

**Tech Anishinaabe Medicine Wheel:
Decolonial Design Principles within Digital
Technologies through the Development of the
*Indigenous Friends Platform***

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Abstract

Digital technologies are not only colonial in their practices, but they are colonially created and designed. Despite the implementation of worldwide responses to counteract the effects of digital coloniality, there is still an absence of decolonial and Indigenous ways of doing digital technologies. The objective of this dissertation, therefore, is to formulate design principles of decoloniality within digital technologies through the story of the development of the *Indigenous Friends Platform* (IFP) in the context of Indigenous urban youth at York University in Tkaronto, Canada. The storytelling of the *Indigenous Friends Platform* describes how in the context of Indigenous youth in Tkaronto, the decolonial design of an Indigenous mobile application needed to be explored through a process of *doing through thinking, thinking through doing*. In that process of development and reflection, the mobile application was conceived as a *technical being* who has a Spirit and founded a *tech-community*: the Indigenous Friends Association. This technical being was developed in four stages that help to differentiate this space from other mainstream hegemonic digital applications and to sustain this technological solution in the long term. These four transdisciplinary stages frame the Tech Anishinaabe Medicine Wheel that consists of four design principles of decoloniality within digital technologies: (1) *Waabinong* (East) – Digital Software Braid; (2) *Zhaawanong* (South) – Embodiment of Indigeneity; (3) *Epangishmok* (West) – Decolonial Infrastructure; and (4) *Kiiwedinong* (North) – Indigenous Data Sovereignty. These four design principles foster the theoretical reflections of decoloniality and digital technologies through the differentiation of digital decoloniality and decolonial computing. Moreover, these principles provide digital activists and Indigenous communities several insights into how digital technologies can be decolonially implemented and reimaged at the community level.

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Introduction

This doctoral dissertation is a new call for collective action through the consideration and integration of Indigenous worldviews into digital technologies and the conception of innovative Indigenous mobile approaches. In the last decade, with the spread and development of mobile devices worldwide, there has been a significant transformation with respect to Indigenous Peoples and digital spaces. The increase in internet usage among Indigenous members through mobile technologies has created a momentum of engagement and conception around digital technology and Indigeneity. Conversations among Indigenous representatives and community members are exploring new possibilities at the community level from opportunities brought by the information society and the Internet, while also resisting new forms of threats for Indigenous individuals and collective bodies.

The global context of digital tech companies is producing new forms of colonization and power structures that reinforce forms of control and domination over Indigenous knowledge and bodies. The lack of understanding of community needs by these digital entities produces new complex scenarios where community representatives must fight for their sovereignty not only on the real/physical level but also in the digital/virtual world. Furthermore, the vulnerable socioeconomic circumstances of the majority of Indigenous communities around the globe caused by historic and ongoing colonization processes generate environments where the majority of Indigenous peoples are not part of the conversations around software, digital embodiment, infrastructure, and data.

The emancipatory perception of digital technologies that landed during the 1990s and 2000s generated a significant number of projects where outsiders to Indigenous communities (commonly non-Indigenous organizations and institutions) such as NGOs, national governments, activists, and researchers, endeavoured to provide access to digital technologies within Indigenous communities. The commonality of these projects, however, is that the majority of them overwhelmingly failed to engage with community needs and could not sustain themselves in the medium and long term (Brooks & Alam, 2017, p. 299; Heeks, 2003; Heeks, 2018, p. 103; Unwin, 2017, p. 7). Recently, new approaches to

creating and designing digital technology by/for/with Indigenous peoples are allowing innovations to emerge as community responses that counteract the colonial consequences of the digital world (Alcantara & Dick, 2017; Beaton et al., 2015; Intrabach, 2018; Wemigwans, 2018). Most of these intersections between decoloniality and digital technologies lack practical applications in their analyses, and do not incorporate design principles and pragmatic specifications that enable them to be deployed and replicated at the local level. In other words, the academic and theoretical analyses provide scarce forms of implementation and deployment in the complex contexts that Indigenous peoples face worldwide.

The objective of this thesis is to formulate design principles of decoloniality within digital technologies through the story of the development of the *Indigenous Friends Platform* (IFP) in the context of Indigenous urban youth at York University in Tkaronto, Canada.¹ The IFP is a digital initiative in which I initially played a central role, but, by adding several community members' participation, the digital solution transformed itself into a tech-community that aims to “ignite the Spirit of Indigenous communities to engage and reclaim digital technology” (Indigenous Friends, 2020). Throughout five years of development, the implementation of the platform triggered several conversations around Indigeneity and digital spaces that I expose in this dissertation. Moreover, the experience of design and implementation required the integration of several areas of study: Indigenous and decolonial studies, software engineering, intellectual property, mobile infrastructures, corporeality, embodiment, and data management, among others. This experience led me to consider that the decolonial and Indigenous vision in digital design is vital to dismantling the accelerated data extraction and colonialism that are happening in relation to the digital world. I argue here that Indigenous worldviews within digital technologies offer new forms of solving the problems triggered by digital and non-digital colonial processes.

In my master's thesis on Indigenous technological design, I explored the principles necessary to

¹ Tkaronto originates from the Mohawk meaning “the place in the water where the trees are standing,” which refers to the wooden stakes that were used as fishing weirs in the narrows of local river systems by the Anishinaabe, Haudenosaunee and Huron-Wendat (DaCosta, 2014; Thunderbird, 2009). The purpose of using the spelling “Tkaronto” instead of “Toronto” is to actively acknowledge that the land where this academic project was developed is still Indigenous land.

braid the Traditional Knowledge of Tipi ceremonies with the mobile design of the *Indigenous Friends Platform* (formerly called *Indigenous Friends App*) (Mayoral-Baños, 2016). The conclusion of this research revealed a palpable need for technical and design principles of software development grounded in Indigenous worldviews in order to continue the process of decolonizing digital technologies. During the subsequent implementation phases of the platform, several design considerations and learnings emerged from the methodological and theoretical framework of what I call *doing through thinking, thinking through doing* that were finally articulated in the creation story of the *Indigenous Friends Platform*. From this perspective, the central research question of this doctoral work emerges as: *what design principles of decoloniality can be used in the context of digital technologies and Indigenous peoples in Tkaronto, Canada?* Although this research question is specifically grounded in the Anishinaabe and Haudenosaunee land of Tkaronto, this project has the potential to be adapted in several contexts worldwide through the integration of different types of local knowledge(s) within digital solutions.

In the storytelling of the *Indigenous Friends Platform*, I describe how in the context of Indigenous youth in Tkaronto, the decolonial design of an Indigenous mobile application needed to be examined from an Indigenous point of view. In that process of development, the mobile application was conceived as a *technical being* who has a Spirit. This technical being was reflected in four stages that differentiated this space from other mainstream digital applications with the intent to sustain this technological solution in the long term. I argue that these four stages frame what I call the *Tech Anishinaabe Medicine Wheel* in reference to the Anishinaabe Medicine Wheel, which represents dimensions of health and the cycles of life grounded in the Anishinaabe philosophy. In the perspective I develop in this research, the Tech Anishinaabe Medicine Wheel translates those representations into the digital world and relates them to digital design; this conception consists of four design principles of decoloniality within digital technologies: (1) Waabinong (East) – Digital Software Braid; (2) Zhaawanong (South) – Embodiment of Indigeneity; (3) Epangishmok (West) – Decolonial Infrastructure; and (4) Kiiwedining (North) – Indigenous Data Sovereignty. Although these design principles do not provide a

formal methodological guide for implementing and managing digital solutions for every local community, they aim to provide fundamental aspects to consider when deciding among different deployment approaches. These considerations are essential to avoid hegemonic practices that would continue replicating colonial practices through digital technologies.

On a theoretical level, these four design principles aim to foster the previous theoretical reflections of decoloniality, and digital technologies of several authors such as Rafael Rodriguez-Prieto & Fernando Martinez-Cabezudo (2016), Mustafa Ali (2014, 2016), Anita Say Chan (2018), and Alexandra Deem (2019) through the reflection of two concepts: decolonial computing and digital decoloniality. Furthermore, the IFP differentiates this Indigenous form of conceiving the digital space from other forms of counteractions to coloniality, such as the open-movement and the Information and Communication Technologies for Development (ICT4D), because those systems of engagement commonly do not respond to the local needs of Indigenous communities and, more importantly, they do not integrate Indigenous worldviews into the conception of the digital. Therefore, they frequently replicate agendas that do not align with Indigenous self-determination and sovereignty. Finally, this research argues that the design and ethical principles that are commonly scattered in separate conversations in academia and activism must be considered in a holistic approach through an Indigenous lens in order to create successful decolonizing digital tools for Indigenous peoples.

On a practical level, these design principles also aim to provide digital activists and Indigenous grassroots organizations several insights of how digital technologies can be implemented and imagined at the local level in a decolonial form. This is why this dissertation is a call to collective action rather than just a contribution to knowledge. More generally, these epistemic encounters between Indigenous Traditional Knowledge(s) and digital spaces aim to situate several academic discourses about digital technologies, infrastructure, digital embodiment, data, and software engineering into the context of Indigeneity as a form of decolonial digital design and, moreover, a form of political action. It is essential to clarify that this thesis is not promoting or inciting individuals or institutions to misappropriate the Traditional Teachings and Indigenous Knowledge that were shared throughout this dissertation to be used

in other academic and activist works without following the protocols that community members have established in order to share that information. However, this academic work offers several principles around software, embodiment, infrastructure and data that were narrowed in the concepts of decolonial computing and digital decoloniality as departing points to continue *doing* and *thinking* decolonial digital applications.

The first step of this inquiry is to clarify that I consider this doctoral research a *journey*. Approaching research as a journey entails that the processes involved in knowledge creation were a particular and unique trajectory, and, therefore, I do not propose this type of process for all Indigenous contexts. However, this research journey illustrates the benefits and analyses of centring Indigenous knowledge within digital creation. An important aspect to highlight, therefore, is that these dimensions of technical design do not presume a form of universality or uniqueness in Indigenous creation, but they aim to provide some principles and reflections on the aspects to be considered when Indigenous digital technologies are imagined at the local level. The intention of bringing different types of local knowledge into one sociotechnical design, such as the Mi'kmaq Two-Eyed Seeing, the Anishinaabek Medicine Wheel and the Cree Raising Tipi Ceremony, is to replicate the sociopolitical dynamics that occur in digital spaces where regularly, several community members with different identities interact within the same virtual places. Although these knowledge systems involve different stories, worldviews and understandings, the harmony among different points of view offers an opportunity to resolve the common consequences that diverse communities are currently facing due to the historical colonization processes. Furthermore, the purpose of this academic proposition does not want to imply any form of pan-Indigenism, but on the contrary, it wants to embrace the diversity that exists within Indigenous communities and bring together these distinct forms of knowledge to find common and innovative solutions for the threats that the Internet is bringing within digital spaces.

The dissertation is structured in five parts to centre Indigenous worldviews and ways of knowing but simultaneously fulfill the requirement of a dissertation in the colonial context of academia. This objective is achieved through a transdisciplinary approach: Part 1 provides a general context of

Indigenous research; Part 2 centres storytelling as a fundamental principle in Indigenous research; Part 3 provides a general context to the topics from a Western academic perspective; and Parts 4 and 5 bind and relate the story of the *Indigenous Friends Platform* to academia.

Part 1 (Chapter 1) presents the methodology and theoretical framework of the research. I introduce myself and present the attributes of this academic research through the vital characteristics of Indigenous worldviews. Specifically, I propose a process of *doing through thinking and thinking through doing* as a form of methodology and theoretical framework in order to frame a *Way of Knowing/Doing* for digital creation. In this section, the challenges of this practical and community-based research are unfolded, and several ethical principles are established in order to guide this research. Then in Part 2 (Chapters 2 and 3), I present the story of the *Indigenous Friends Platform*. In Chapter 2, I specifically introduce the Spirit of the *Indigenous Friends Platform* and how different cultural teachings frame the conception of the space through the birthing ceremony, a software development methodology, and the embodiment of Indigeneity in the digital space. In Chapter 3, I introduce how the *Indigenous Friends Platform* with the support of community members and allies became the tech community that it is today through a not-for-profit structure as a communal infrastructure and the considerations around Indigenous knowledge and data. In Part 3 (Chapters 4 and 5), after introducing the story of the platform, I situate the story and research in academia through a literature review of the state of the art of digital technologies and decolonization. In Chapter 4, I present a general framework to understand the conceptualizations and exploration of coloniality within digital technologies. In this section, it is demonstrated that several digital technologies are not only colonial in their practices, but they are colonially created/designed. Thus, in Chapter 5, several decolonial practices are distinguished as reactive forms to coloniality within the digital, but it is demonstrated that there is an absence of decolonial ways of doing (i.e., methodologies) for digital technologies. As a consequence of this finding, in Part 4 (Chapters 6, 7, 8, and 9), I introduce the Tech Anishinaabe Medicine Wheel and propose four design principles that should be considered in the conception of Indigenous digital technology: Waabinong (East) – Digital Software Braid (Chapter 6); Zhaawanong (South) – Embodiment of Indigeneity (Chapter 7); Epangishmok (West) – Decolonial

Infrastructure (Chapter 8); and Kiiwedining (North) – Indigenous Data Sovereignty (Chapter 9). Finally, in Part 5 (Chapter 10), I present the transdisciplinary balance in the Tech Anishinaabe Medicine Wheel among stories, academia, and practice through the conclusion of this research and the linkage between these design principles and other academic authors.

At the end of this research journey, the overall results and findings of this Ph.D. dissertation will be shared with community members. The dissertation will be available through the web and mobile application in an accessible format at the end of the process. In this form, the participants and the community will have access to the document, but more importantly, to the experiences around it. Moreover, the results also will be shared with community members through the INDIGital educational program of the Indigenous Friends Association, which aims to develop tech-skills among Indigenous youth and community members.

Part 1: The Methodology and Theoretical Framework of the *Indigenous Friends Platform*

Part 1 presents the methodology and theoretical framework of this doctoral research. I position myself with respect to the research and present the attributes of this academic research through the vital characteristics of Indigenous worldviews. Specifically, I propose a process of *doing through thinking* and *thinking through doing* as a form of methodology and theoretical framework in order to frame digital creation. In this section, the challenges of this practical and communal research are unfolded, and several ethical principles are established in order to guide this research.

Chapter 1

Doing through Thinking, Thinking through Doing as a Way of Doing/knowing

Indigenous researchers are continually facing the task of justifying our worldviews, epistemologies, and methodologies to the dominant knowledge systems within traditional Western academia. This justification entails that Indigenous researchers commonly need to provide a theoretical framework of the meaning of Indigenous research and epistemologies, the endorsement of Elders and Knowledge Keepers as sources of knowledge, as well as the explanation of the significance and relevance of cultural aspects such as storytelling, relational accountability, and the validation of Traditional Knowledge (Kovach, 2009; Smith, 1999; Wilson, 2008, p. 12). The following chapter therefore aims to introduce myself and to present the attributes of this academic research through the vital characteristics of Indigenous worldviews that were considered throughout this academic inquiry. To accomplish these objectives, I introduce/position myself, explaining where I come from and why I am doing this work. I then engage in a dialogue with Indigenous authors in Canada and the United States, as well as decolonial scholars from Latin America, who have developed similar approaches to explain Indigenous worldviews. Next, I introduce the consequences of the absence of academic dialogue between Indigeneity and digital technologies and why it was necessary to frame an entirely new research methodology and theoretical framework. After this presentation, the characteristics of Indigenous research are unfolded, and I explain the transdisciplinary character of Indigenous methodologies. This analysis introduces the next section, which develops the decolonial alternative of *doing through thinking and thinking through doing* as a methodological and theoretical framework, which is central to understanding the research process of this academic work. Finally, I expand the characteristics of this methodology through teachings, principles, actions, and data as a process of digital development of the *Indigenous Friends Platform*.

1.1 Positionality: Who Am I?

The start of this research journey is based on centring local knowledge, because decolonial inquiries must be contextualized at the local level (Mignolo, 2011, p. 217; Snively & Williams, 2016, pp.

33–34). In other words, the epistemic framework of this research requires it to be based on the local space where this research is framed: Tkaronto, Ontario, Canada:

The area known as Tkaronto has been care taken by the Anishinaabek Nation, the Haudenosaunee Confederacy, the Huron-Wendat, and the Métis. It is now home to many Indigenous Peoples. The current treaty holders are the Mississaugas of the Credit First Nation (part of the Anishinabek Nation). This territory is subject to the Dish With One Spoon Wampum Belt Covenant, an agreement to peaceably share and care for the Great Lakes region. (York University, n.d.)

My name is Alejandro Mayoral Baños; my spiritual given-name is *Black Jaguar*; I am a cis-man originally from Mexico City. I am the firstborn of Alejandro and Diana Antonieta, who are both identified as *mestizos* and they are monolingual Spanish speakers. Since 2014, I have lived in the city of Tkaronto, which is located in the traditional territories of the Anishinaabe, Haudenosaunee, and Huron-Wendat peoples in the settler country of Canada.

