quickly revised our thinking as it became apparent that such an approach embodied the very technological determinism that we reject.

It is not a particular technology that determines the outcome or success of an initiative, but a broader web of social, cultural, and often political

factors that help to create (or constrain) a supportive environment for language revitalization. To that end, we organize our findings thematically, rather than by specific technologies, cutting across regions, applications, and communities. We believe that this better represents the flexibility and innovation of technology appropriation for culture and language mobilization in communities.

Findings

The Pace of Change: Speed and Obsolescence

Emerging technologies provide new opportunities and offer great possibilities. However, the pace of development also poses a challenge for communities, such as the Heiltsuk, who continue to be early adopters of emerging tools for language and culture work. A survey of literature over the last fifteen years demonstrates a series of rapidly changing uses, perceptions, and expectations of the internet.

In 1965 Intel co-founder Gordon Moore observed that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. Now commonly referred to as “Moore’s Law,” it has become a truism to state that overall processing power for computers doubles every two years.

At the turn of the millennium, as availability and capability increased, the internet was largely discussed as a tool for delivering information and economic opportunity.¹⁵ Rural and remote communities in Canada expressed frustration at the comparatively sluggish pace of infrastructure development, which failed to keep up with technological change. Yet, to this day, communities struggle with connectivity problems, and impatience with centrally organized infrastructure projects has fueled community-driven efforts to establish broadband and mobile networks. K-Net, for example, is a First Nations–owned ICT service provider that has established a cellular service, broadband connectivity, and online applications envisioned by and for rural and remote First Nations communities in Ontario.¹⁶

Since 2001 the internet has been increasingly conceptualized as a medium through which different and diverse tools function. The recent

explosion of digital applications, prompted by the growing pervasiveness of mobile devices, is now shaping the future of the Web. This “appification” has fragmented digital functionality, assigning specific tasks to specific software, and it is not clear what the long-term consequences of this splintering will be.

Media technology is fast becoming asynchronous and individualized. In-flight entertainment systems on long-haul aircraft offer a lens through which we may observe this development. Films and television shows were first shown on one fixed screen, requiring that all passengers watch together. In the 1990s advances in technology, coupled with the demand for more personalized in-flight entertainment systems, prompted airlines to install individual screens, through which a sequence of films could be broadcast synchronously. In the early 2000s airline entertainment systems were upgraded to allow passengers to choose content from a wide selection, consume it when they liked, and pause programming as needed. The most recent trend in in-flight entertainment has individualized the experience even further, allowing (in some cases even forcing) passengers to access the system through their own digital devices, removing the costly requirement for screens in the back of each seat and pushing the service to passengers who use their computers, tablets and phones.

Such shifts offer an insight into the direction of individualized, customized digital experiences. We can now say with confidence that no two users of the internet use its services and consume content in the same way.

Free, Accessible, and Omnipresent Mobile Technologies

The availability of free, sometimes open-source, versatile, and mobile technologies has created high expectations, particularly among young people, in terms of what digital tools can do, how they function, and what they should look like. Many mobile (in all senses) users now rely exclusively on devices, such as smartphones and tablets, with operating systems that are app-driven. Users expect to realize all of their work through off-the-shelf systems, yet assumptions baked into many of these tools limit their functionality for different languages and across various operating systems. Basic research is critical to identify opportunities to

increase the flexibility of such systems as they cross epistemological and ontological boundaries.

The development of cloud computing, which provides shared, internet-based processing and storage power on demand, presents a major reconceptualization of how hardware, firmware, and software technologies should be considered. Instead of relying on and committing to one expensive software tool locally housed within their device, users can now access, utilize, and save their licensed software in “the cloud,” sometimes for free, other times for a fee. With this shift to multiple digital tools stored externally in third-party data centers, the issue of ownership and compatibility—already complex for Indigenous users—becomes even more intricate. Once located in the cloud, it is difficult to exercise control over a software platform, opening users up to unexpected vulnerabilities, changes, and updates, as well as new challenges in terms of backup and offline access.

Younger digital users have increasingly high expectations of what technology can do for them and how adaptive it is. Over the last decade we have witnessed a growth of immersive and interactive technologies that support such expectations. Yet, with the technological landscape moving so quickly, there is very little incentive to commit to tools that do not serve a user group’s immediate needs. At the same time, although expectations for new technologies remain high, very few have the capacity to deliver everything that a user wants. An understanding of the range of available technologies and the ways they can be effectively combined to realize specific tasks is increasingly necessary to keep up with the needs of users. This process needs to be carefully explored to understand how choices are being made and what compromises, if any, are made along the way.