I actively do not identify with the *mestizo* identity of my parents because the *mestizaje* is a sociopolitical construct that was created in Mexico at the beginning of the twentieth century as a form of nation-building to erase the historical racial differences and to embrace European values and culture. Several scholars and intellectuals have agreed that the *mestizo* identity is a false identity that was politically created by the national states to finish the assimilation process of the Indigenous identities and at the same time maintain the supremacy of European concepts of decency (Diaz-Polanco, 2007; Navarrete, 2016; Nemser, 2011). The purpose of the *mestizaje* project was to generate the national identity of the “Mexican” and simplify the implementation of public policy in the post-period of the Mexican Civil Revolution at the beginning of the 20th century (Navarrete, 2016, pp. 83–88). This process of cultural assimilation was implemented through the education system and cultural expressions throughout the 20th century. The *mestizo* identity denigrates Indigeneity and diversity and overemphasizes the colonial process of the conquest to reclaim a certain level of “whiteness.” In the social imaginary, *mestizaje* is a phenomenon defined as the racial or cultural mixing of entities that had previously been pure (Nemser, 2011, p. 1). This political ideology pretends to impose that all Mexican

peoples must talk the same language, Spanish, and they belong to the same race: the mestizo (Navarrete, 2016, pp. 5–16). The colonial “encounter” is only its departing point from which follows a trajectory of growth where necessary breaks can be identified, such as the slave trade, Enlightenment science, or the wars of independence (Nemser, 2011, p. 1). It is important to highlight that while the mixed-race of the *Métis* in Canada is linked to Indigeneity, the mestizo in Latin America is linked to whiteness.

Due to the consequences of the history of colonization in Mexico, I cannot trace my ancestry beyond the end of the 19th century; however, both of my parents have strong roots in the state of Oaxaca, Mexico.² My great-grandfather from my father’s side is from the city of Oaxaca, Oaxaca, while my mom was born in Santiago Pinotepa Nacional, which is a municipality located on the coastal region of the same state (all her family members are from this town). This municipality is still a territory with a Mixtec and Afromexican tradition where 19.97% of its population continues to speak the Mixtec native language (Instituto para el Federalismo y el Desarrollo Municipal [INAFED], 2010).

Although my family has Indigenous and Afromexican ancestry from the states of Oaxaca and Jalisco (8 out of 16 of my great-great-grandparents), I was raised in Mexico City as a cis-man and mestizo because my parents do not consider themselves Indigenous due to the long history of colonization. Although I was raised as Catholic, I identify myself as a Spiritual person who believes in the Creator. I question the colonial influence of the Church and its ideologies against Indigenous peoples.

The person who has influenced my connection to my Mixteco and Afromexican roots was my Godmother Francisca Gerónima. She is a Mixtec woman from El Añil, a small town 10 kilometres away from Santiago Pinotepa Nacional. She lived in the same household as me from when I was one year old (November 1989) until I moved to the city of Tkaronto in August 2014. Francisca Gerónima has taught me the Indigenous values and teachings of humility, honesty, respect, courage, wisdom, love, and truth. I

² The state of Oaxaca is the state in Mexico with the highest number of Indigenous peoples' populations in the country. According to the National Institute of Statistics and Geography of Mexico [INEGI], by 2010, there were 1,165,186 people over the age of 5 who speak some indigenous language in this state, representing 34% of the entity's population (INEGI, 2010).

understand that this connection with her is a form of communication between my ancestors and myself.

More actively, I continued my journey with Indigenous communities in 2007, when a group of friends and I were invited to participate in community projects in the Totonac Indigenous Communities in the state of Veracruz (Mexico) by the Elder-Nun Obdulia Coteró. Two years later, this invitation became the base for the creation of the Indigenous non-profit organization of Magtayani.³ Within this organization, I have worked with Totonac communities, municipalities of Papantla, Filomeno Mata, and Mecatlán since 2007 to create youth-driven projects based on socio-economic solidarity schemes and traditional values. From the members of these communities, I have learned the required organizational elements to support communal projects. Throughout these 14 years, I have continued to participate actively in several ceremonies and traditional Totonac dances and to strengthen my community relationships based on *Compadrazgos*.⁴ These days the community knows me as *Lakgaxixiwa*, which in the Totonac language means the “bearded man” or “man with facial hair.”

In 2011, I finished my bachelor’s degree in Computer Science at La Salle University in Mexico City. In 2015, I was invited to create the *Indigenous Friends Platform* by the Elder Blu Waters and community member Ruth Koleszar-Green. The initial phase of the project allowed me to finish my master's degree and start the journey of the Ph.D. The birth of the *Indigenous Friends Platform* grounded my Spirit in the territory of Tkaronto, where this dissertation is based. It is essential to mention that my

³ Magtayani means “help in communal work” in the Totonac language.

⁴ Compadrazgo is a network of interpersonal kinship relationships, based on the spiritual kinship recognized by the Catholic Church. Compadrazgo in Latin America formalizes certain relationships interpersonal, reciprocal behaviour in patterns of customs so that the godchild reaches a degree of economic and spiritual security. In this social institution, the parties involved—i.e., the godparent/godchild/parents of the godchild—help their economic, social and spiritual needs. All of them help each other in diseases, visit each other, take food and take care of themselves; promote morality by recognizing mutual obligations and patterns of action; facilitate law and order; give spiritual help; and reinforce social solidarity through rites prescribed on religious occasions and in life cycle crisis (Mendoza-Ontiveros, 2010, p. 143).

Compadrazgo is a social institution that is not limited to the socio-familiar nuclei, but it extends to communities linked among them (Montes, 1979, p. 12). The Compadrazgo is a complex social construction in Latin America that has been extended discussed for decades (Montes, 1979; Cerón-Velásquez, 1995; Gudeman, 1972; Thompson, 1971). The full implications and understanding of the compadrazgo are beyond the scope of this research.

proximity to the research as an active element of the design and implementation process of the mobile application might trigger several conversations about the objectivity of the research. However, the approximation and the involvement at the community level beyond an academic purpose is an essential element of Indigenous research. Therefore, my positionality is complemented with five ethical principles that were developed as vital elements of the research in order to remain accountable to community members and reassure being critical to the results of this inquiry (see section 1.3.2). As a transversal element of this accountability process is that the results and all the tangible and non-tangible materials produced from this inquiry are totally owned and controlled by the not-for-profit organization: Indigenous Friends Association, which as a mandate has a board of directors which the majority of their members must be First Nations, Métis or Inuit (see Chapter 3 for more details).

The knowledge keeper Philip Cote shared that the primary responsibility that I have as a *Black Jaguar* is to be a gatekeeper between environments that cannot understand each other (Philip Cote, personal communication, March 30, 2016). I am the person in charge of translating the forms of knowledge and express them in ways that facilitate communication with each other: I consider that some of these antagonistic worldviews are:

- Digital Technology <> Indigeneity
- Coding <> Traditional Knowledge
- Community members <> Developers
- Academy <> Civil Society
- Anglo-Saxon Culture <> Latin Culture
- Canada <> Mexico
- Godparent <> Godchildren
- Students <> Supporters
- Computer Science <> Communication Studies
- Decoloniality <> Postcolonial

Although I would be consider “Indigenous” from outside of Canada based on my ancestry, and membership (my relationships in Mexico with my Godmother and the Totonac communities), there is one important aspect to consider and disclose. Because of my class privilege in Mexico, which meant a better quality of education (I can communicate in English and Spanish) and therefore access to opportunities, (i.e., I was able to get informed and apply to several funding opportunities), I struggle differently from what my Indigenous peers have to experience within the mainstream society in Mexico with the experiences of historical and systemic violence and discrimination. Because of these privileges, whenever I enter a space my experience in Mexico is different from my other peers. In Canada, however, these privileges blur and transform because as a “Latin” immigrant in Canada, my class has changed; I experienced the violence and discrimination of being non-white and my access to opportunities has decreased based on my cultural background and my accented English. Therefore, I recognize that the privileged middle-class economic status where I grew up allowed me to take risky decisions to do this work, but at the same time, I struggle with violence and discrimination of being a person of colour in the context of Canada. My approach is to actively use/exercise those privileges in a form that enables connections among different actors and allows Indigenous youth to be the leaders of the initiatives.

In this regard, journalist Rodrigo Chacón (Iwani) (2021) states that in order for Mexicans to claim their Indigeneity, they need relearn to walk well and live well through putting their privileges at the service of their siblings in resistance, giving up spaces, supporting as much as possible in struggles for life and nature, and hindering whenever possible to those who oppress and dispossess.

According to the Nahuatl speaker and illustrator from Zongolica (Veracruz, Mexico), Cuauhtemoc Wetzka, being Indigenous means:

Indigenous is being linked to a collective root of resistance that has been strengthened from generation to generation; our grandparents have taught us to be patient and resilient to adapt to the changes that there is in each generation so that the knowledge and wisdom of the people who founded these lands and who still have a lot to contribute to us continue to be preserved. (C. Wetzka, personal communication, December 12, 2017).

Thereby, I identify as an Indigenous person with a strong Mixtec ancestry and adopted by the

Totonac communities in Veracruz. These two groups are part of what is known as Turtle Island,⁵ and therefore I am accountable to the Indigenous communities in this whole territory. As a person from another territory of this region, I acknowledge that I am only a guest in the Indigenous lands of Tkaronto, and, as such, I have several responsibilities towards the Indigenous peoples and the land. As Koleszar-Green (2016) explores in her research, being a guest in a territory entails being respectful and treat spaces with the same respect as my own physical, emotional, intellectual and spiritual dimensions (p. 178). Moreover, Koleszar-Green (2016) concludes that, as guests, it is our responsibility to behave and learn the teaching of this territory; in this form, the importance of respecting protocols is shared (p. 38). In the same way, hosts and guests in a territory need to "know each other, to teach each other, and to work together to build reciprocal relationships that are based on Peace, Friendship, and Mutual Respect" (Koleszar-Green, 2016, p. 178-179). I claim that this teaching is the most required understanding in digital spaces as they have become territories where different identities interact and learn from one another.

From a technical point of view, it is essential to disclose that I am GAFAM⁶ active user. Several academics and activists have made active calls to avoid engaging with these companies due to the high level of capital and power that these entities have worldwide (Fontanel, 2019; Hughes, 2016; Mosco, 2017; Smyrnaiois, 2016). As I explain throughout the thesis, however, the simple exclusion and avoidance of this oligarchy without intermediate educational steps for Indigenous peoples would continue to replicate forms of exclusion and generate an elite of tech-savvy⁷ academics and activists that hold power about digital development.

⁵ Turtle Island is the name many Algonquian- and Haudenosaunee- speaking peoples mainly in the northeastern part of North America use to refer to the continent.

⁶ In 2016, the biggest tech companies worldwide were (1) Apple, (2) Google, (3) Microsoft, (4) Amazon and (5) Facebook – ordered by value (Mosco, 2017, p.66, 75). Their initials made the acronym of GAFAM.

⁷ Knowing a lot about modern technology, especially computers (Tech-savvy, n.d.).

1.2 Indigenous Worldviews as a Research Paradigm

Science can explain many things, but in the tribal world, there is another realm. Yet we value knowledge, and we combine it with the assistance we seek from the spirit world. One should not be afraid to seek assistance to develop a thought. In our world, you are a physical being, and you are a spiritual being. (Murdena Marshall in Bartlett et al., 2012, p. 332)

As explained in the previous sections, after the journey of creating the first version of the platform and the exposure of the work in my master's degree, I had the opportunity to continue expanding the findings of this work through a Ph.D. program. During that transition process, I was questioned several times about the academic field in which the research of the mobile platform could stand regarding Western academia and Indigenous worldviews. On the one hand, the involvement of Traditional Knowledge throughout the development process entailed a direct connection to Indigenous ways of knowing and doing. On the other hand, the intersections of digital technologies at several layers involved the engagement with Western sciences around technology and media. Thereby, the platform's transdisciplinary character did not allow me to identify particular theories within a single discipline within academia, and, more importantly, this factor located this research between two different epistemic paradigms: Western Science and Indigenous worldviews. According to the theoretical physicist and transdisciplinary advocate Basarab Nicolescu (2006), transdisciplinarity is an invitation to a research space that is "beyond disciplines." Transdisciplinarity integrates "which is at once between disciplines, across the different disciplines, and beyond all disciplines. Its goal is the understanding of the present world, of which one of the imperatives is the unity of the knowledge" (Nicolescu, 2006, p. 145). Transdisciplinary research implies a form of describing the phenomena of reality without being limited by the disciplinary boundaries that academic disciplines impose on the research subjects. The possibility of doing research "beyond disciplines" allows new forms of knowledge creation and forms of interaction. At the end, in its most pure conception, transdisciplinarity indicates that there are no discernable boundaries between disciplines. In this thesis, the tensions within Indigenous research remain; however,

they are intertwined with the complexity of its transdisciplinary character with digital technologies. At several times during the research process, many social and technical disciplinary boundaries were crossed in order to build knowledge and, most importantly, to create a decolonizing digital experience for the people involved in the process.

In this regard, Mi'kmaq Elder Murdena strongly affirms that Indigenous knowledge “was never meant to be static and stay in the past; rather it must be brought into the present so that everything becomes meaningful in our lives and in our communities” (as quoted in Bartlett et al., 2012, pp. 335–336). The phenomenon of the lack of translation within academia between divergent epistemic perspectives has been expressed through the isolation of methodologies for the creation and deployment of digital tools that do not consider other types of knowledge because of disciplinary “purity” and hierarchical perspectives of Western science and technology. Under this perspective, digital technologies are seen as the only solution and possibility to “save” Indigenous peoples with the “help” of Western science and technology. In the words of Argentinian decolonial thinker Walter Mignolo (2011), these technological approaches have replicated the vision of the missionaries who act in the name of the “truth” to “save” the “powerless” Other (p. 219–220).

The first stage of this research methodology, therefore, involved displacing myself from these approaches by shifting the initial academic inquiry from a Western epistemology in digital technologies to an Indigenous paradigm. In the context of this academic inquiry, I needed to actively start from Indigenous worldviews and support the research from digital methodological tools through a Two-Eyed Seeing perspective. This research’s importance relies on the dialogue between digital technologies and Indigenous knowledge to find new forms of digital reappropriation.

The implications and characteristics of Indigenous research and worldview have been widely discussed and developed in academia for the last 20 years (Absolon, 2011; Cajete, 2000; Graveline, 1998; Kovach, 2009; Smith, 1999; Snively & Williams, 2016; Tuck & Yang, 2012; Wilson, 2008). Research paradigms are the beliefs and assumptions held about knowledge creation, where they come from, and whom they involve (Wilson, 2008, p. 33; Kovach, 2009). These sets of knowledge beliefs guide the

action of the researcher.

From an Indigenous point of view, these beliefs and assumptions are called *worldview*. Tewa author and professor Gregory Cajete (2000) defines worldview as “a set of assumptions and beliefs that form the basis of a people’s comprehension of the world” (p. 62). As stated by Gloria Snively & Lil’watul Lorna Wanosts'a7 Williams (2016), although Indigenous peoples are diverse and have different cultural contexts, there is a shared worldview in which humans are intricately connected to nature (p. 33). Moreover, Indigenous worldviews are a connector of similar colonial experiences in different colonial histories (Mignolo, 2011, p. 217).

The Indigenous character of this research incorporates Indigenous worldviews and ways of knowing that guide the entire framework of the research, such as the creation of kinship and relationships, continuous consent, storytelling, relational accountability, and the use of the local knowledge as the framing structure. In other words, Indigenous worldviews provide a filter, the lens from which place-based epistemologies, methodologies, and pedagogies can be articulated (Snively & Williams, 2016, p. 33). Indigenous worldviews are a decolonial research paradigm and place Indigenous knowledge(s) or epistemologies at the centre of the research inquiry and the relationship derived from the process. According to Opaskwayak Cree scholar Shawn Wilson (2008), Indigenous research is a ceremony that is based on relationships and respect for those connections (p. 69, 74). In this matter, Mignolo (2011) asserts that within Indigenous paradigms, there are only interacting subjects, namely relationships, and there are no objects to be observed/studied or “others” to be included (p. 228).

Regarding Indigenous knowledge, Plains Cree and Sauleaux scholar Margaret Kovach (2009) describes Indigenous epistemologies as “interactional and inter-relational, broad-based, whole, inclusive, animate, cyclical, fluid and spiritual” (p. 56). In the same way, Cree scholar Willie Ermine explains Indigenous epistemologies as: “[i]n their quest to find meaning in the outer space, Aboriginal people turned to the inner space. This inner space is that universe of being within each person that is synonymous with the soul, the Spirit, the self or the being” (as stated by Snively & Williams, 2016, 32). Wilson (2008) describes Indigenous epistemologies as a “system of knowledge built upon relationships between things,

rather than on the things themselves. Indigenous epistemology is more than merely a way of knowing” (p. 74). This factor means that Indigenous epistemologies are not only related to intellectual knowledge, but they are interconnected to the relationships among community members, cultural expressions, ways of knowing the world and nature. Moreover, Kovach (2009) characterizes Indigenous epistemologies as pragmatic, ceremonial, physical, metaphysical, non-fragmented and holistic nature. She agrees, however, that trying to create universal definitions of Indigenous epistemologies or knowledge(s) does not fit into Indigenous inquiry because Indigenous knowledge is particular and personal (p. 56-57).

Mignolo (2011) conceptualizes Indigenous worldviews and epistemologies based on the respect of human dignity. According to him, dignity “has been taken away” from Indigenous peoples since the beginning of the colonization process in 1492 (p. 216). He claims that shifting from a “universal” truth in Western knowledge to human dignity in the Indigenous worldviews as the centre of the research promotes the stirring from a Eurocentric colonial option to decolonial thinking (p. 116, 214). Indigenous worldviews are a theoretical revolution that guarantees respect for human dignity (p. 217).

During the process of creation of the IFP, I centred the methodology of creation in Indigenous worldviews and incorporated the local experiences and knowledge(s) into the digital process. This complex and transdisciplinary intersection required a balance between Indigenous knowing and Western science views (Kovach 2009, 21–46; Snively & Williams, 2016, p. 32).

1.2.1 Indigenous Methodologies as a Transdisciplinary Dialogue

After exploring Indigenous worldviews, it is fundamental to describe the transdisciplinary character of this inquiry and its implications in the construction of the methodology and theoretical framework. For Wilson, methodology refers to the theory of how knowledge is gained (Wilson, 2008, p. 34). Anishinaabe scholar Kathy Absolon (2011) states that one of the main struggles of Indigenous researchers is finding Indigenous methodologies congruent with Indigenous worldviews (p. 81). Indigenous methodologies are guided by Indigenous knowledge, and Indigenous knowledge is not Western knowledge (Kovach, 2009, p. 30). Therefore, the complexity of Indigenous research

methodologies relies on the interaction between Indigenous and Western frameworks (Wilson, 2008, 84; Absolon, 2011, 124; Smith, 1999, 16). Analyzing the characteristics of Indigenous methodologies is important to justify why a transdisciplinary approach was required throughout the research and to explain the rationale of the intersections of several research practices and forms of analysis used in this academic work. The creation and examination of the *Indigenous Friends Platform* was a process that intertwined different transdisciplinary methods required in the intersections of the digital creative practice and Traditional Knowledge. The relevance of unfolding the properties of Indigenous methodologies relies on providing the epistemic tools required to understand the process of creation and deployment of the digital space that ended in integrating four design principles under the categories of decolonial computing and digital decoloniality. The relevant aspect of this practice is that the transdisciplinary character was used throughout the praxis and during the theoretical process of the different aspects of the digital.

This form of knowledge creation urges a displacement of the researcher as the “expert who acts in the name of the truth to become a mere mediator of knowledge that encourages the dialogue among different worldviews and paradigms. As Mignolo (2011) stated:

The theoretical revolution is here already at work: the role of the missionary (of any missionary, whether Christian, Islamic, liberal, Marxist) who acts in the name of the truth to convert the misguided has been displaced by the role of mediator dwelling in the colonial ontological and epistemic difference. (pp. 219–220)

In the words of Unangax̂ Eve Tuck & Wayne Yang (2012), decolonial methodologies cannot convert “Indigenous politics to a Western doctrine of liberation; it is not a philanthropic process of ‘helping’ the at-risk and alleviating suffering” (p. 21). This factor means that within this type of decolonial practice, there is an equivalent dialogue between different epistemic worldviews that change and modify each other. The result of this process is that Traditional Knowledge is framed upon digital technologies, but also digital technologies are being changed through the usage of Traditional Knowledge.

This aspect of Indigenous methodologies has been explored in several decolonial scenarios. The

Mi'kmaq principle of the Two-Eyed Seeing, shared by Elders Albert and Murdena Marshall, refers to “learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of Western knowledges and ways of knowing, and to using both these eyes together, for the benefit of all” (Bartlett et al., 2012, p. 335; Peltier, 2018, p. 2).⁸ According to them, this form of the epistemic process brings the opportunity to create solutions for the current problems of the world and open new possibilities for the youth (Bartlett et al., 2012, p. 336). Elder Albert Marshall indicates that it is essential to weave back and forth between both types of knowledge (i.e., Western and Indigenous knowledge paradigms), which entails the understanding of them as being systems with their own ontology, epistemology, methodology, and axiology (Bartlett et al., 2012, p. 335). Moreover, the Indigenous knowledge perspective with Two-Eyed Seeing implies that the research is ethically and philosophically consistent with Indigenous worldviews (Peltier, 2018, p. 2).

This aspect of epistemic exchange, which is also called *double translation*, can also be seen in the Zapatista movement in Mexico with the Subcomandante Marcos (now known as Subcomandante Galeano), where he acted as a translator between the Mexican Nation on one hand, and the discourses of local Indigenous communities in Chiapas on the other. Moreover, Marcos became an epistemic translator between the local population and Marxism, where both discourses nurtured each other (Mignolo, 2011, p. 221). In the Zapatista movement, the understandings of socialism, communism, democracy, and Nation were not departure points, but they created a dialogue that includes epistemic diversity and includes the particular demands of the communities (Grosfoguel, 2007, p. 75). In the Bolivian context, the reappropriation of bilingualism as a decolonizing practise denotes a non-Western form of knowledge production where a common creation is developed through a process in which producers of knowledge and interlocutors have discussions as equals with other centres of thought and currents in the academies (Cusicanqui, 2012, p. 106). The commonality in this decolonial characteristic is that this process entails a

⁸ Two-Eyed Seeing was first mentioned in Fall 2004 by Mi'kmaq Elder Albert Marshall when in an interactive science co-learning project, he encouraged a common consciousness needed for collaborative work: “it's us, together” (Bartlett et al., 2012, p. 335).

transgression of the disciplinary boundaries within Western academia because it implies a double form of epistemic communication and reconfiguration, displacing the academic research outside of a single discipline and transgressing disciplinary boundaries, that requires multiple forms of understanding the world. In this aspect, Colombian decolonial philosopher Santiago Castro-Gomez (2007) argues that in order to decolonize the knowledge production within educational institutions, the transgression of disciplines, hierarchies, and departments is required to avoid reproducing the exclusionary methodologies of the positivist scientific method (pp. 81–83).

As explained in Chapter 2 and 3, the constant transgression of the structures within York University allowed the possibility of the development and implementation of the *Indigenous Friends Platform*. In other words, the interactions between Indigenous and Western paradigms enabled the creation of research methodologies and transdisciplinary research where the outcomes relate to relevant social issues, transgress disciplinary paradigms due to the complexity of the experiences, and include non-academic authors (Bartlett et al., 2012, pp. 335–336). Concerning the transdisciplinary character of Indigenous methodologies, Elder Albert claims that:

Two-Eyed Seeing is hard to convey to academics as it does not fit into any particular subject area or discipline. Rather, it is about life: what you do, what kind of responsibilities you have, how you should live while on Earth...i.e., a guiding principle that covers all aspects of our lives: social, economic, environmental, etc. The advantage of Two-Eyed Seeing is that you are always fine-tuning your mind into different places at once, you are always looking for another perspective and a better way of doing things. (as quoted by Bartlett et al., 2012, p. 336)

In the same line, Mignolo (2010) refers to decoloniality as “not an interdisciplinary tool but, rather, a transdisciplinary horizon in which decoloniality of knowledge and decolonial knowledge places life (in general) first and institutions at the service of the regeneration” (p. 11). In this same regard, Kathy Absolon, in a conversation with Margaret Kovach, agrees that there must be a transformative praxis element in applying Indigenous methodologies themselves because this type of research pushes boundaries within colonial institutions (Kovach, 2009, pp. 85–86). A lack of transdisciplinarity in this

academic work would signify an absence of dialogue between different discourses and the imposition of one culture over another that would perpetuate the colonial perspective and the continued isolation of Indigenous forms of knowing. In this respect, Elder Albert mentions that “no one being [culture] is greater than the next, we are part and parcel of the whole, we are equal, and that each one of us has a responsibility to the balance of the system” (Bartlett et al., 2012, p. 332). In the same regard, Mignolo (2011) warns that the simple acceptance that the knowledge expressions and creations are culture-relative without intersecting and challenging them perpetuates colonization because the historical reasons for categorizing those cultures in the first place remain silent (p. 221).⁹ In this matter, the Bolivian feminist Silvia Rivera Cusicanqui (2012) asserts that the acceptance of discourses of multiculturalism, i.e., the existence of diverse epistemologies without intersecting them and reflecting on their historical implications, is essentialist and renews the effective practice of neo-colonization and subalternation (pp. 100–101). This aspect of dialogue became relevant in creating the *Indigenous Friends Platform* due to the recurrent transgression of particular disciplines to address the complex situations of development, deployment, and implementation of digital technologies. Moreover, due to this transdisciplinary character, several areas of inquiry within digital technologies were explored—e.g., infrastructure, data, embodiment, and software—to propose a decolonial approach in the framework of this research.

Cusicanqui (2012) also cautions that the mixing of two different epistemic beings or cultures into a third one in complete harmony is again a colonial practice that does not recognize the historical context of local struggles because this type of approach minimizes the oppression and power imbalance, along with their consequences, within communities today (pp. 100–101, 105). Incorporating the Mi'kmaq Two-Eyed Seeing or double translation into digital technologies will not signify the creation of a new apolitical and harmonical discipline that does not recognize the historical and political processes of colonization

⁹ Through colonization, people were categorized by religion, colour, region, and continent. “If we accept, for instance, that actions, objects, beliefs, languages, ideas, and so on are culture-relative, we hide the power of coloniality from which ‘different cultures’ came into being in the first place. ‘Cultures’ have not been ‘there’ all the time, but have been forced into being what they ‘are’ today by the making of the modern/colonial world” (Mignolo, 2011, p. 221).

where the power imbalances and injustices are not considered. This strategy is commonly used in several research cases within digital technologies, where this epistemic hybridity is embraced because digital technologies appear neutral and apolitical without recognizing the historical forms of oppression and colonialism.

To avoid processes of hybridity and colonial implications, the transdisciplinary character of Indigenous methodologies requires strict considerations of the relevance and interpretations of quantitative and qualitative Western research methods' outcomes. In this respect, Wilson (2008) asserts that as long as the methods suit the ontology, epistemology, and axiology of Indigenous worldviews, they can be borrowed from other suitable research paradigms (p. 39). However, this process of appropriation implies an epistemic transformation that triggers a decolonial effect. In this regard, Kovach differentiates Indigenous *Ways of Knowing* (e.g., sharing circles, conversations, ceremonies) from qualitative methods (e.g., focus groups, interviews) due to their epistemic origin. She states that the differentiation between them is fundamental, as knowledge is neither acultural nor apolitical (p. 29–32). The differentiation between the two paradigms is a fundamental part of the political and cultural discourse of decoloniality in academia.

To avoid the process of hybridization and to guarantee its differentiated transdisciplinarity character, the development of the *Indigenous Friends Platform* included a continuous dialogue between digital technologies and Indigenous paradigms following a particular principle of Indigeneity: *doing through thinking, thinking through doing*. This concept incorporated the praxis and theory—methodology and theoretical framework— in the same step of the research process.

1.3 Doing through Thinking, Thinking through Doing

Several academic authors do not delineate concrete decolonial actions (*doing*) but only theorize (*thinking*) about Indigenous peoples, replicating institutional colonial research practices. This issue became central in the design when I created the research methodology for this dissertation. Regarding the practical component within Indigenous methodologies, Kovach (2009) argues that this type of knowledge

production must commit praxis and social justice for Indigenous peoples (p. 47–48). In the same regard, Bartlett et al. (2012) assert that in the Mi'kmaq Two-Eyed Seeing principle, it is important to “do things in a creative, grow forward way” rather than “just talk” about what happened (p. 334). Absolon (2011) states that Indigenous knowledge leads to “doing” and becoming active and involved. She also asserts that research needs to be experiential and required to go beyond the writing and move into the doing and being (p. 132). In the same respect, Cusicanqui (2012) firmly claims that there can be neither a discourse of decolonization nor a theory of decolonization without a decolonization practice (p. 100). Venezuelan critical thinker Belin Vázquez (2013) argues that decolonial projects cannot remain only in the academic text or environment but rather need to be constructed in a praxis towards decolonization. Furthermore, Maori scholar Graham Smith stresses the importance of praxis within Indigenous research to any Indigenous methodology because this type of knowledge production must benefit Indigenous peoples in some way, shape, or form (as stated by Kovach, 2009, p. 93). Métis scholar Fyre Jean Graveline (1998) suggests that in transforming the “Eurocentric consciousness,” educators, philosophers, researchers, activists, shamans, artists, and visionaries shall “move and act on knowledge.” Finally, according to decolonial Cuban author Alexander Luis Ortiz-Ocana & Colombian María Isabel Arias-Lopez (2019), there are several decolonial methodological proposals, but in the majority of cases, they are failing to detach from the Western conceptual configuration. They state that, commonly, academic authors focus on doing theoretical research and embracing Western theorization instead of moving to social praxis, and therefore a decolonial project must have a practical component (pp. 5–6). The absence of action in the research signifies the continuation of colonial forms of knowledge production and the embracing of false decolonization within a colonial discourse. In order to conceive the usage of an Indigenous methodology, therefore, and to aspire to frame design principles to create digital technologies, I conceived that the praxis must be central in this research. Nevertheless, how is it possible to organize a reflection of the praxis, especially when those actions are uncertain and can be prolonged over time?

Western research has the task of applying conceptual frameworks that demonstrate the theoretical and practical parameters of their research; these theories illustrate the “thinking” behind the “doing”

(Kovach, 2009, p. 39). In his exploration of Western modernity, the decolonial author and scholar Walter Mignolo (2011) credits the Zapatistas with replacing the binary of knowledge/experience with the decolonial alternative framework of doing through thinking and thinking through doing. This concept demands epistemic disobedience and epistemic delinking from Western science through understanding that thoughts and praxis are part of the same epistemic object (pp. 22, 54, 214–215). This form of conducting research has frequently been mentioned by other Indigenous and decolonial scholars. Absolon (2011) regards the doing as the embodiment of research that involves internalizing the process and the tendency towards the physical aspect. Learning by doing is an important form of the transmission of Anishinaabe Knowledge from one generation to another and from one person to another (Absolon, 2011, pp. 133–134). In the same way, Wilson (2008) emphasizes the production of knowledge by “watching and doing” through participant observation (p. 40). Anishinaabe scholar Leanne R. Simpson (1999) asserts that research is a process of “learning by doing:”

Learning by doing was a central method chosen by Elders and community experts to teach me. For me, it meant participating, experiencing and reflecting in a number of activities in spiritual, emotional, physical and mental dimensions. I went on hunting trips, out to fishnets and to check traps. I travelled old canoe routes. I visited sacred sites and participated in sweat lodges and shaking tent ceremonies. I camped on the land a number of times with community members and observed healing and sentencing circles. I participated in a number of smudging ceremonies and sharing circles. I also shared my dreams and visions. (pp. 35–36)

In the same regard, Ortiz-Ocana & Arias-Lopez (2019) mentions that the “decolonial doing” implies committing with social actors, with the community, generating in them reflections and constructions around research, which is not always comfortable amid academic and institutional logic (p. 6). The significance of this decolonial approach is that thinking or reflection on research happens simultaneously with doing or acting with community members or participants.

This aspect presents tensions between the academic concepts of theoretical framework, however, namely epistemology, and methodology. A conceptual or theoretical framework provides the researcher

with the justification of how their methods are being aligned with a particular way of knowing (Kovach, 2009, p. 43). However, under the decolonial alternative of doing through thinking and thinking through doing, the research methodology frames the theoretical framework as the theoretical framework transforms the research methods. In other words, the implication using the framing of Western Science is that the methodology and the theoretical framework within research are intertwined and cannot be separated. The concepts and theory align the methodology, but also the methodological journey frames the theoretical framework. The theoretical framework (thinking) expands while the methodological journey is being deployed (doing), and the methods (doing) change based on that process of reflection (thinking).

This process of epistemic displacement is reflected because the research process of the *Indigenous Friends Platform* in Tkaronto was based on the praxis of the deployment of the digital space. These practical sociotechnical experiences and their challenges framed the theoretical framework of the research so that, at the same time, it permitted finding solutions for the physical and practical challenges. In other words, the methodology and theoretical framework of this research is based on the decolonial alternative of doing through thinking, thinking through doing. In this process of discovery in an unknown field, (a) it was essential to use some digital tools to create an initial state of a digital tool in order to test/embody/experiment with it (doing); then, (b) use a process of reflection (thinking) to (c) transform the process into four design principles (thinking) in order to (d) educate others (doing). These cycled moments of doing and thinking happened several times throughout each of the *Indigenous Friends Platform* versions explained in Chapters 2 and 3.