Harnessed through the use of free software, emerging technology is being used to support access to learning of Indigenous languages, such as UBC faculty member Candace K. Galla’s project to teach Hawaiian hula lessons¹⁷ over Skype.¹⁸ Here follow a series of rich examples and illustrations of projects, programs, tools, and technologies that are being leveraged to assist communities reach their goals of language revitalization.

Waldayu (and its mobile counterpart, Waldayu Mobile) was the first dictionary app suite for endangered languages to combine a language

agnostic design, customizable approximate search, cross-platform deployability (Web, Android, iOS), and open-source code.¹⁹ *Waldayu*, meaning “word tool” in Kwak’wala, allows language communities with preexisting lexical data and materials to quickly create web and mobile apps that display their data in an engaging way. Additionally, *Waldayu* can be used on- or offline, making it especially useful for remote communities. *Waldayu* has been implemented and at the time of writing was in beta testing for over six languages from five different language families, including Tsimshianic, Wakashan, Salishan, Sino-Tibetan, and Iroquoian.²⁰

FirstVoices is a suite of online and mobile app-based language archiving and learning tools developed for and available to Indigenous communities in Canada and administered by the First Peoples’ Cultural Council.²¹ Tools include a chat app with an orthography keyboard input system and language learning games. Language communities receive training and technical support to develop and manage their own language and culture archives and resources. The FirstVoices Keyboards app gives its users access to more than a hundred Indigenous languages—spoken in Canada, New Zealand, Australia, and the United States—through specialized keyboards that can be used within email, social media, word processing, and other apps on mobile phones. FirstVoices Chat was developed in response to Indigenous youth who want to communicate via social media in their own languages. This mobile app supports people who wish to compose and send text messages in the unique characters of their own Indigenous languages.²²

The Resource Network for Linguistic Diversity is an international nonprofit organization founded in 2004 to advance the sustainability of the world’s Indigenous endangered languages, and to support Indigenous people’s participation in all aspects of language documentation and revitalization through training, resource sharing, networking, and advocacy.²³ The network hosts interactive online lists of Indigenous language projects, blogs, relevant links, and teaching resources to support language documentation and revitalization projects.²⁴ Haida-speaking Alaskan communities are engaging with multiple digital platforms,²⁵ including creating language-based YouTube videos to support Indigenous language learning.²⁶

The multimodal ACORNS project supports the language revitalization efforts of the tribes of northern California and southern Oregon.²⁷ The ACORNS project provides free software to support teachers and learners of any language in building digital classes for language practice outside of the classroom.²⁸

The Mi'gmaq language group developed an interactive language learning website, blog, talking dictionary, interactive Mi'gmaq wiki, Facebook, Instagram, Tumblr, and Twitter accounts to help language learners understand and speak the Mi'gmaq language on whichever platform or combination of platforms they feel best serves them.²⁹ The talking dictionary project, for example, has over 3,900 entries recorded by three different Migmaq-Mi'kmaq speakers, to assist with variations of pronunciation. These are then used in accompanying phrases to give learners the opportunity to distinguish individual words when they are spoken in a phrase.³⁰

The Evaluation Gap

Despite the sharp uptake of digital tools to support endangered-language learning, there is little in the way of systematic and rigorous evaluation on the results of their use. In order for such technologies to have lasting and positive impacts on language revitalization, all stakeholders—communities, policy makers, and academics—need to know which tools are proving to be most effective, where, why, and how. For that, community-grounded, longitudinal case studies need to be commissioned that assess the success and review the impact of emerging technologies using criteria that are community-developed and locally appropriate.

In researching and preparing this chapter, examples of technological interventions for language mobilization were easy to find. Gauging their success and influence in supporting language preservation and use, however, has proved to be much more difficult. Few initiatives explicitly document and evaluate their effect on language use, and there is very little published research in this area. We therefore highlight the assessment and impact of revitalization technologies as a key knowledge gap to be addressed in future work.

We are not the first to highlight the lack of reporting on the evaluation, impact, and success of revitalization initiatives. While we found a general lack of evaluation programs in global as well as local contexts, previous research has highlighted that Canada in particular could do more to develop appropriate criteria to understand the impact of revitalization programs. Christopher Wetzel has observed that most research studies focus on the status of Indigenous languages, with little attention paid to revitalization efforts and their impact.³¹ Little progress has been made in the intervening decade; Siomonn Pulla's Social Sciences and Humanities Research Council (SSHRC) knowledge synthesis report on mobile learning technologies found almost no research to report on.³² Calling for more research in order to understand the impact of newer projects across the country, Pulla concluded that "Canada lags behind other countries in innovating, implementing and reporting on mobile learning for Indigenous people."³³

More recently, Noelani Iokepa-Guerrero has noted that despite a range of programs designed to support Indigenous language learning, most programs do not document language use outcomes: "There is a wide variety of programs to teach traditional Indigenous languages. . . . However, most such programs have not explicitly documented language use impacts."³⁴ Greater knowledge in this area would help to identify successful strategies that could translate to other locations, with Onowa McIvor concluding that a great deal more could be learned about the "efficacy of Indigenous language revitalization strategies" from existing projects and programs.³⁵ Comparative evaluations based on locally relevant criteria to assess the functionality, technical architecture, and deployment of different software platforms and products have proven beneficial to communities when considering which resource management package to select and would likely also be of use in reviewing and selecting technologies that support language and culture.

The emergent nature of much of the technology is certainly one reason behind the apparent lack of evaluation. Since many language revitalization strategies are still relatively new, "few longitudinal studies are available to assess the impact on language vitality."³⁶ The press and public media also has a role to play. Articles and reports usually focus

on technology rather than on the use, community, or relationships that underwrite a language context and thus perpetuate a form of technological determinism that is unnuanced and unhelpful. While we welcome the pivot away from sensationalist reports along the lines of “last speaker dies, language now extinct” to stories that are more positive and focus on Indigenous resurgence and vitality, mobile-phone apps and online dictionaries do not save languages any more than linguists do. Long-form investigative journalism has an important role to play, but even science reporters have an appetite for catchy headlines. The new online platform for increasing public engagement with anthropology, SAPIENS, recently published an article entitled “Can an iPhone App Help Save an Endangered Language?”³⁷ while the independent news and views web platform the Conversation led with an editorial entitled “Taking Indigenous Languages Online: Can They Be Seen, Heard, and Saved?” as we were finalizing this chapter.³⁸

Understanding which stakeholders are actively involved in a specific project and making sense of how a collaboration progresses is not always easy. Relationships and dynamics within and between communities and outside partners are complex; technology projects often have an impact on these relationships and establish new power dynamics. Projects operating within a community informatics framework are more likely to be driven by community needs and agency. Projects that involve corporate bodies are frequently influenced by market forces. We would be well advised to be skeptical of headlines such as “Community Teams Up with Tech Company to Save Language,” as there is often a backstory. Any account of a specific project, whether by academics, the media, or the community themselves, will be written from a certain subject position and agenda. The subjectivity of such representations is unavoidable and needs to be acknowledged and addressed.

Resisting Technological Determinism and Selective Use

Digital technologies do not, cannot, and will not save languages. Speakers keep languages alive. A digital dictionary on its own won't revitalize an endangered language, but speakers might use it to do work that will. At the same time, technology can be as symbolically powerful, as it is

practically useful and often carries considerable political weight. In the English-dominant world of cyberspace, Indigenous communities are engaging with and disrupting technologies to create their own online presences. By generating their own digital visibility and legibility, Indigenous communities become present online and thereby exert increasing control over the terms of their own representation rather than be continually misrepresented by others.³⁹

Some communities have chosen to resist engaging with certain technologies in order to retain control of their cultural knowledge and adhere to specific cultural sensitivities and protocols. What may therefore appear to outsiders as the nonpresence of an Indigenous community online is very often deliberate and thought out, a product of mindful resistance to a hegemonic representation rather than any kind of technological inexperience.

An example can be seen in how different communities have responded to British Columbia-based FirstVoices. Initiated by the First Peoples' Cultural Council, FirstVoices is a suite of web-based tools designed to support Indigenous people in language documentation, archivization, education, and revitalization. FirstVoices supports individual language communities to manage a space on their site to share language phrases, recordings, and teaching tools. The FirstVoices team have also developed and released an app for language learning and a keyboard and messaging app for texting and communicating in Indigenous languages.⁴⁰

While many Indigenous communities in British Columbia have a presence on the FirstVoices website, others have chosen that their language not be included at this time. To note that even a system built with the needs of Canadian Indigenous people in mind may not meet the requirements of all communities is not intended as a criticism of the work undertaken by FirstVoices. Reasons are varied, but they may include policies around access to and ownership of information, specific structural design features that are not appropriate to certain languages and communities, or because communities are developing their own culture-specific digital tools. In addition, not all technologies allow for selectivity or value-driven adaptation by those trying to use them in different or unanticipated ways.⁴¹