It is essential to highlight that this rationality of doing through thinking and thinking through doing does not imply an abstract universal or empty signifier as a universal methodology and theoretical framework, but a connector that links the struggles of different Indigenous communities around the world emerging from the global colonial experience of digital technologies (Mignolo, 2011, p. 276). Thereby, this experience aims only to provide some guidance to the deployment for other local experiences.

1.3.1 Ways of Knowing/Doing: The Displacement of Methodology

Different decolonial authors have frequently stated that the terms “method” and “methodology” carry the epistemic and conceptual weight of Western knowledge due to the connection with academic research and the extraction of knowledge (Absolon, 2001; Cajete, 2000; Ortiz-Ocana and Arias-Lopez, 2019, p. 8; Smith, 1999; Wilson, 2008, pp. 32–35). Therefore, I need to reflect on the epistemic conceptions and implications of these terms in order to explain how the terms are used in the context of this academic research.

Cajete (2000) suggests that the process of developing understanding in Indigenous Science is described by the term *Coming to Know*. This term reflects the idea that knowledge learning is a “journey, a process, a quest for knowledge and understanding” with all our relations (Cajete, 2000, p. 66). This process “requires the individual to personally reflect upon and conceptualize the balance between [their], his or her own Indigenous Knowing and the views presented in Western Science” (Snively & Williams, 2016, p. 32). Wilson (2008) uses *strategies of inquiry* when referring to research methods in order to refer to the way knowledge is gained in Indigenous research because implying the word “method” without reflecting on it would not fit the epistemologies being studied (pp. 39–40). In the same regard, Ortiz-Ocana & Arias-Lopez (2019) argue that due to the substantial connection with colonial epistemologies, “decolonial research” and “decolonial methodologies” are contradictory tautologies, and they propose a displacement of those concepts by the terms *decolonial doing* and *decolonial actions/footprints*, respectively (pp. 4–10). These terms reflect the call-to-action of Indigenous inquiry and the possibility of having an open journey of discovery within research: “when someone cares a lot about offering and applying a method, it is acting from modernity and is being dragged by its hidden face: coloniality. To set up a decolonial doing and a decolonial life through a decolonizing process, we cannot apply methods or techniques, only consider decolonial actions or footprints that are not techniques, nor instruments, nor tools, nor methods” (Ortiz-Ocana & Arias-Lopez, 2019, p. 10).

In terms of accessibility, Margaret Kovach (2009) agrees that Indigenous research and

methodologies must be “user-friendly” in the sense that people from the communities should understand what the theorist is talking about (p. 47). Ortiz-Ocana and Arias-Lopez (2019) highlighted how Western research methodologies commonly do not get back to communities, nor is the knowledge accessible for community members (p. 7). However, it is essential to highlight that the majority of Indigenous scholars explored in this research (e.g., Kovach, Wilson, Absolon, Cajete) agree that the words “method” and “methodology” can be used as long as there is an active process of reflection on the colonial context where the terms are used. On the contrary, decolonial authors Ortiz-Ocana and Arias-Lopez propose more radical approaches where they encourage replacing the terms to try to displace the colonial implications. In this academic work, I will guide the process of methodological reflection in this chapter, and therefore, the conception of “methodologies” is used interchangeably with the notion of Indigenous Ways of Knowing/Doing that imply the displacement of Western knowledge by Indigenous knowledge and the notion of giving back to the community. Moreover, Ways of Knowing/Doing reflects on the conception of doing through thinking, thinking through doing as a methodology and theoretical framework. In the case of methods, the decolonial / Indigenous action concept is being integrated as proposed by Ortiz-Ocana and Arias-Lopez.

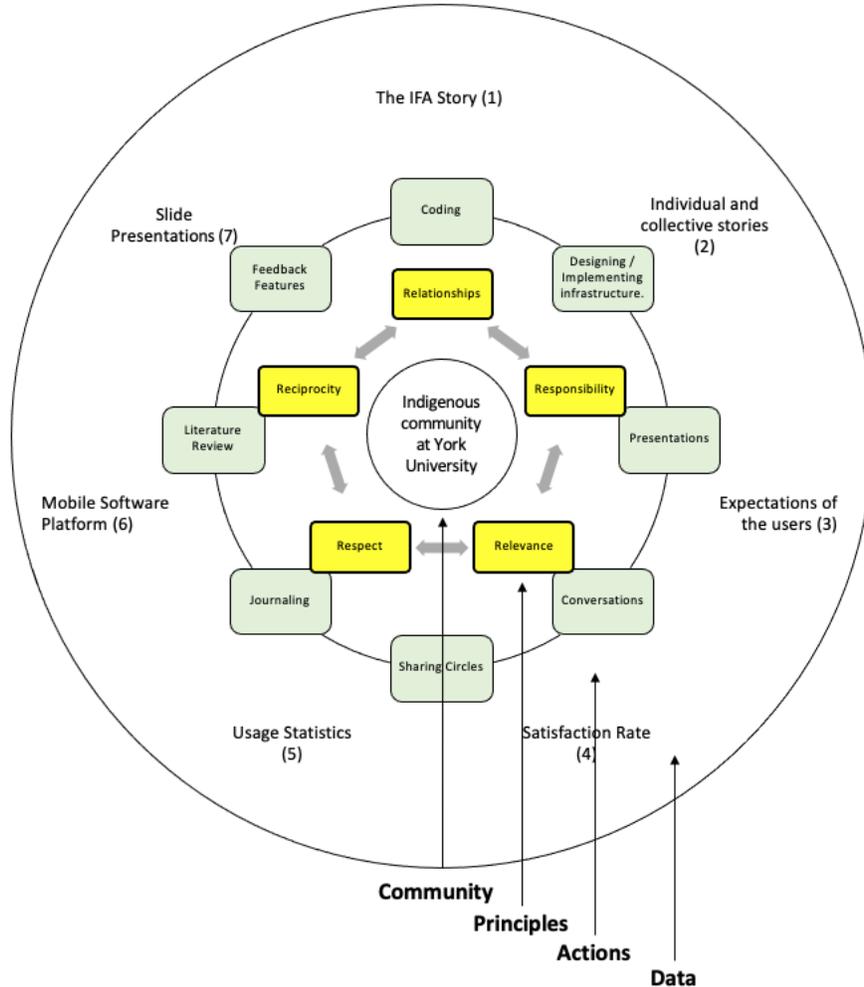
A fundamental aspect to understand about this type of knowledge production beyond the linguistic terms, however, is that Indigenous methodologies are unstructured and are not linear on time. Ortiz-Ocana and Arias-Lopez (2019) define this type of research as a process of not creating a methodological plan and following it, but rather as a process of searching, inquiring, unveiling, and unravelling (p. 16). Absolon (2011) firmly asserts that prescriptions or formulas for Indigenous methodologies do not exist (p. 48). Moreover, she asserts that the process of research involves progression or steps forward, which can be planned or unplanned series of actions. This process can be “defined and determined ahead of time or nebulous and emergent” (p. 85). Finally, she asserts that Indigenous researchers should be careful not to be so dogmatic or rigid because it is difficult to talk about the home, groundedness and Spirit (p. 136). Absolon (2011) calls this form of doing research: “organic methodology” (p. 87). In the context of the *Indigenous Friends Platform*, the research process could not

happen in a structured form due to the complexities of its transdisciplinarity character as well as its Indigenous and decolonial setting. Moreover, the nature of the cyclical actions of doing and thinking did not permit a linear focus, but only a circular process of development.

Therefore, I envisioned the Way of Knowing/Doing of the *Indigenous Friends Platform* by proposing four main components intertwined and related to each other: community, ethical principles, decolonial / Indigenous actions, and expected data that are not necessarily linear in time but cyclical (Figure 1). This methodology and theoretical framework originate in the Indigenous community at York University and are grounded on Indigenous principles as an ethical form of performing research. As a third component, several methods or decolonial / Indigenous actions are proposed as ways of collecting the experiences of digital creation. Finally, different types of data are envisioned as possible outcomes of the research inquiry.

Figure 1

Way of Knowing/Doing the Indigenous Friends Platform



Note. This figure illustrates the decolonial alternative of *doing through thinking and thinking through doing*. This circle shows the relationships among the four components of this research process: community, principles, actions, and data.

1.3.2 The 5Rs as Ethical Principles

Before I can define some possible actions in this research, it is crucial to frame ethical principles that guide the research actions due to the historical relationship between research and Indigenous peoples. Based on the holistic character of Indigenous Ways of Knowing/Doing and placing my research in

Tkaronto, I searched for ethical frameworks that were developed in this area in the context of Indigenous research and digital technology. In the context of digital spaces, I found that in the case of the First Nations Schools Principals' Course (FNSPC) in Tkaronto, a team of researchers developed five R principles to conduct research in online learning among Indigenous students: (R)espect, (R)elevance, (R)eciprocity, (R)esponsibility, and (R)elationships. These principles proved that the challenges within digital learning spaces and Indigenous students could not only be mitigated, but they could be transformed into strengths (Tessaro et al., 2018, p. 141). These principles were “highlighted as a mitigator for the contentious tasks of incorporating Indigenous knowledge and learning into online environments, whereby core values of Indigenous education appear to conflict with the goals and uses of online education” (Tessaro et al., 2018, p. 126). At the same time, this ethical framework was concluded based on the work of other scholars such as Kirkness, Barnhardt, Harris, Wasilewski, Restoule, Styres, and Zinga (Tessaro et al., 2018, p. 132). Hence, I decided to align the ethical principles of this research to this approach due to several reasons:

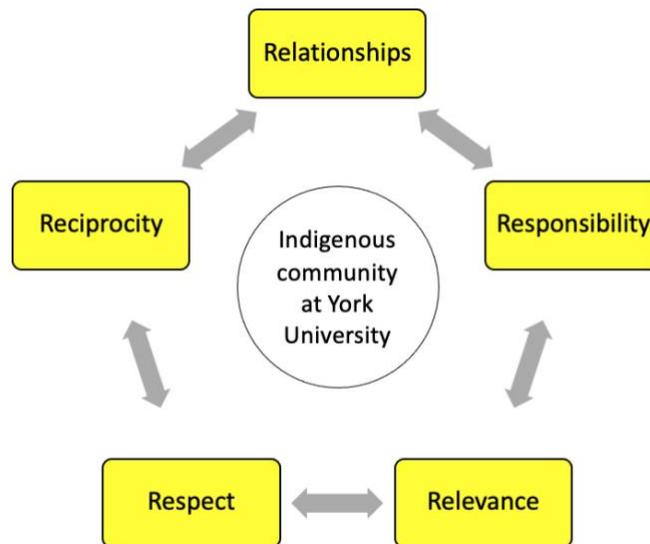
1. As mentioned earlier in the text, this framework was developed on the same land where the academic work of the *Indigenous Friends Platform* was developed.
2. The FNSPC employed a decolonizing approach based on the work of Linda Smith (1999) and Shawn Wilson (2008), which are also central in the framework on the methodology of this research (Tessaro et al., 2018, p. 129).
3. In the context of the FNSPC and the *Indigenous Friends Platform*, there is a constant tension between academic institutions and Indigeneity in order to accommodate Indigenous knowledge and worldviews (Tessaro et al., 2018, p. 133).
4. The relevance that this work has in digital spaces and the challenges that they face regarding the engagement of Indigenous youth online are quite similar in both contexts. Therefore, ethical principles can guide both approaches.

Consequently, the production of knowledge within this research includes five ethical principles that consider the fundamental values of Indigenous research through the interweaving of these concepts

with the methodological elements that other decolonial and Indigenous scholars have developed around Indigenous research (Figure 2). Furthermore, these principles locate “community” at the centre which is composed mainly by the members of the Indigenous community at York University (e.g., Elders, Knowledge Keepers, undergrad and grad students, faculty members, staff members, volunteers, and allies) that are users, constructors or both in the *Indigenous Friends Platform*. As part of this community, there are members of the Indigenous Friends Association (IFA) that are not directly linked to York University, but they collaborate as Elders, staff members, volunteers, and board members. By March 2020, the *Indigenous Friends Platform* had 130 users. At the same time, the Indigenous Friends Association had a membership of 20 collaborators. It is essential to clarify that this construction of “community” is complex, and some cautions need to be considered. The Indigenous community at York University does not see itself as a uniform body of membership, but on the contrary, community members recognize their differences because people are coming from different Nations and communities across the country (and sometimes across the world). Therefore, there is no notion of nationhood or territory. The identity of this group is constructed in the common objective of navigating the postsecondary ecosystem and override the complexities that urban life brings to Indigenous peoples in this context. In the context of this research, I also considered the members of IFA as part of this community because the organization shared the same common objective through the continuous maintenance of the app, plus most of their members also belonged to York University.

Figure 2

Ethical Principles in this research based on the five R's of the FNSPC



Relationships. The importance of relationships, or the relationality of Indigenous epistemology, has been emphasized by Indigenous scholars as the most important part of Indigenous research (Tessaro et al., 2018, p. 139). According to Wilson (2008), the relational way of being is at the heart of what it means to be Indigenous. In other words, identity for Indigenous peoples relies on their relationships with land, ancestors, and future generations (p. 80). In other words, methodology “needs to be based in a community context (be relational) and has to demonstrate respect, reciprocity and responsibility (be accountable as it is put into action)” (Wilson, 2008, p. 99). This factor means that it is necessary to generate and maintain genuine relationships with several stakeholders and community members. These relationships enable the sense of community and create the environment required to establish the infrastructure for deploying the digital platform and the development of this academic research. The respect of these relationships requires a continuous process of explicit consultation with the community members about the platform and how they feel about the overall outcome of the process. This consent is obtained in person at the beginning of each individual or collective session. In the end, these principles

are expressed throughout the story in Chapter 2 and 3 in the creation of the software and the implementation of the communal infrastructure. In this form, the research process is accountable for the relationships created to develop this research journey.

This ethical principle aims to provide members with the immediate ability and power to make decisions in the research process and implementation process to benefit the overall community. Some of the rights embedded in this protocol are to provide feedback about the research decolonial actions and their interpretations, create strategies, think about how the research can create more awareness, or even, if necessary, decide on the termination of the research process.

Responsibility. According to Kovach (2009), Indigenous research is about collective responsibility (p. 36). In Indigenous research, everyone in the process has the responsibility to uphold Indigenous worldviews and values. The personal responsibilities and relationships, such as family members, work, or community, are acknowledged for their function in society and shaping daily experiences (Tessaro et al., 2018, p. 138). First, the decolonial doing implies to cease having “objects of study” but rather knowledge partners. It implies that the researcher allows themselves to be amazed, and at the same time, let themselves be led by children and young people for their stories, social understandings, and the actions they do every day (Ortiz-Ocana & Arias-Lopez, 2019, p. 6). In the same way, Absolon (2011) claims that humility is central in conducting responsible research because the researcher does not structure community-driven projects, and therefore, they make the researcher relinquish some power and control (p. 86). Ortiz-Ocana & Arias-Lopez (2019) consider responsibility as a form of communal contemplation. The communal contemplation is the mediator with them, and them with the mediator, together observing-listening-feeling through affectively conversing, taking into account “other” forms of knowledge(s) to enhance the dialogue of knowledge among equals (p. 11). It is “a decolonial feeling-listening-experiencing-observing, a collective listening-perceiving-observing, in which the decolonial mediator is not the only one who contemplates, but allows themselves to be observed by observing” (Ortiz-Ocana & Arias-Lopez, 2019, p. 11). Therefore, the creation of knowledge can come from the researcher's analysis and conclusions but must emerge from the community as a whole.

Relevance. The research process should be relevant to Indigenous culture and ways of knowing, which means going beyond books; thereby, the research should be based on typical community and oral stories (Tessaro et al., 2018, p. 137). According to Kovach (2009), “stories remind us of who we are, and our belonging. Stories hold within them knowledge while simultaneously signifying relationships” (p. 94). She claims that storytelling and knowing are inseparable in Indigenous paradigms. The main objective of relevance in this research is to place the Indigenous voices and stories at the centre of the research. In order to convey the story in a *good way*,¹⁰ Mi'kmaq Elders Albert and Murdena Marshall provide the following criteria and mechanisms that need to be met, especially in a process of transdisciplinarity:

1. The authenticity of Traditional Knowledge: Validation by recognized Elders and knowledge keepers is exceedingly important;
2. Appropriate sources for particular topics within Traditional Knowledge: it is essential to recognize that each person has particular expertise, but no one knows everything. Traditional knowledge is collective knowledge;
3. Nourishment of the living relationships within Traditional Knowledge: The sources of knowledge come from stories, songs, crafts, practices, family, language, ceremonies, and connectivity to the land, among other expressions; therefore, Traditional Knowledge is *living* knowledge that is always evolving. This aspect of Traditional Knowledge aligns with the necessity of doing through thinking, thinking through doing.
4. The lifelong learning journey of Traditional Knowledge: it is essential to acknowledge that Traditional Knowledge is acquired over the whole person's life journey (as stated by Bartlett et al., 2012, p. 337).