Indigenizing Cyberspace

Historically, media technologies in English (or other colonial languages) informed the way settler cultures imagined Indigenous people, whether in print, photography, or film. The internet, initially envisioned to serve military functions, unexpectedly developed into a free and relatively open space, available to anyone with access to a computer and a level of comfort in one of its principal languages. Yet, just as Indigenous writers, photographers, and filmmakers have always carved out powerful Indigenous spaces in earlier media, so, too, Indigenous communities around the world are working to develop unique tools to reclaim cyberspace.

Within many English-dominated new media technologies, much free and open software actually asserts ownership and requires full access to all materials created by users or hosted through its architecture. Since the early 1960s Indigenous new media artists and programmers have been working to reclaim or “indigenize” technological spaces by generating their own sovereign spaces, on their own terms—what Mohawk artist Skawennati Tricia Fragnito and Swampy Cree artist Jason Lewis refer to as “Aboriginal Territories in Cyberspace.”⁴²

In *isi-píkiskwêwin-ayapihkêsisak* (Speaking the Language of Spiders),⁴³ Cree/Métis artist Ahasiw Maskegon-Iskwewhe created an interactive, interconnected web portal showcasing various Indigenous artists, with a focus on Indigenous culture and worldview as expressed by Indigenous languages.⁴⁴ In his artist statement on the website, Maskegon-Iskwewhe outlines how “the underlying thematic context of the screenplay is based on an examination of the differences in worldview and the construction of reality that occur between cultures structured by First Nations languages and those constructed by English language.”⁴⁵ The site was designed in 1996, the same year that the last Indian residential school in Canada closed.

Mohawk artist, writer, and independent curator Skawennati Tricia Fragnito’s *Cyber PowWow* is a powerful and popular project that created an “Aboriginally-determined corner of cyberspace.”⁴⁶ Part virtual gallery and part virtual chat room, *Cyber PowWow* was designed by emerging and established Indigenous writers and artists. Also launched in 1996, Skawennati’s goal was to “overcome stereotypes about Aboriginal people;

to help shape the World Wide Web; and to generate critical discourse—both in person and online—about First Nations art, technology, and community.”⁴⁷

Never Alone, also known as *Kisima Inŋitchuŋa* (I am not alone), is a puzzle-platformer video game and a landmark in game development. Built in collaboration with the Iñupiat Nation in Alaska and made with contributions from around forty Alaska Elders, storytellers, and community members, Never Alone was produced by Upper One Games, the first Indigenous-owned commercial game company in the United States. Following an Iñupiaq girl named Nuna and her companion, an Arctic fox, the player completes puzzles in a story based on an Iñupiaq story told across eight chapters.⁴⁸ By developing a contemporary digital tool to present, represent, and engage people with Indigenous knowledge and culture, the designers made clear that “we are not a museum piece, the Iñupiat people are a living people and living culture.”⁴⁹

As unicode standards have extended and become more inclusive, and greater localization has enabled people around the world to use computers in any language, mainstream platforms such as Twitter have witnessed increased Indigenous presence in Indigenous languages. An example is the Twitter feed of Rory Housty, Heiltsuk community member from Bella Bella and staff member at the Heiltsuk College. Housty regularly tweets in Heiltsuk, often (but not always) with an English translation or an audio or a video file attached.⁵⁰ In a digital space so dominated by colonial languages, Housty’s creation of an online presence for the language of his community serves both a pedagogical and political function. His Twitter feed is followed by many Heiltsuk community members, whose employment has taken them away from traditional territories, and provides them with a freely accessible and searchable archive of useful phrases. At the same time, by not translating all of his tweets into English, Housty is helping to create a distinct Indigenous online presence in Heiltsuk.

Technology Didn’t Start with the Digital

We now live and work in such digitized spaces, with portable devices, databases, and materials present in all aspects of our lives, that the very word

“digital” is becoming less relevant. While the term “digital humanities” still has traction in universities, we foresee a time in the not-so-distant future when the digital aspect of humanities scholarship will be implicit, and students will instead refer to an era of “analog humanities” before access to computing power was so widespread.