Respect. The concept of respect is the “need to recognize and respect First Nations [Indigenous] cultural norms and values” (Tessaro et al., 2018, p. 133). This ethical principle refers to gathering all the

¹⁰ *Good way* is a traditional expression, which means to speak the truth, offer validity, relational accountability, and credibility (Kovach, 2009, p. 52).

stories collected by the other methods and analyzing them respecting Indigenous values. Indigenous worldviews are holistic and encompass attitudes towards nature, community, and education (Tessaro et al., 2018, p. 133). In other words, the meanings and the outcomes of Indigenous research are guided by the ways of understanding the particular context of inquiry (Wilson, 2008, pp. 116–120). As Kathleen Absolon (2011) states, the methodological congruency during the inquiry “includes consideration of factors such as cultural traditions, community, people, relationships, Spirit, ownership, oppression, empowerment, protocols, and decolonizing. These factors became as much a part of the search as was the gathering of the data” (p. 82). This principle involves reflection, which means writing our feeling–thinking based on a communal form of understanding. This communal action delimits the research from what has already been configured and managed to obtain information for a particular benefit in academia to an action without a priori or expectation (Ortiz-Ocana & Arias-Lopez, 2019, p. 15). This ethical principle implies that the respect of the feedback and opinions of participants is critical for the frame of the overall research (Tessaro et al., 2018, p. 135).

Reciprocity. Reciprocity is an essential concept of Indigenous research (Wilson, 2008, pp. 122–125). Reciprocity means that research must be mutually beneficial to researchers and participants instead of solely to the scholar (Tessaro et al., 2018, p. 135). In other words, the research journey has mutual purposes and outcomes for both researchers and participants (Kovach, 2009, pp. 83–84). Wilson (2008) affirms that Indigenous methodologies must entail respect, reciprocity, and responsibility (i.e., relational accountability) (p. 77). Graham Smith links the action of giving back to the community through research as praxis. The knowledge produced in research needs to go back to community members in a practical and accessible form and create a relationship throughout the entirety of research (Kovach, 2009, p. 27, 149). Therefore, the dissemination of the research includes the participants, and it is meaningful for them. Regardless of the research outcomes, the *Indigenous Friends Platform* is open for community members as a space of exchange. The results of this research will be shared to community members in an accessible form through the INDIGital program that is explained in Chapter 3.

These five ethical principles are the axiological considerations for this research journey of doing

through thinking and thinking through doing. They provide the guidelines and parameters that guided all the decolonial / Indigenous actions in deploying the *Indigenous Friends Platform*. It is crucial to mention that the values of these ethical principles are not linear but cyclical in time and nature due to the significant role of reciprocity and community within Indigenous worldviews. Thereby, these five ethical principles are reflected in several stages throughout the creation story in Chapter 2 and 3. Furthermore, these five ethical principles made me accountable for my own positionality and my proximity to the research. The involvement of community members (i.e. relationships and reciprocity) during the different stages of decision-making and their engagement (i.e. responsibility, respect, relevance) to inform the research allowed me to continue being accountable to the communities of this research.

1.3.3 Way of Knowing/Doing the Indigenous Friends Platform: Doing through Thinking and Thinking through Doing

Based on the ethical principles for doing through thinking and thinking through doing in the context of this research, several decolonial actions are delimited that provide several forms of data (Figure 3). These actions were not performed in a particular order; nevertheless, they were adapted based on the needs presented in the digital space deployment. It is important to mention that I reflect on these methods through the actions of creating the digital space, telling the story in Chapter 2 and 3, and through reflecting on the analysis and results of this research process.

Conversations. Conversation is a non-structure method of gathering knowledge. It differentiates from the interview because it is a combination of reflection, story, and dialogue. In this method, the researchers participate in the participants' stories as well as with their experiences with culture and ways of doing (Kovach, 2009, p. 51). Moreover, this type of action is affective and reflective, without assumptions, without expectations, without a priori, without conditions, allowing the other to also ask and express their emotions, judgments, and evaluations. "Alterative conversation" presupposes that both actors assume that they are talking, either configuring knowledge intentionally or simply decolonizing, to live in communality (Ortiz-Ocana & Arias-Lopez, 2019, pp. 12–13). In the context of this research, I had

several conversations with different stakeholders throughout the process of development to address the challenges and the threads in the process. These conversations were mentioned throughout the story of the deployment of the Indigenous Platform. At the end of the data collection process—April and May 2020—nine conversations were conducted with several app collaborators and users (Table 1). All these conversations were recorded and transcribed for their analyses.

Table 1

Conversations about the Indigenous Friends Association and Platform in May 2020

Date of conversation	Name and short bio
May 4, 2020	Mitch Gegwetch is an Urban Indigenous Entrepreneur, born and raised in Tkaronto Ontario. He is Ojibwe and a Member of Sagamok First Nation; a community on the North Shore of Lake Huron. Mitch studied Computer Science at Ryerson University and collectively has over 10 years of IT related experience, alongside a passion for advancing Indigenous Education Initiatives.
May 4, 2020	Alina Rizvi is a Pakistani Canadian, moved to Canada in 2006. She is a current student in the Master of Information Technologies at York University. For more than 5 years, she has been an Indigenous ally intersecting her own diaspora to Indigeneity and learning about how to be a guest, and not a settler, in Indigenous lands.
May 6, 2020	Laureen Blu Waters Istchii Nickamoon, known merely as Blu Waters, is Cree/Métis/Mi'kmaq from the wolf clan member of the Métis Nation of Ontario. Elder Blu Waters Gaudio's family is from Big River Saskatchewan, Star-Blanket Reserve, and Bra'dor Lake, Eskasoni First Nation, Cape Breton, Nova Scotia. Her teachings come from community elders such as Rose Logan, Pauline Shirt, Harry Snowboy, and others.
May 6, 2020	Keith González-Sujo is originally from Nicaragua. He moved to Canada about fourteen years ago to study in a post-secondary setting. He studied international development studies as his undergrad degree and political science as his master's

degree. He joined IFA as an executive assistant in January 2019.

May 12, 2020 Lisa Maracle is Mohawk and Ojibway, her band is Tyendinaga, and she has years of experience as a student and staff at York University. Lisa graduated from her undergrad in Multicultural and Indigenous Studies; she was a student who had an active role on campus with the Aboriginal Student Association at York University as treasurer, and she also held a work/study position with the Centre for Aboriginal Student Service as the Special Events & Activities Coordinator.

May 12 and 13, 2020 McKenzie Farrah Toulouse is an Indigenous woman from the Ojibway community of Sagamok Anishnawbek First Nation. McKenzie has a background of traditional cultural teachings inherited from her grandparents. McKenzie recently graduated from the undergraduate program in Health and Society with Honors at York University.

May 19, 2020 Stefan Piercey was born in Winnipeg, Manitoba, from the Sagkeeng First Nation. This is the traditional territory of his mother and grandparents. His father is from Newfoundland.

May 23, 2020 Faith Desmoulin is a student at York University. She is Anishinaabe from Wikwemikong First Nation. Currently, she is the Student Success Mentor.

May 25, 2020 Bonnie Rogers, also known as Aboneh, is from the Buffalo River First Nation, which is Treaty 10 territory in Northern Saskatchewan. She grew up with the Dene Nation. Her mother was Dene, and that is the community she grew up in, but her father's side is Métis, and they were descendants on that side from Chief Big Bear.

Talking Circles. Talking circles “are based on the sacred tradition of sharing circles. People leading a traditional sharing circle will have a blessing from an Elder to do this and will use special prayers and sacred objects in the ceremony. The purpose of the less formal talking circle, used as part of classroom instruction, is to create a safe environment where students can share their points of view with others. In a Talking Circle, each one is equal, and each one belongs. Participants in a Talking Circle learn to listen to and respect the views of others. The intention is to open hearts to understand and connect with one another” (Alberta Education, 2005, p. 163). According to Lavallée (2009), talking circles are used to

capture people’s experiences. Moreover, all participants, including the facilitator, are viewed as equals within the circle, and the information, spirituality, and emotions are expressed through a cyclical sharing process (pp. 28-29). First, the facilitator asks one guiding question. Next, each participant answers the inquiry, then another, and then another, until all voices and expressions create a reflection group spontaneously, without assumptions, expectations, a priori, and conditions, allowing these people to ask doubts and express their feelings. It is a respectful and supportive dialogue, with affection, between equals, without the decolonial mediator being the only person who guides the conversation. It is not an interview; it is a spontaneous and fluid emerging conversation (Ortiz-Ocana & Arias-Lopez, 2019, p. 14). The talking circles’ outcomes are not necessarily quoted in the text, but they were integrated into the design of the digital space and incorporated in the process of doing through thinking and thinking through doing. In Table 2, the talking circles of the process are described.

Table 2

Talking Circles in the Creation Story of the Indigenous Friends Platform

Date	People in the circle	Type of recording
May 10, 2017	ChengDa Zheng, Allen Zhang (Lun), Stefan Piercey, Brandon Bear Jeanes, Alejandro Mayoral-Baños	Notes
March 14, 2019	Megis Nadjiwan, Aria Mozzone, McKenzie Toulouse, Emery H. Jones, Amy Desjarlais, Lisa Maracle, Alejandro Mayoral-Baños	Audio-recorded
July 24, 2019	Alejandro Mayoral-Baños, Alina Rizvi, Emery H. Jones, Lluvia Machuca-Ruelas, McKenzie Toulouse, Keith González-Sujo	Audio-recorded
January 17, 2020	McKenzie Toulouse, Alina Rizvi, Alejandro Mayoral-Baños	Video-Recorded
January 29, 2020	Lluvia Machuca-Ruelas, Alina Rizvi, Althea Balmes, Emery H. Jones, Jacob Shuman, McKenzie Toulouse, Keith González-Sujo	Video-Recorded
February 1, 2020	Lluvia Machuca-Ruelas, Alina Rizvi, Althea Balmes,	Notes

	Jacob Shuman, Keith González-Sujo	
April 7, 2020	Alejandro Mayoral-Baños, Althea Balmes, Lluvia Machuca-Ruelas, Mitch Gegwetch, Karla González, Bonnie Rogers, Jacob Shuman, Alina Rizvi	Video-Recorded
April 20, 2020	Lluvia Machuca-Ruelas, Bonnie Rogers, Mitch Gegwetch, Jacob Shuman, Emery H. Jones, McKenzie Toulouse, Keith González-Sujo, Ruth Koleszar-Green, Alejandro Mayoral-Baños	Video-Recorded

Note. Due to the sporadic nature of talking circles, several people involved in this method were not necessarily included in the individual conversations.

Journaling. Journaling or diaries are defined as part of the type of research method that involves keeping a regular record of peoples’ experiences of personal events, motives, feelings, and beliefs in an unobtrusive way and over some time (Bartlett & Milligan, 2015, p. 5). For this purpose, I created a journal via email from April 6, 2017, to December 31, 2018. Due to the project's growth, the format of the journal changed to a calendar format from January 8, 2019, to April 30, 2020. This method helped me keep track of several elements of the research data, shape the process of analysis, and frame the storytelling of the *Indigenous Friends Platform* in Chapters 2 and 3.

Feedback Features. As a continuous improvement method, the research participants and collaborators can provide comments through the feedback screen within the mobile application. This feature offers an open window to the participants to communicate with the mediator to express ideas, emotions or comments about the research or the web environment at any time. It is an open space where users could express any type of concerns and expectations. It includes the option to provide a name or be anonymous. From September 2016, to March 2020, 11 feedback comments were considered within this research.

Digital Coding and Design. The method used to produce the first version of the *Indigenous Friends Platform* was the Enhanced Indigenous Iterative Method, based on the iterative method that I used to create the *Indigenous Friends Platform* in 2015 (Mayoral-Baños, 2016, pp. 92–93). This method

connects orality, storytelling and the needs of a particular Indigenous group to the user software functionalities. It consists of iterative sessions of conversations and talking circles to design and improve the software's prototypes through an open-source online collaboration tool. From January 15, 2015, to March 31, 2020, there were 28 accepted releases of the app in Google Play and the Apple Store. This means that there were 28 versions of the coding during this period.

Designing / Implementing Backend Infrastructure. Additional to the coding and design of the platform, several times during the implementation there was the need for designing and implementing a backend solution (database where the data is stored) that could respond to the needs of the frontend requirements (i.e., the website / mobile application). The deployment of this solution provided a specific context and analysis of the technical requirement for the platform. By July 2020, the server running the database and where the platform's data is stored resided in Mi'kmaq territories in Halifax, Nova Scotia (CloudA Infrastructure).

Visual Presentations. This method consisted of creating accessible presentations to disseminate the project and receive feedback (Appendix E includes several hyperlinks to these presentations). These presentations were shared with several community members and acted as an inspiration for more decolonial technological initiatives within several communities.

Literature Review. A literature review is an evaluation and search of the available literature in a given subject or topic area. In the particular case of this research, this form of analysis and knowledge production became significantly complicated due to the transdisciplinary character of the research. The literature review was across Media Studies, Digital Humanities, Science and Technology Studies, Indigenous Studies, Information and Communication Technology (ICTs), and ICT4Ds. This review provided state-of-the-art concepts to analyze the outcomes of different digital concepts—such as, infrastructure, data and software— to propose design principles of digital technologies and decoloniality. I expand this literature review in Chapters 4 and 5.

All the aspects have the same relevance in creating Indigenous knowledge and include a connection with the quantitative and qualitative data produced through the decolonial methods. Finally,

the data produced were: (a) the Story of the IFP; (b) personal and collective experience stories of the people using and creating the platform (online/offline); (c) the mobile platform itself; and (d) the different presentations and materials to disseminate the results.

1.4 Conclusion: How the Story Came to Be

All the previous *decolonial / Indigenous actions* and their derived data generated several individuals and collective stories that came to be through a methodology and theoretical framework of *doing through thinking* and *thinking through doing*. This process of *acting* and *reflecting* on research implies alternative forms of conceiving scholarly work and wanting to provide a path for finding applications outside of academia. Moreover, the conception of a holistic methodology and theoretical framework that includes Indigenous values aims to assure that research is conducted in a *good way* and following Indigenous protocols. Throughout this chapter, I explored the characteristics of Indigenous research and its complicated relationship with Western science, and most importantly, an Indigenous Way of Knowing/Doing for digital research was proposed based on central ethical principles.

It was these initial teachings that initiated the journey of mobile development. The massive number of stakeholders, possibilities, and data in the deployment process generated uncertainty on how the story could be shared in a meaningful and useful way. In the next two chapters, all the teachings, ethical principles, decolonial actions, and data join together in the *storytelling* of the *Indigenous Friends Platform*. This story reflects the effort to deploy the digital platform—*doing*—in order to embrace the journey of reflecting—*thinking*—on decoloniality and digital technologies.

Part 2: The Creation Story of the *Indigenous Friends Platform*

In Part 2, I centre the *Indigenous Friends Platform* story as the main part of this doctoral research. I introduce the Spirit of the *Indigenous Friends Platform* and how different cultural teachings frame the conception of the space through the birthing ceremony, the Tipi raising as a software development methodology and the embodiment of Indigeneity in the digital space. Finally, I introduce how the *Indigenous Friends Platform*, with the support of different community members and allies, became the tech community that it is today through the conception of a not-for-profit as a communal infrastructure and the considerations around Indigenous knowledge and data protection.

Chapter 2

The Spirit of the *Indigenous Friends Platform*

Figure 3

The Spirit of the Indigenous Friends Platform



Note. This illustration was created by Anishinaabe Onyota'aka artist Tsista Kennedy¹¹ based on the story of creation of the app. Copyright 2020 by the Indigenous Friends Association.

...the searching for knowledge in an Indigenous way, to me, is about turning around and finding the familiar landmarks through our dreams, through our stories, through our experiences, and we're finding our way back home. (Absolon, 2011, p. 115)

Throughout five years of development, the implementation of the *Indigenous Friends Platform* in

¹¹ Tehatsistahawi Kennedy (Tsista) is an Anishnaabe Onyota'aka artist from Beausoleil First Nation and Oneida Nation of the Thames. He creates woodland-style artwork through various mediums, advocating for and communicating what he believes in through his perspective as a young Indigenous man.

the context of urban Indigenous youth opened several questions around decoloniality, digital creation, and Indigeneity. The objective of this chapter is to explain and structure the initial research journey of the *Indigenous Friends Platform* (IFP) through a process of storytelling that will bring forward narratives and experiences shared with me by different community members, allies, collaborators, knowledge keepers, and volunteers. In order for me to aspire to frame practical and design principles of decoloniality and digital technologies, I establish the accountability and clarity of the design and implementation of the platform as a fundamental component before analyzing the ethical and political implications of such technological development. In the initial stage of creation, Traditional Knowledge integration through several teachings such as the Anishinaabe Medicine Wheel and the Cree Tipi Ceremony became fundamental to conceive the mobile application as a technical being, aka a virtual Tipi. This transformation is reflected in Figure 3. Anishinaabe Onyota'aka artist Tsista Kennedy created this piece when he heard about the teachings and the journey of creation. I explain the different details of this image throughout this chapter. In this regard, Michelle Gegwetch shared with me that the *Indigenous Friends Platform*:

It's something that's not been done before, and it's something that's very, very necessary for Indigenous people[s]. Because we need a space to call our own, a space to basically build upon technology and stuff in our own way and the ways that connect back to our communities. And the only way to do that is to build that ourselves if we can't go to somebody else and expect them to do it for us. So, us being a part of that project and putting it all together is what makes it so unique. Instead, it's actually Indigenous people building stuff for Indigenous people. And that, to me, was amazing when I first figured that out. (Michelle Gegwetch, personal communication, May 4, 2020)

The experiences of the IFP community and their voices over our past five-year journey are stories of creation, implementation, maintenance, adaptation, and growth. The vast number of community members have created several separate side stories. These stories are not included in this academic piece to facilitate the analysis of this scholarly work in the upcoming chapters, and most importantly, their

implications and scope are beyond the scope of this research.¹² The communal narrative expressed here was created by gathering the information collected during the master's thesis, several internal communications via email and IFA's internal communication system (i.e., Slack), extensive notes in my journals, informal conversations, talking circles, calendar records, and meeting minutes and agendas. At the beginning of writing these stories, I had planned to separate the technical parts from the communal journey in a separate section; however, while I was writing it, I discovered that this was precisely the recurrent problem in digital technologies. Technical people try to exclusively focus on tools, while non-technical members focus on the communal journey and requirements. This work is trying to push boundaries on both sides.¹³

I used a writing method called crossing narratives as proposed by the Indigenous academic and storyteller Shawn Wilson (2008) that interweaves the academic style and personal narrative (pp. 8, 9). This writing presents the story to two different audiences: academia and Indigenous community members. Wilson claims that the style of the anonymous reader in academia does not fit the standards of relational accountability, fundamental in Indigenous research.¹⁴ To support this statement, Wilson (2008) claims that based on the analysis of Tafoya, "an idea cannot be taken out of this relational context and still maintain its shape" (p. 8). The personal narrative encourages the inclusion of the learned experiences and the accountability of relationships created in order to generate this knowledge within Indigenous research. Hence, in order to construct the design principles, the learnings and relationships built during the development and implementation of the *Indigenous Friends Platform* are explained by interweaving these

¹² For all these unwritten stories and unmentioned characters, I pray for them and thank them for being part of this journey.

¹³ This connection among technological tools and community members can be partially described under the Actor Network Theory by Bruno Latour (Latour, 2005). However, this approach differentiates itself from this theory because in the case of the Indigenous Friends Platform, an intersectional approach is taken where the characteristics of the individual (e.g., race, gender, age, etc.) affects the interaction with the technical object.

¹⁴ Relational Accountability "means that the methodology needs to be based in a community context (be relational) and has to demonstrate respect, reciprocity and responsibility (be accountable as it is put into action)" (Wilson, 2008, p. 99).

writing styles. These writing styles allow for a decolonial discourse within the colonial structures of academia while engaging and respecting non-academic audiences such as civil society and activism.

The importance of this chapter relies on centring my personal and collective story as a fundamental design element of digital technology and how my story is interweaved with Indigenous knowledge. As explained in Chapter 1, storytelling is central to Indigenous methodologies, and it requires a critical departure from Western methodologies and academia. The dismissing of this central research aspect would imply a contradiction in its decolonial intent of challenging colonial forms of knowledge. The journey of this chapter captures the experiences of my personal journey and how this encounter between digital technologies and Indigeneity became a collective story of digital creation.

The purpose of this story is to provide a detailed understanding of the key players, processes, and results of the project in order to understand the upcoming analyses, while challenging colonial forms of presenting academic research. This story is accountable to academia and the Indigenous community members of Tkaronto who have trusted me with their personal stories and teachings.

This initial journey of creation and collaboration is explained based on several crucial moments of development of the IFP mobile application v1.0. Moreover, the different stages of development shaped the findings of this research through the interrelation of the IFP's design principles and the teachings of the Anishinaabe Medicine Wheel.

In the first section, this story starts with how my journey met with community needs through the birthing ceremony and how the Indigenous community at York University shared the teachings of the Anishinaabe Medicine Wheel with me. Next, I explain how I technically implemented these necessities before releasing the first version of the app through the Cree Tipi Ceremony. Finally, after the release of version 1.0 and the conception that the app is a technical being, aka a virtual Tipi with a Spirit, the embodiment of Indigenous worldviews became a crucial component in the design of the digital space.

2.1 The Birthing Ceremony and How the Spirit Came to Be

2.1.1 My Personal Story

It was the beginning of January 2015. I was starting my second term in my master's studies and my fifth month in Tkaronto, Ontario. As an international master's student, I struggled to cope with the winter season and the isolation of being disconnected from home and my different communities of belonging. In the five years prior to living in Tkaronto, I was connected to several intense participatory processes in the Indigenous municipalities of Mecatlán and Filomeno Mata in the Eastern part of Mexico. In the first four months in Tkaronto, I was trying to adapt to a different lifestyle, a new set of values and a new spoken language (English). Although my decision to move to this city was well-informed, everything was different from what I know, my cultural understanding, and how things were performed. I was sad and anxious about the upcoming months and the expectations that everyone back home had towards me regarding my studies abroad. In the previous months, I had attended several ceremonies with Elder Blu Waters,¹⁵ such as the Tipi raising ceremony and the full moon ceremony (as a two-spirit guest), in order to find a sense of belonging. Although I created several connections with different community members at York University, such as Lisa Stewart, Mariah Abotossaway, Nancy Johnson, and Randy Pitawanakwat, I struggled to cope with the feelings and memories of the intense relationships from back home. That week, I had to decide what the plan would be for the upcoming months, because my academic supervisors wanted to have a clear proposal for my master's thesis. In my last conversation with them, they had suggested going back to Mexico and doing something related to the Totonac communities, where I had worked for more than ten years. However, I already started a cycle in Tkaronto, and if I had

¹⁵ Lauren Blu Waters Istchii Nickamoon, known as Blu Waters, is Cree/Métis/Mi'kmaq from the wolf clan member of the Métis Nation of Ontario. Blu's family is from Big River Saskatchewan, Star-Blanket Reserve and Bra'dor Lake, Eskasoni First Nation, Cape Breton, Nova Scotia. Blu currently works at Peel Aboriginal network as an Elder Providing Traditional teachings, counselling, full-moon ceremonies, and workshops, and at Seneca College as an Elder on campus providing traditional teachings and one-on-one counseling. Blu grew up with her grandmother and learned about traditional medicines, performing healings, and care of the sick and teachings. Her teachings come from community elders such as Rose Logan, Pauline Shirt, Harry Snowboy, and others.

gone back to the Totonac region, that decision could jeopardize the funding that I had got for my master's studies abroad from the Mexican Government and Becas MOB (a Mexican NGO) as the funding required me to remain in Canada. The uncertainty of my research topic became a significant issue in my mood and well-being because I needed a plan for the upcoming months, while my anxiety about being isolated was gradually increasing. I decided to look for help with the community that I had recently joined at the Centre for Aboriginal Student Services at York University (CASS).

It was January 15, 2015; I went to CASS because I wanted to talk to Elder Blu about my feelings and the anxiety growing inside me of being under pressure and isolated. When I knocked at the door of the healing room, Professor Ruth Koleszar-Green¹⁶ (Ruth) of the School of Social Work was finishing talking to Elder Blu about some other events within the space. I decided to talk to both of them. As the conversation progressed, I expressed my concern about personal expectations and how I should start my approach to research in an Indigenous context in Canada. Elder Blu started by saying that before thinking about academic expectations, it was important to be in-balance based on the Cree/Anishinaabe Medicine Wheel's teachings as she had already explained to me since October 2014. Every person has four dimensions: the spiritual, the emotional, the physical, and the intellectual, and when one of these dimensions is out of balance, the person enters a phase of uncertainty.

2.1.2 The Anishinaabe Medicine Wheel

This teaching of the Anishinaabe Medicine Wheel (Figure 4) was central in the design of the *Indigenous Friends Platform* because the vision of the digital space is to support the users of the platform to find a balance. In October 2014, Elder Blu Waters introduced me to the teachings of the Anishinaabe Medicine Wheel and explained its importance in the land of Tkoronto. After these initial teachings by Elder Blu Waters, several Anishinaabek teachers continued educating me about the Medicine Wheel in order to support my personal journey through several conversations, experiences and ceremonies: Young

¹⁶ Throughout the narration of the story, I call Professor Ruth Koleszar-Green, simply "Ruth" to acknowledge the relationship and the way how she asked me to call her.

Elder Philip Cote,¹⁷ Knowledge Keepers Ronnie Ann-Toulouse,¹⁸ Brian Outinen¹⁹ and Amy Desjarlais²⁰, as well as community members Nancy Johnson²¹, Stefan Piercey and Mckenzie Toulouse.²² In addition, in 2018, I was introduced to the Four Directions Teachings' digital portal, where the Ojibwe Elder Lillian Pitawanakwat shared her knowledge about the Anishinaabe Medicine Wheel.²³ Different Indigenous communities have particular teachings of this wheel; however, there are several common learnings. These teachings are alive, moreover, and they might change based on the Knowledge Keeper; therefore, they are not universal or homogenous. Paula Gunn Allen defines the Medicine Wheel as “a tangible object seen as possessing non-rational powers to unite or bind diverse elements into a community, a psychic and

¹⁷ Philip Cote is a Sundancer, Pipe Carrier and Sweat Ceremony leader recognized by Elder Vern Harper and Floyd Looks for Buffalo Hand. Cote received his Indigenous name Noodjmowin (The Healer) in 1979 from Joe Couture and was made a member of the Falseface Society at the Seneca longhouse in 1992. He is member of Moose Deer Point First Nation (Philip Cote, n.d.).

¹⁸ Ronnie-Ann Toulouse is a member of the Anishinaabek Sagamok First Nation. Through a personal healing journey, she has learned about life, the gifts from the Creator and the importance of community relationships. Ronnie-Ann has been a single parent for 38 years. She has supported her community through following Spirit and becoming a guide/helper at the Benbowopka Treatment Centre by providing culturally based harm reduction services to those seeking treatment for substance abuse. Her motto in life is: "Don't ask me, if you're not ready to hear my truth."

¹⁹ Brian Outinen is a Professor at Algoma University, instructing Anishinaabe's Philosophy of Language and Culture. He is Ojibwe from Serpent River First Nation, Ontario and a member of the Hummingbird Clan. He is the author of "Ancient Ojibwe Teachings," a Facebook page dedicated to the education of Anishinaabe philosophy, world views, and of the original instruction of the language and structure of words.

²⁰ Amy Desjarlais is Ojibway/Potowotomi from Wasauksing First Nation. In 2003, Amy founded, EarthTALKER, a magazine focused on women and families. In 2008, Amy was the recipient of the FNNTI/Ryerson University Practicum Award for Theory of Interconnectedness - An Indigenous perspective on political decision-making. Amy has an MA in Culture & History; her thesis, Emptying the Cup: Healing Fragmented Identity, explores an Anishinawbekwe (female) perspective on historical trauma and culturally appropriate consultation and is published by the Centre for World Indigenous Studies' Fourth World Journal. Amy recently published her first non-fiction full-length book, Starblanket – A mother's gift to her son. When she is not writing, Amy facilitates cultural workshops and drum circles. Amy is also a hand drummer and singer.

²¹ Nancy is Ojibwe from Nipissing First Nation, Ontario. She is a graduate from the Image Arts New Media Program at Ryerson University. She coordinates the Cultural Programs at the Centre for Aboriginal Student Services at York University as well she oversees the use of Skennen'kó:wa Gamig and CASS/Gamig card access program.

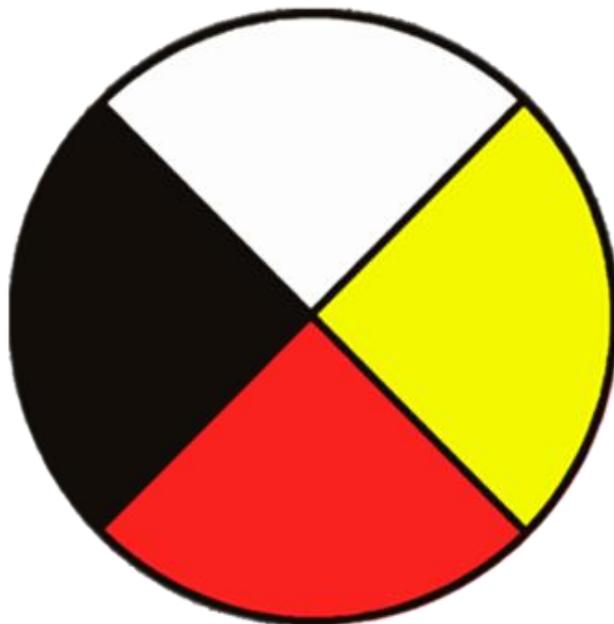
²² Stefan Piercey and Mckenzie Toulouse were introduced in Section 1.3.3.

²³ Lillian Pitawanakwat was a Thunderbird Eagle Woman, part of the Thunderbird Clan. Moreover, Elder Lillian emphasized the importance of the Medicine Wheel in the Anishinabe territories. She was interviewed in 2005 for the Four Directions Teachings project. She passed away on January 4, 2011 (InvertMedia Inc., 2012a).

spiritual whole” (in Graveline, 1998, 14). This circle is divided into four sections that have different meanings depending on the Nation or Indigenous group. However, the interpretations of this Sacred Circle have the common goal of “mutual balance and harmony among animals, people, elements of nature, and the Spirit World” (Archibald, 2008, p. 11).

Figure 4

Ojibwe/ Anishinaabe Medicine Wheel



Note. From Personal communication, Elder Blu Waters, October 26, 2014 – November 26, 2014; Elder Lillian Pitawanakwat (InvertMedia Inc., 2012a); Personal communication, Young Elder Philip Cote, April 2016 – December 2016; Personal communication, Ronnie-Ann Toulouse, March 7, 2020; Personal communication, Brian Outinen, September 16, 2020.

Elder Lillian Pitawanakwat, Elder Blu Waters, Brian Outinen and Ronnie Ann-Toulouse agree that the four directions of the Medicine Wheel represent the need for balance in the world, and the balance we must attempt within ourselves as humans (Figure 1) (Snively & Williams, 2016, p. 35; Brian Outinen, personal communication, September 16, 2020; Elder Blu Waters, personal communication, October 26, 2014, January 15, 2015 & October 26, 2019; InvertMedia Inc., 2012a; Ronnie-Ann Toulouse,

personal communication, March 7, 2020). According to them, everything comes in fours, so knowledge is easier to digest, more comfortable to learn. Any living being aims to balance these four dimensions as a fundamental purpose of their existence. This balance provides a tool for constant self-assessment and coping for the living being; therefore, the successful implementation of this framework means that the four dimensions remain in balance without overlapping one another. However, Brian Outinen warns that to fully understand the teachings of the Anishinaabe Medicine Wheel, the understanding of the Ojibwe language and its philosophy are required (personal communication, September 16, 2020). Although exploring the Ojibwe language is beyond this research, the potential to continue exploring it offers more possibilities with the Anishinaabek Medicine Wheel. Furthermore, Ronnie-Ann Toulouse shared with me the importance of not only understanding the Anishinaabe Medicine Wheel as knowledge or information but the importance of practicing those teachings in a daily basis (personal communication, March 7, 2020).

According to Elder Lilian Pitawanakwat, Medicine Wheels made of rocks are located in several significant places throughout North America, such as sites of energy, ceremony, meetings, gatherings, meditations, teachings, and celebrations (InvertMedia Inc., 2012a). There were thousands of Medicine Wheels across North America before European colonization. According to Elder Blu Waters, there were and are several types of Medicine Wheels depending on the purpose and the intention of the wheel (personal communication, October 26, 2019). The Medicine Wheel is a circle divided into four parts, representing four dimensions or directions interconnected to form a complete entity. Each quadrant of the Medicine Wheel represents one of the four cardinal directions. As a full body, the Medicine Wheel represents the relationships among several seen and hidden elements of the world and highlights how the levels of being are interrelated and interconnected through a life force. All elements of the wheel are essential and rely on each other in the cycle of life. The Anishinaabe/Ojibwe peoples thought that each quadrant has seven teachings and each one has sub teachings. The East quadrant represents the spring and the beginning of life (childhood). The journey continues to the summer stage and the South (youth), then to the West and Fall (adulthood) and finally to the winter and North (elderhood) (Elder Blu Waters,

personal communication, October 26, 2014 & January 15, 2015; Brian Outinen, personal communication, September 16, 2020; InvertMedia, 2012a).