Our contemporary digital lives are the cumulative sum of the technologies of the past, and this layering shows no signs of slowing down. In language description, conservation, and revitalization, our current reliance on screen and keyboard derives from our earlier use of pen and paper, wax cylinders, reel-to-reel and other audio recording technologies, early videotape, and even specially modified typewriters with customized keys that could accurately represent Indigenous orthographies. In the 1960s and 1970s, for example, the Bell & Howell Language Master, used by communities in British Columbia, including Bella Bella, recorded on cards holding a magnetic tape with two three-second audio tracks — one for the language student and one for the teacher — allowing a comparison between student and teacher pronunciation.⁵¹

In the North American context in particular, with such a rich and deep history of language documentation and recording, we must be mindful to represent digital technologies for what they are: simply the most recent tools being harnessed to represent Indigenous languages, cultures, and worldviews. It is perhaps paradoxical to note that the depth and richness of cultural and linguistic documentation in North America makes the deployment of emerging digital technologies more complex, even if the promise of what can be achieved is all the more exciting. Any new technology, in the context of such a rich history of documentation, has to address the legacy of colonial collections and engage with a complex and problematic archival record.

The Dogma of Best Practice

Unworkable standards and a dogmatic insistence on “best practices” in digital technologies and language documentation set by scholars and funding agencies can have a disempowering effect on individuals and communities. Even well-funded academic research programs, archives, and library systems are not always able to adhere to the standards that they themselves

promote and advocate. No surprise, then, that community-based language mobilization projects that utilize emerging technologies — often without sustainable funding and outside of academic research standards — risk being silenced in a culture that promotes unrealistic technical ideals. The First Nations in BC Knowledge Network, a hub for First Nations in the province to share ideas and tools on many aspects of governance and community development, encourages the creative term “inspired practices.” Terms such as “evolving practice” and “inspired practice” in language mobilization move the conversation beyond the best practice of implementing a specific technological tool or platform to include a consideration of the complex social, cultural and historical contexts in which the work is being conducted.

Although rarely addressed in the scholarly literature, there are significant trauma-based barriers to language mobilization within Indigenous communities. As a result of the legacy of the system of Indian residential schools, many Indigenous language learners and teachers still carry feelings of distress and shame in relation to their language and can have a deeply emotional response to learning, hearing, and sharing their language. Intergenerational trauma and distress can lead to tensions and conflict over how or what to teach, particularly around the utility of writing systems versus the importance of oral transmission.

Such conversations are rooted in understandings that go far beyond simply building and implementing a curriculum, let alone an emerging digital tool or technical platform. These complicated and interconnected factors need to be better recognized by technologists, educators, and academics involved in language revitalization, and the power of language to work as a force for healing and well-being needs greater acknowledgement.

Implications

Our considered position is that Indigenous cultural insights can help to inform national policies around access to, and engagement with, emerging digital technologies. This section outlines some of the implications emerging from our environmental scan and some productive directions moving forward. Implications from this chapter can be organized around *community*, *funding*, and *technology*, with obvious intersections. In many of

the most successful technology-based language initiatives, funding, technology, and community concerns are well aligned, working in common cause, with information and resources flowing freely. These implications speak to many diverse audiences, including, but not limited to:

- Community organizations (e.g., cultural, political and educational);
- Community groups (e.g., families, teachers, cultural practitioners);
- Government (e.g., federal, provincial, funding bodies);
- Academics (e.g., universities, faculty, staff, research NGOs).

These distinct groups are implicated by the outcomes of this chapter in the following ways:

Community-based language work needs significantly more resourcing. Previous funding, largely focused on novelty, has resourced a series of pilot language projects in communities without the means for continuity, even when proven to be very effective. Sustained, multiyear funded support is required for community-based language revitalization, reclamation, and planning that is not necessarily tied to research or academic partnerships.

Sustainable funding models for continued technical infrastructure, development, and support at the community level are essential. Most funding bodies reward novelty and innovation over preexisting projects that have a proven track record and community involvement. Communities cannot plan without secure funding for existing platforms and digital commitments. Short-term funding breeds self-contained, disconnected, poorly articulated, and often rushed time-bound projects that are hard to maintain and migrate forward. It is imperative that future funding models address this gap and target support for successful, ongoing community-led projects.

Connected initiatives that ground work within a community's specific revitalization environment are needed. Technologies do not save languages; speakers do. Rather than discrete, independent technology installations, communities need integrated tools that engage with, reflect, and nurture the lived experience of language learners and teachers.