The journey within this wheel always starts on the Waabinong (East), where the sun rises, and the spiritual dimension resides. As stated by the Elders Pitawanakwat and Blu Waters, this dimension signifies springtime, the beginning of life and childhood. It is where the journey as a “being” commences. The Spirit of forms of life resides within this dimension, and tobacco remains in this dimension as a form to be thankful for the life journey (InvertMedia Inc., 2012a; personal communication, Elder Blu Waters, October 26, 2014 – November 26, 2014; Brian Outinen, personal communication, September 16, 2020;).

Following childhood, the being moves to the Zhaawanong (South), where the emotional dimension resides. This direction signifies summertime and youth. It is where nature is awake, and everything is new and growing fast. This stage is a moment of discovery, where youth is learning about life and looking for guidance and significance. The emotions and feelings reside on this dimension, and the Cedar is the medicine for this dimension as it calms our Spirit and does not take unnecessary things for the journey (InvertMedia Inc., 2012a; personal communication, Elder Blu Waters, October 26, 2014 – November 26, 2014; Brian Outinen, personal communication, September 16, 2020).

In a third quadrant, the Epangishmok (West) is where the physical dimension remains. This dimension is the fall or autumn time and adulthood, where the identity is complete, and the body resides. Elders Pitawanakwat and Blu Waters stated this direction represents the heart, the evaluator of what is going on the whole life. The physical body resides on this dimension, and the medicine for this dimension is Sage as a cleansing for our body and takes away negative energy (InvertMedia Inc., 2012a; personal communication, Elder Blu Waters, October 26, 2014 – November 26, 2014; Brian Outinen, personal communication, September 16, 2020).

As the last dimension, the Kiiwedionong (North) is where the knowledge prevails and remains. As Elders Pitawanakwat and Blu Waters state, the Kiiwedionong is a rest and reflection period, where the person uses all of the teachings learned and contemplates what has happened in his/her/their life. In this quadrant is where all the memories and knowledge remain after a long journey. In this dimension, the

Elders are honoured, and the medicine Sweetgrass resides on this dimension as a reminder that people are strong when mind, body, and spirit are bound together in a balanced way (InvertMedia Inc., 2012a; personal communication, Elder Blu Waters, October 26, 2014 - November 26, 2014; Brian Outinen, personal communication, September 16, 2020).

As Elder Blu Waters stated, all those dimensions are interconnected, and they affect one another:

Physically, you are not going to feel well, emotionally and intellectually, you are not going to be well, and then, of course, how can you focus on your spirituality, which is something that's above and beyond logic and reasoning and more than emotion, more than a physical because you can't touch, I mean, you can touch spirituality in the way that you can see the wind moving, you can feel it hitting your body, and that is a spiritual way, right? It is nothing that we can hold on to, but we know it is there but is it a full feeling like when you leap forward and pick up a glass, you have something that's solid, and you can hold on to, but our spirituality is not like that, right? It takes all those parts to be well spiritually because it's more than physical. It's more than emotional. It's more than intellectual. It's a combination of all those things together. (Elder Blu Waters, personal communication, May 6, 2020)

After all the stages are completed, the being moves to the centre, and the cycle restarts again (Snively & Williams, 2016, pp. 35–36). The centre correlates with the concept of “withinness” and how to keep the fire within the self. The centre of the Medicine Wheel represents the self-being in balance in its life. The circle's central place is where the person seeks to develop a holistic view and understanding of creation and connection to all beings (InvertMedia Inc., 2012a). This place is the guiding position where the being is looking at different directions/dimensions and where the balance of the four dimensions is required in order for the self-being to be healthy and continue supporting other community members. The Anishinaabe Medicine Wheel's centre symbolizes the self in balance on its life journey, from the perspective of traditional Anishinaabe philosophy. The Anishinaabe Medicine Wheel's central place is where a being seeks to develop a holistic vision and understanding of creation and connection to all things (InvertMedia Inc., 2012a). The Anishinaabe peoples believe that a flame represents the Centre of the Wheel, and it is the responsibility of human beings to nurture this fire by reconciling conflicts with

others and making peace within ourselves. Moreover, this centre is where the self is located as a knowledge producer. The centre of the Medicine Wheel represents the self-being in balance on their life. This place is the guiding position where the being is looking at different directions/dimensions, and where the balance of the four dimensions is required in order for the self to be healthy and in-balance through reflection, meditation, awareness, acceptance and surrender (InvertMedia Inc., 2012a). In other words, the balance in the Anishinaabe Medicine Wheel is when the four dimensions: Waabinong, Zhaawanong, Epangishmok, Kiiwedionong, are in equilibrium with one another.

It was these initial teachings that initiated the journey of the development for the app that I would continue learning throughout the journey of creating the mobile application. How could I apply this to my personal struggle and what are the commonalities within the digital space?

2.1.3 Finding my Community

When Elder Blu Waters finished explaining the four dimensions of the Anishinaabe Medicine Wheel, I mentioned that my main struggle in my journey at that point was my lack of belonging and how it was required to have a community to do research. Ruth responded that it was unnecessary to find a community to do my academic work because I was already in a community with several needs, and most importantly, I was an active part of such a community.

At that moment, Elder Blu and Ruth explained that the struggle I was facing in being isolated and far from my community was common to several Indigenous youth members in urban settings in Canada. Most of the Indigenous students in postsecondary education come from different backgrounds and remote communities out of the big cities. Therefore, looking for balance was a common thread within members of CASS. After that explanation, I mentioned that I wanted to support this process in my academic journey; however, part of the requirements was to do something “technical” or “digital.” Also, I noted that even though I could technically create some essential online resources for the youth, there were already several supports, such as websites and Facebook pages, with information about CASS and its community. Elder Blu Waters replied that there was an absence of a space, such as a mobile app for

Indigenous students in postsecondary settings, saying:

“It would be meaningful to have an app that students can download and install in their phones where they can access a support system even if they are not on a laptop or computer. The majority of them do not have access to those devices. [...] a tool where students can try to find balance and access educational resources” (Elder Blu Waters, personal communication, Jan 15, 2015).

Elder Blu and Ruth agreed that this could be the path for me personally to move forward, but at the same time, they supported me to develop a mobile app for the CASS community as an answer to my academic struggle. At that moment, Elder Blu ask me to offer some tobacco in a *good way* for my prayer. I put down tobacco on the Buffalo skull at the healing room and marked the birthing ceremony of this digital space. The intention of the app was to guide Indigenous youths that are far from their communities, especially members who are in urban contexts, to reconnect with their culture and to find a support system that can guide them through their journey. As Anishinnabek guide/helper Ronnie-Ann Toulouse and I reflected through the journey of writing this story, the mobile application is only a vessel for Indigenous ancestors to reconnect with Indigenous youth, especially the ones that are in urban settings who want to reconnect to their communities and traditions.

2.2 Tipi Ceremony as a Software Design Methodology

2.2.1 From an Idea to Implementation

As soon as I left the healing room, I doubted if I could develop the mobile application. I did not know how to start because I did not grasp how to create mobile applications at that time, and more importantly how to connect Indigeneity and digital technologies. My initial purpose was only to create a chat space for Indigenous students to interact and connect with other peers in the university, as well as to provide access to mentorship from Elders and Knowledge Keepers.

One of the challenges of generating a mobile application is that this type of digital technology requires a diverse group of skills in order to be implemented. These skills range from coding in different programming languages, data management, user interface design, security, and, in this specific case, the

understanding of Indigenous worldviews and knowledge(s). I was confused about where to start because there are multiple topics to learn, understand, apply, and develop at the same time, especially when the majority of knowledge is significantly different from Indigenous Ways of Knowing / Doing.

I decided that the first step of the journey was to ask for guidance and advice from technical experts. My idea was to connect back to some of my technical peers back home who could support me in this new journey. Although these particular individuals do not have a full understanding of Indigenous worldviews, they clearly understood the implications and scope of mobile technologies. Through the community of Magtayani, I contacted my close friend and colleague, Jose Edgar Hernández Vilchis, who has started several startup businesses. He pointed me to one of his business partners at the time, Jose Alberto Garcia (Alberto), who kindly agreed to provide me with initial guidance on mobile development over the phone.

During that 30-minute conversation, Alberto introduced me to the concepts and types of mobile applications. In the context of mobile development, there is a significant scope of resources on the web; however, understanding the basic notions and where to start is essential to avoid getting overwhelmed with the amount of available information. After this brief exchange of ideas, I started a self-learning journey on how to create mobile applications, the frameworks and understanding the advantages and weaknesses. This process was throughout the summer of 2015 when I consulted different books, online videos, forums, and repositories explaining mobile development techniques. I tried several technologies, such as Telerik NativeScript, Microsoft Xamarin, and Ionic Framework. After much learning and reflection, I decided to use the Ionic Framework as the front end (i.e., the visual appearance of the app) and Parse and Firebase in the backend (i.e., solutions to store the information).

Simultaneously, the journey of incorporating more Indigenous voices in the development occurred. Over eight months, I held four sharing circles and twenty conversations with different CASS members (e.g., students, faculty members, staff, and undergrad and graduate students) about Indigenous students' needs and experiences at York University. I presented hard copies of screenshots for different pages in the app to community members during our talking circles and conversations; this allowed them

to draw and visually express their ideas. A recurrent issue that members mentioned was that they were far from home and community, and therefore they were forced into the university spaces with different norms, peoples, and procedures than their home communities. Most felt isolated and excluded from experiences within the academic institution. Through this process of consent and consultation, the app's initial purpose expanded into three primary larger purposes: to provide information to the Indigenous communities about the resources available on campus; create a network where students could connect; and generate a peer/guidance support system for their educational journey.

These two parallel processes produced two initial main concerns for me in “doing and thinking” the mobile application: how could I integrate Indigenous worldviews into the technical digital language and mobile frameworks? Most importantly, how could I incorporate the Indigenous community's ethical needs at York University into a digital space?

In reflecting on these processes, I understood that I first needed to comprehend the methodology to successfully create mobile software applications and then indigenize this form of digital creation to interweave Traditional Knowledge into it. In other words, I concluded that the teachings and Traditional Knowledge of the Indigenous community at York University required to be fully integrated into the digital space throughout the technical development process and not only in the content and visual appearance of the mobile application in order to be able to Indigenize the digital space.

The first approach was to learn about common software development methodologies, such as waterfall and agile (see Appendix D more details on these methodologies). However, these forms of creating software did not match how Indigenous worldviews are lived, understood, and shared. Most importantly, this type of digital development commonly does not include ethical guidelines or principles for managing digital spaces. I decided to start from the other side of the spectrum. Where did we, students at CASS at that time, learn teachings and Traditional Knowledge about our cultures? From actively participating in Ceremony and learning from Knowledge Keepers and Elders. In order to aspire to support Indigenous students in the digital space, therefore, it was essential to incorporate these ways of teaching and learning into the digital design process.

A central ceremony in that academic year for other students and me was the Tipi raising ceremony. The Tipi is a form of Indigenous technology that has passed from one generation to the next and is shared with several communities and Nations across Canada and the United States (Holley, 2007, pp. 3, 23). The Tipi as technology is full of life teachings and reflects several aspects of Indigenous worldviews. Was there a way to integrate the software development methodologies and this ceremony?

2.2.2 Tipi Ceremony as a Mobile Technology

The term tipi in Lakota means, “They live [someplace].” In Lakota, objects are described; therefore, the word does not refer to the shape itself. The more correct term would be *tipes'tola*—“He or she lives in the sharp-pointed lodge” or *ti ikceya*, “She or he lives in the common lodge.” (White Hat Sr, 1999, p. 35)

The Tipi as a technological development was utilized by numerous Indigenous Nations across North America prior to colonization. The Cheyenne, Arapaho, Lakota, Cree, Blackfoot, Assiniboine/Stoney, Kiowa, Mandan, Hidatsa, Arikara, A'aninin, Ponca, Otoe, Kitikiti'sh, Tsuut'ina, Comanche, Shoshone, Omaha, and the Western/Eastern Dakota, among many other Nations, have used the Tipis historically throughout the centuries for dwelling, ceremonies, and storage (Holley, 2007, pp. 3, 23). Tipis have existed since the first groups of hunters gathered as small social communities and there is no one unique type of Tipi, but a diverse range of sizes, shapes, and variations derived from the needs of a community based on the weather, use, and natural resources available. Even among the same Nation members, the Tipi has evolved differently throughout the centuries based on external developments related to the availability of new materials and the knowledge exchange among Nations and members (Holley, 2007, pp. 2–5).

With all the previous aspects in mind, I realized that the Tipi Ceremony as taught to me may be conceived as a methodology for software development in order to interweave Traditional Knowledge into the digital process and to unsettle the way that a software program is created. Although there are many other Indigenous technologies created over the centuries in North America (e.g., wigwams, longhouses, canoes, chinampas, and pyramids, among others), I found that the tipi has particular characteristics that

made it suitable for a digital mobile framework. First, and most importantly, the Tipi is recognized as a mobile structure and home for hunting societies (Holley, 2007, p. 2), which means that the Tipi has been a mobile infrastructure and technology for Indigenous peoples for millennia. In the case of the Anishinaabe wigwam,²⁴ although it also served as a similar shelter across the region, it is a semi-permanent dwelling (i.e., it is not a mobile structure).²⁵ The Tipi allowed hunting societies to move across different places following different animals' migration paths, such as the buffalo and moose (Hungrywolf, 2006, pp. 6, 106). The commonalities with mobile digital technologies and Tipis are that both offer the possibility for Indigenous peoples to move and carry "home" with them. This factor means that the Tipi is a technology adapted to the needs of the communities and the resources around them. Moreover, the Tipi was able to be constructed with the materials available in a particular region (e.g., birch bark in the Northeast, dressed caribou hides in the far north, buffalo or elk in the Midwest and Plains). In the same way, mobile technologies are required to be adaptable to the available resources of the devices, and therefore there is a vast range of variations for mobile infrastructure. Finally, a Tipi also incorporates the teachings of the Medicine Wheel because the floor represents a circle divided in four directions.

As Cree Elder Mary Lee states in the Four Directions' portal, the Spirit of the Tipi is the Spirit and body of a woman because the Tipi represents the foundation of family and community. Moreover, according to her teachings, the Tipi cover is like a woman with a shawl. The shawl/cover embraces all the teachings within the Tipi/woman hold, and no matter how many children come into that circle, there is always room for them (InvertMedia Inc., 2012b). The Tipi represents the safety of the mother's shawl or skirt felt by children when they go underneath. This factor placed coding and mobile development in femininity because the virtual Tipi is a female Spirit.

Furthermore, the Tipi is a technology that has evolved throughout the centuries, adapting itself to

²⁴ A wigwam is a semi-permanent domed dwelling used by several communities and Nations across North America (Hungrywolf, 2006, p. 53-55).

²⁵ A future research exploration might be the protocols to raise an Anishinaabe wigwam in the context of desktop applications (not mobile).

new external technological developments. The two main significant adaptive innovations were the use of horses, which enabled the transportation of larger poles and, therefore, larger lodges.²⁶ Second, in the early 1800s, the introduction of cloth covers sustained the use of this dwelling technology because animal leather covers had become scarce (Holley, 2007, p. 1). In the same way, mobile technologies quickly adapt to different external developments that allow the progression and usage of devices throughout time and locations. Mobile technologies, such as mobile applications, need to adapt to manufacturers' continual development and comply with the new development of protocols and policies. As one of the former collaborators of IFA, Stefan Piercey asserted: "now that we're in such a critical age of development, we're at that cusp where people are being born with the ability to just use a telephone. I think Indigenous technology, just like I was saying before, is just developing so quickly. And Indigenous people are adapting to our surroundings so quickly" (Stefan Piercey, personal communication, May 19, 2020).

The decision to follow the Cree tradition in the raising of the Tipi was based on several factors. First, the teachings of the Knowledge Keepers and Elders in the Indigenous community at York University were based on the Cree tradition. Although York University is not located in the traditional territory of Cree peoples, urban settings in Canada currently are home to several Indigenous Nations and communities (including Cree members), and, therefore, there is an active knowledge-sharing across cultures and traditions. Furthermore, historically, the Cree people alongside the Sioux people (i.e., Dakota, Nakota, and Lakota) in the United States and Canada shared knowledge across centuries with several Nations about the teachings of the Tipis. The extreme weather conditions on the prairies pushed these communities to take advantage of the natural resources available and learn from their experiences (Hungrywolf, 2006, pp. 59-117). The expertise gained by Cree and Sioux peoples in the prairies was well spread in communities across North America.

²⁶ Horses were reintroduced to Indigenous communities in North America after colonization by Christopher Columbus in 1493 and Hernán Cortes in 1519 (Arita, 2011, p. 46, 53-55).