Not all work is research. An overemphasis on academic funding mechanisms can divert energy and resources from community needs in order to

fulfill research requirements and strategic objectives within universities and colleges. While academic-driven projects can generate data sets that are useful to communities, they do not always do so and often prioritize research over applied, practical work and advocacy. In order to truly serve community needs through research, university-based academics and bodies that fund it must address the interests and needs of communities and be open to engaging in community-directed research agendas that offer tangible benefits to the communities themselves.

Platforms that better support Indigenous content must be explored and resourced. The last decade has seen an increase in language mobilizing technologies that are either very cheap or entirely free, considerably reducing the bar to entry. Users are multimodal, utilizing a wide array of technologies, which they combine to achieve broader tasks. Communities may no longer need to spend a great deal of money on specific customized software and the capital costs of hardware continue to decrease (but remain nontrivial). One consequence of the plurality of platforms is that little structured and experience-based guidance exists to support community members in choosing from a growing buffet of technologies that do not always interact or communicate well with one another. Herein lies an opportunity to develop platforms that better support Indigenous content. Further research that addresses knowledge security concerns to inform supportive policy and the development of appropriate applications is needed.

Unicode is central in achieving a core baseline agreement about digital language encoding. Customized and proprietary character sets and unique encodings pose barriers to digital language use and wider mobilization. Mobilization and rollout can only begin once unicode standardized encoding has been agreed on. It is likely that governing bodies such as the Unicode Consortium will need to continue to engage with localization requests and that community organizations will have to agree to adopt certain character sets and representations.

Support networks should be fostered to share expertise and experience within, across, and between communities. Inspiring and creative work is being undertaken in individual communities across Canada, but there are

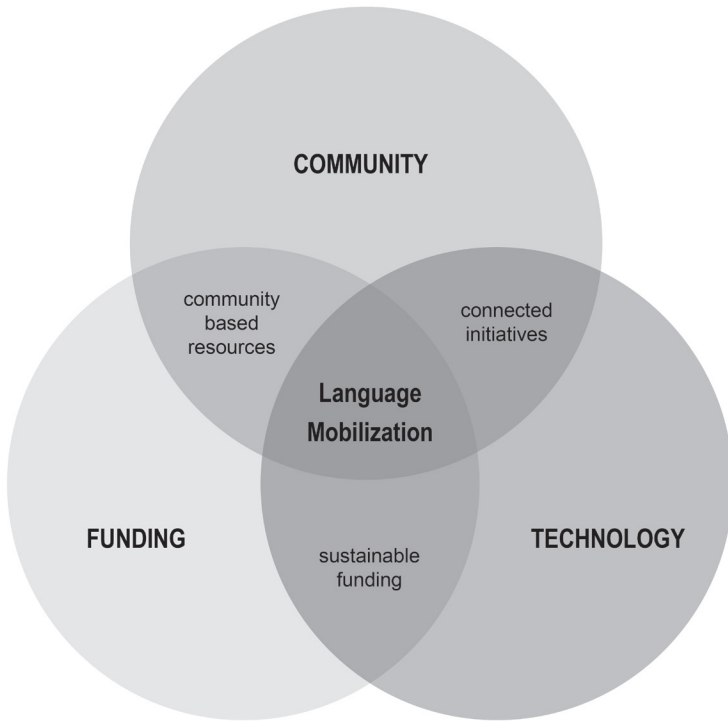


Fig. 3. Language mobilization nexus. Concept: Mark Turin 2016; implementation: Julia Schillo, 2019.

few structured spaces for sharing what people are learning or for seeking guidance. Technology platforms can build in channels of communication to support sustainability and community knowledge-sharing. In addition, structured knowledge-sharing provides an effective way to develop tools and criteria for evaluation that strengthen the support for effective language learning and mobilization at the community level. Support networks can be developed through existing networks, such as the Confederacy of Cultural Education Centers, the First Nations Schools Association, and the informal network of communities that have participated in Indigitization projects.

Community-grounded evaluation and impact assessments are needed. Despite the great variety of ways in which emerging technologies are being

used by Indigenous communities and the fast rate of technological change and innovation, there is a surprising scarcity of published material reporting on the impact of such technologies. At this point it would be valuable to explore what has worked in the past. It should be noted that “inactivity” does not necessarily imply ineffectiveness; some good methods and technologies are defunct simply through lack of financial support or human resources. Independent studies are needed to review and evaluate the success of strategies such as dictionary apps and online learning modules, to offer just two examples. Researchers and communities conducting such evaluative work should be mindful to consider a number of criteria for how impact might be measured, including speaker proficiency, political impact, and symbolic value. At present, publications on Indigenous uses of technology for language mobilization are mostly sensational press reports that speak either of languages being “saved” by technology or, rather, predict doom, gloom, and extinction. More nuance and community-grounded, systematic review is needed.

Further Research

Computation, crowdsourcing, and crowdfunding offer promising emerging directions for future research. Unicode standards are now in place for many Indigenous languages, and some analysts see the next step to effective language mobilization being computational tools such as automated translation, optical character recognition, semantic interpretation, and speech recognition. Yet these developments are still very much in their infancy. Even in well-established Indigenous languages such as Hawaiian (‘Ōlelo Hawai‘i), most translation software can still only effectively manage individual words or short phrases.⁵²

Collaborative technologies provide a means and a space for collecting and synthesizing knowledge. Ryan Henke, a doctoral candidate at the University of Hawaii, used Google Sheets to solicit input on and then compile a list of master-apprentice programs. The list is “intended to help serve as a first stop for linguists or language community members looking for answers to questions such as: Has the Master-Apprentice program been used for my language? For languages related to my language? For

languages near my community?”⁵³ By sharing the document on LISTSERVS, Henke has helped to crowdsource and synthesize information that would otherwise be difficult to locate.

Emerging technologies are also being leveraged to fund language revitalization initiatives. Crowdfunding websites such as Kickstarter provide a digital platform for people to campaign and raise resources for language programs, with filmmakers, artists, poets, and language teachers launching effective online campaigns to realize specific projects around language revitalization.⁵⁴

The answers to the questions raised in this chapter are not primarily technological, but rather social, cultural, political, and economic. Specifically, future research will need to address the following issues:

Sensitive, user-based, community-grounded evaluation and impact studies must be commissioned to evaluate the effect of emerging technologies on projects that seek to revitalize Indigenous and endangered languages. These studies must be designed collaboratively with communities so that their methodologies and criteria are rooted in a recognition of cultural norms and community goals.

Further research is urgently needed on the state of digital media asset management in Indigenous communities in order to better understand the barriers to effective mobilization and deployment of digital media for language revitalization and cultural work. Once again, this process should be comparative and community-driven, encouraging knowledge-sharing across and between Indigenous communities.

Since evaluation and assessment have a bitter colonial legacy for many Indigenous communities, it is essential to *codesign methods and assessment tools that strengthen the work being undertaken in community rather than compromise it*. It is easy to forget that learning to read and write activates a different set of neural pathways than learning to hear, understand, and speak a language. Multiple longitudinal studies can help to identify areas where the development and deployment of digital platforms has brought or is bringing tangible benefit to community-based language revitalization programs. Specific areas to explore include applied language learning programs as well as language use in

natural cultural contexts, initiatives that have been designed to increase literacy and confidence, and programs that increase incentives through engaging technologies that help to generate prestige through digital access and ease of use in digital environments. Such impact studies should be publicly available in a central repository for easy access.

Conclusion

The Heiltsuk language, as with other Indigenous languages, is an integral component in Heiltsuk traditional and contemporary knowledge systems. Heiltsuk knowledge creation, development, dissemination, and intergenerational sharing is developed in—and carried through—varied modes of documentation and expression. These include spoken language, song, oral performance, ceremony, visual arts, architecture, fishing, and wood-working technologies. Heiltsuk knowledge exists in an intercultural and international context, and Heiltsuk people have a long, uninterrupted history of artistic innovation and cultural creation, sharing with and learning from other nations across the central coast. Similarly, Heiltsuk people and organizations have always adopted and adapted writing and media recording technologies.

Better resourcing language instructors in Indigenous communities and schools will promote stronger learning outcomes, language retention, and trust. Learning goals set by the community are more attainable, more credible, and have a higher chance of fulfillment.

The intellectual property and ownership implications of cloud-based storage and mobile language-learning apps are underexplored and central to ensuring that our shared digital future is a space of respectful coexistence.

Community-based language mobilization needs significantly more long-term, stable, and sustained funding. Simply put, Indigenous communities need more funding, dispersed in a better way, in order to plan strategically over the long term. Communities must not be positioned as competitors with universities for funding resources and visibility, but rather receive dedicated funding streams that will enable more equitable partnership.

Research agendas, funding needs, and success criteria must be designed, determined, and implemented by Indigenous communities themselves. Indigenous communities have long identified the language-related questions that they want research to answer and should be directly resourced to further develop and investigate these.

For Indigenous communities to continue to participate and cocreate our shared digital future, ongoing investment in the common digital backbone is essential. Infrastructure and capital costs are rarely one-off, and technology investments must be long-term and equitable—not only for communities themselves, but also for the organizations that support them.

The story of the resilience of Indigenous languages and cultural health in Indigenous communities is a story of local endurance and perseverance against enormous opposition. Indigenous scholars and organizations are creators and innovators (and not just recipients or clients) of new technologies, particularly in the domain of cultural and linguistic heritage. Direct provincial and federal investment in the research infrastructure and human capacity in Indigenous communities is therefore imperative and urgent.

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NOTES

1. Of the many terms that are currently in use, we chose the term “Indigenous” for this article, with the exceptions of names of specific nations, communities, and organizations, such as the First Nations Technology Summit, First Nations Confederacy of Cultural Education Centre, and the Union of BC Indian Chiefs, or specific titles such as the Indian Act. Name changes from “Aboriginal” to “Indigenous” at Canadian postsecondary institutions (including at UBC) and in other Canadian contexts, such as at CBC News, reflect this wider discussion. For an exploration of these terms and their historical origins, see UBC Indigenous Foundations.
2. Howland, *Digital Divide*, 287–89.
3. Hallett, Chandler, and Lalonde, *Aboriginal Language Knowledge*, 392–99.
4. Nathan, *Access and Accessibility at ELAR*, 21–40.
5. Anderson, *Making of Indigenous Knowledge*, 347–73.
6. *Hítzaqv* means “native (of any place or country), aboriginal; (written with a capital letter:) Heiltsuk” while *hítzaqv!a* means “one’s native language, to speak one’s native language; (written with a capital letter:) Heiltsuk language, to speak Heiltsuk.”
7. Pine, “Waldayu.”
8. Belanger, *Northern Disconnect*, 43–69.
9. Belanger, *Northern Disconnect*, 43–69.
10. Gurstein, *Effective Use*.
11. Michael and Dunn, *Information and Communication Technology*, 170–74.
12. Warschauer, *Technology and Indigenous Language Revitalization*, 139.
13. Galla, *Digital Futures*.
14. Banks, *Towards a Continuum of Scholarship*, 4–11.
15. Belanger, *Northern Disconnect*.
16. K-Net, “About K-Net.”
17. University of British Columbia, “Hula Power.”
18. University of British Columbia, “Hula Power.”
19. Pine, “Mother Tongues.”
20. Pine, “Waldayu.”
21. First Peoples’ Cultural Council, “FirstVoices.”
22. First Peoples’ Cultural Council, “FirstVoices.”
23. Resource Network for Linguistic Diversity, “Sustainability of Indigenous Languages.”
24. Resource Network for Linguistic Diversity, “Sustainability of Indigenous Languages.”

25. Jenkins, "Reviving an Endangered Language."
26. Jenkins, "Reviving an Endangered Language."
27. Harvey, "ACORNS Overview," ACORNS Language Restoration Project.
28. Harvey, ACORNS Language Restoration Project.
29. Listuguj Education Directorate, "Introduction to Mi'gmaq."
30. Migmaq, "Migmaq Language Resources."
31. Wetzell, *Neshnabemwen Renaissance*, 61–86.
32. Pulla, *Mobile Learning and Indigenous Education*.
33. Pulla, *Mobile Learning and Indigenous Education*, iv.
34. Iokepa-Guerrero, *Revitalization Programs and Impacts*, 227.
35. McIvor, *Indigenous Language Revitalization and Maintenance*.
36. Whaley, *Future of Native Languages*, 967.
37. Arnold, *Can an iPhone App Help?*
38. Dickson, *Taking Indigenous Languages Online*.
39. Hennessy and Moore, *Language, Identity, and Community Control*, 189–91.
40. First Peoples' Cultural Council, "FirstVoices."
41. Nathan, *Sustainable Information Practice*, 2254–68.
42. Lewis and Fragnito, *Aboriginal Territories in Cyberspace*.
43. Maskegon-Iskwew, "Speaking the Language of Spiders."
44. Maskegon-Iskwew, "Speaking the Language of Spiders."
45. Maskegon-Iskwew, "Speaking the Language of Spiders."
46. CyberPowWow.
47. CyberPowWow.
48. Never Alone, "Cultural Insights."
49. Never Alone, "Cultural Insights."
50. @rhousty.
51. Waldbillig, "Bell & Howell Language Master."
52. Galla, *Digital Futures*.
53. Henke, "List of Master-Apprentice Approach Programs."
54. Brookes, "Right To Read."

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