Another fundamental reason to use the Tipi raising ceremony as a form of software creation is that the Tipi is a space that has several protocols and guidelines. In order to get into the Tipi, every individual is required to follow community guidelines and rules to respect the interaction within the space. When the Indigenous community at York University conceived the *Indigenous Friends Platform*, the mobile application was required to establish several guidelines to create a safer space for Indigenous youth. These guidelines include the code of conduct in the space, the discretion of the voices and opinions, and the different responsibilities of the members within the space, among others. Through a consultation process with Elder Blu Waters, I realized that these protocols required in the mobile application were very similar to the ones required to enter a Tipi, and therefore, the process of creation was not only following the steps of a ceremony to raise a Tipi, but the mobile application itself was embodying a virtual Tipi.

As the last aspect, the teachings of the Tipi and Anishinaabe Medicine Wheel complement each other. The Traditional Knowledge shared alongside these two cultural elements has crossed several communities. If a Tipi is raised in a *good way*, it will be a place of healing people in the four dimensions: spiritual, emotional, physical, and intellectual. The Anishinaabe Medicine Wheel is acknowledged in a physical Tipi through four coloured cloths tied at the extreme top of four poles, which face the four cardinal points on the top part of the Tipi (Elder Blu Waters, personal communications, October 26, 2014). This aspect became relevant later on when other aspects of the app were reflected throughout the years.

The analysis of the Cree Tipi as mobile technology allowed me to integrate several of its teachings into the virtual and cyberspace. The conceptualization of a mobile application as a virtual Tipi enabled the incorporation and participation of community members into digital technology design and finding solutions for the challenges created within these digital spaces. Moreover, the ethical and cultural guidelines that are followed in raising a Tipi could be incorporated into the digital space.

During my master's thesis (Mayoral-Baños, 2016), I explained in detail the process of creating software through the decolonial guidance of the teachings of the raising of a Cree Tipi. Through several

talking circles, conversations, and community gatherings, the process of software development departed, following the protocols and teachings to raise a Cree Tipi. The technicalities of raising the Tipi had several practical applications in the software design and impacted how community members got involved in the development process. As I described in detail in Mayoral-Baños (2016), software development was divided into seven steps:

1. Birth offering and praying to the ancestors.
2. Selecting the poles: method, platforms, and development kit.
3. Placing the tripod: finding the balance.
4. Putting the poles into position: creation of the features of the mobile application.
5. The canvas and the logo of the mobile application.
6. Crossbars and adjustments: system of roles.
7. The door and the lining: The access code and the privacy policy.

Some examples of these direct applications of Traditional Knowledge over technical digital design are: the conception of the logo (Mayoral-Baños , 2016, pp. 123–124), the code tag to sign up in the app (Mayoral-Baños , 2016, pp. 135–142), the clan system within the app to assign responsibilities (Mayoral-Baños , 2016, pp. 125–131). Under this decolonial lens, “[a] virtual Tipi, meant to be a safer space for Indigenous youth to connect with each other, connect with resources that are available to them locally, connect with mentors or Elders or traditional Knowledge Keepers” (Alina Rizvi, personal communication, May 4, 2020). This form of software design displaced the common forms of coding and, most importantly, the way in which computer programs are conceived. In other words, the Way of Knowing/Doing the ceremony of raising the Tipi was used as a methodology for software creation in order to create safer mobile applications for Indigenous youth. The teachings of the Tipi were directly applicable to the digital space to create safer environments, and the protocols that were developed over several generations and Nations were applied to digital social spaces, especially as common shared spaces. As explained in the introduction, incorporating knowledge from different traditions into a single digital creation is to acknowledge the complexity of digital spaces and how different local understandings

can resolve some of the issues of such spaces.

The app was ready for its first launch in the mobile application stores (Google Play and Apple Store) by February 2016, however the Apple Store rejected the iOS version of the app due to its app review guidelines. After a long technical struggle, the app's first version finally got out in the stores on Apple Store and Google Play on March 17, 2016.

2.2.3. The University as a Space of Creation

With the earliest prototypes out and the first version almost ready, the necessity to start thinking and reflecting about the creation process arose, and the several articulations and agreements with the academic institution began. In fall 2015, based on these prototypes, several faculty members at York University, such as Professors Barbara Crow, Stephen Chen, and Cheryl van-Daalen Smith, proposed that I should continue with a Ph.D. after my master's program in order to continue further developing the mobile application and therefore to continue my research process. I applied to the Ph.D. joint program of Communication and Culture in December 2015. One month after, I was required to start writing about the research journey, which triggered a process of compiling the story that I presented about the Tipi ceremony as a software development methodology in my master's thesis. As I was in the process of writing this journey, I got accepted to the Ph.D. program in March 2016.

After six months of doing (i.e., debugging and releasing the mobile application) and thinking—i.e., writing my master's thesis—the first version of Indigenous Friends App, I successfully defended my thesis on June 30, 2016. During the master's defence, Professor David McNab, a Métis scholar and historian who was part of the deliberation committee, stated two significant perspectives that would frame several critical points within this doctoral research. Professor McNab stated that the Indigenous Friends App was not only a computer program, but also that the app had a Spirit, and therefore, the app needed to be nurtured and cared for by the entire community. Moreover, he claimed that the Indigenous Friends App had the potential to become the new “electronic Buffalo” to bring communities and Indigenous peoples together. The Sacred Buffalo has always held significant meaning for First Nations and Métis

people. For Métis peoples, the Buffalo represents their spirit and reminds them of how their lives were once lived in harmony with nature (Elder Blu Waters, personal communication, May 6, 2020). As the guide/helper Ronnie Ann-Toulouse and I reflected in several conversations, the mobile app is only a vessel for the Spirit. This Spirit is vital for several communities because it can potentially reconnect Indigenous youth with their ancestors by sharing traditional knowledge and connecting Indigenous youth to other community members. The central point to keep this Spirit healthy and in balance is that the initial intentions of the app do not change and continue building community relationships.

From an epistemic and ontological point of view, this perspective expanded and opened a further exploration and research in the development of the Indigenous Friends App. In my master's thesis, I claimed the idea that a digital space can be created following the Cree Tipi protocols, which allows the conception of novel approaches about safety and security for Indigenous youth. Nonetheless, the statement of Professor McNab provoked a new intriguing line of thinking about conceiving a computer mobile program as a Being with a Spirit. Therefore, the first version of the app was not only a piece of software or computer program that was created using Indigenous protocols but also had a Spirit.

2.3 The App and the Embodiment of Indigeneity

2.3.1 Indigeneity in the Digital Space

After the provocative statements of Professor David McNab in June 2016, I decided to start a further analysis about the implications of the *Indigenous Friends Platform*. The mobile application was not only a piece of software or computer program that was created using a Cree Tipi Ceremony but also had a Spirit. How could I develop further this conception? I started my Ph.D. program at the end of August 2016. For me, the program could potentially signify a form of continuing the process of doing and thinking about the *Indigenous Friends Platform* within an environment that fosters collaboration among peers and using the academic institution as a space to develop the digital application further. This also brought forth questions like: how do the experiences of Indigenous communities and digital technology fit in academia? How are the collective struggles and ownership of information acknowledged in academia? I started the Ph.D.

confused and without knowing where the analysis of this research could belong within academic disciplines. Ironically, the *Indigenous Friends Platform* became a project within postsecondary institutions but outside academia itself because it did not fit any single disciplinary category. Nevertheless, this interdisciplinary aspect changed as I entered the program. During my first term in the Ph.D. program in Communication & Culture, I became a teaching assistant in the School of Information Technology (ITEC). In this position, I had the opportunity to teach the programming language JAVA to several students in their first or second year of postsecondary education. The students of this department are from different backgrounds and worldviews, and therefore, it was required that I modify and adapt the technical content for them. I was challenged by finding examples or analogies that were accessible to all the individuals in the room. This fact later impacted the framing of the future of the *Indigenous Friends Platform* in the context of the INDIGital Program (explained in detail in the next chapter) through the holistic integration of several digital frameworks. This opportunity allowed me to present the project to a different sector audience triggering several ideas and forms on how a project can be sustained in the long term.

At the same time, during the first term in the Joint Ph.D. Program of Communication and Culture in Fall 2016, I opted to take a course in Race and Gender in Digital Technologies with Professor Darcey Callison at York University. This course offered me an alternative way to continue thinking about the mobile application as a Being with a Spirit. It made me reflect on how digital technologies are intersectional because they are cultural creations that embody the different aspects of identity such as race, gender, class, age, and ability, among others. This examination meant that if the mobile application can embody certain aspects of Indigeneity, then there is a possibility to think about this mobile digital creation as a Spirit. I was faced with more intellectual and spiritual questions. How is Indigeneity expressed in this medium? Are there any values to consider? How is land related to this digital space? How are Indigenous identities transposed in the *Indigenous Friends Platform*?

Since the beginning of the app, several users have mentioned diverse forms of how Indigeneity is translated in this digital space:

[The *Indigenous Friends Platform*] is a place where you could connect with other

Indigenous people in the greater area. I think it's really cool that you guys post up stuff, programs, and you also... I'll get a notification every now and then just checking up, [...] And it's just like you just know that there's a bunch of other Indigenous people around the area that are also looking at this, and it's like a way to be connected still, even when we're not in the same room (Faith Desmoulin, personal communication, May 23, 2020).

In Fall 2016, I determined through the experience of IFP that digital spaces can ethically engage Indigenous peoples because mobile technologies and social media are technically capable of including essential values of Indigenous worldviews and Ways of Knowing/Doing. The essential values in this experience were: the capability to be present with other members (presence); the opportunity to look after community members in a safe(r) form (caring & safety); the possibility of providing to others (sharing); and the character of these spaces being spoken or verbally communicated (orality), (Mayoral-Baños, 2018). This reflection is reinforced by Snowshoe et al. (2016) who state that Indigenous Knowledge and cultural elements have a significant positive impact on the health of Indigenous youth . If the digital space aspires to support any healing process in the real world, the users need to support each other by developing these values rooted in cultural worldviews. These aspects were developed based on the talking circles and conversations that I had with several users throughout the two years of my master's thesis and the feedback that I received after the release of version 1 of the mobile application. In these conversations, the main questions posed included: What aspects are Indigenous students looking for in digital spaces to feel safe? What characteristics are Indigenous youth are looking to express to reflect themselves in digital spaces? In the next section, I unfold these aspects to answer these questions and present a visualization of how the mobile application was developed.

2.3.2 Presence: Indigenous Identity in the Digital Space

As I mentioned, the embodiment of Indigenous peoples implies the possibility of interacting with other peoples who are part of our community or related communities without the necessity of being located in the same geographical space. In this way, I claim that mobile devices could become an extension of Indigenous bodies under certain circumstances. The *Indigenous Friends Platform* relies on

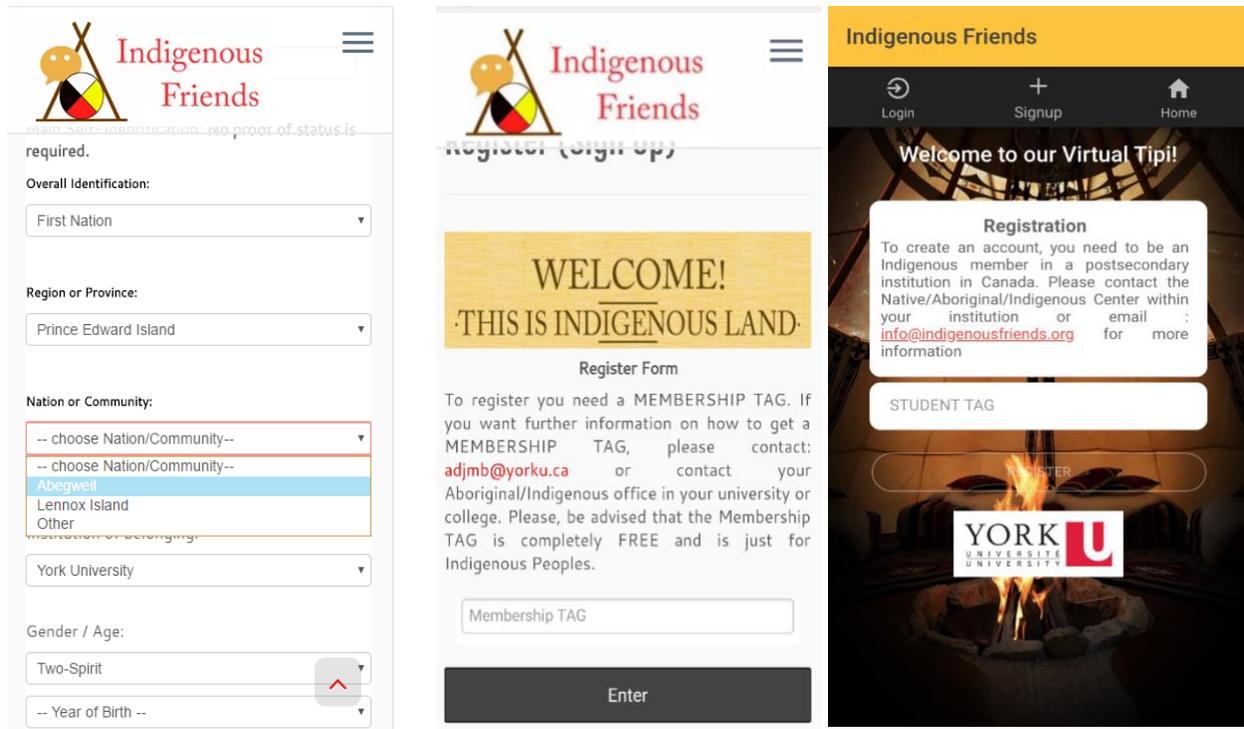
the imaginaries opened up by this virtual Cree Tipi, created to support the healing processes of Indigenous bodies, and therefore to be a potential decolonizing tool. However, enabling embodiment and presence are the most difficult challenges I faced when creating the *Indigenous Friends Platform* and throughout the improvement and maintenance.

The first central aspect that I considered for the embodiment was the Indigenous presence in the space, or in other words, the assurance of safely recognizing Indigeneity in digital spaces without the fear of being discriminated against because Indigenous worldviews are central to the space. Therefore, the community's initial requirement was to design a registration form (signing up) that delineated some initial parameters²⁷ or fields for identification purposes, such as specific community, gender, and year of birth (Figure 5A). In all fields, there was an option to self-identify outside the usual digital parameters. These parameters had the purpose of organizing some of the internal spaces and providing a way of bringing the individual differences into the user profile. All the identifiers aimed to follow the principle of self-determination (i.e., a personal decision grounded in the embodiment). In the case of group identification, the initial options for potential users were: 636 First Nations, 5 provincial Métis Federations, 51 Inuit communities divided into 4 Arctic regions, non-Indigenous identification for allies, Indigenous groups outside Canada, and also, the unknown option for people who are in the process of discovery. All the previous information, along with the name, educational institution, username, and password, could be changed on the Profile Screen when the user logs in to the app.

²⁷ There is an ongoing tension between the uses of parameters alongside with self-determination because they forced the categorization of the individual.

Figure 5

Membership Screen (A), Sign-up Screen V.1 (B) and Sign-up Screen V.2 (C).



Note. Indigenous Friends Platform 2018. Copyright 2020 by the Indigenous Friends Association.

An example of the community-engaged changes was the first sign-up screen. When it was tested, several community members were concerned about the safety of their identities within the space of this virtual Tipi (i.e., the first evidence that they were beginning to embody themselves in the space). They did not want a completely open space where any person could register and enter inside this virtual Tipi because they were concerned with the potential of being bullied, threatened, or harassed by non-Indigenous individuals. Moreover, it was important to avoid the reference to a monolithic pan-Indigenous ideology that is pervasive in mainstream understandings. Indigenous communities are diverse, and although they have several historical commonalities, their physical characteristics are heterogeneous. The decolonial digital space must allow and encourage a broad self-identification process.

In the Anishinaabe and Cree traditions, the conical shape of a physical tipi is compared to

women's skirts and how they can provide shelter for young children when they feel scared or threatened. For that reason, ceremonial Tipis have protocols, and certain people may not be granted entrance to specific events within the Tipis.²⁸ On the other side of the spectrum, Indigenous communities face oppressive issues based on their identities, such as cyberbullying, cyber racism, and the exchange of sexually explicit content (Rice et al., 2016, p. 12). As user Stefan Piercey explained:

Entering into a public space where it's not Indigenous focused, you're always ready for the trolls that you're going to face. Even in my lunchroom, these are grown men who go through Facebook, and they see an article, and they're like, "Stefan, look at this, you're native, you represent every single person." Having those resources accessible to non-Indigenous people, it's not an Indigenous focused conversation; it's just a whole bunch of people talking badly, really, with their own idea of what's going on. It's not safe. It's not safe on the Internet, and then it's not safe in a public space like the library, when you're having a conversation with your fellow students [...] The self-oppression, the weight that we carry. I feel like even though you used to have access to the Internet, to a phone, to social media, you don't want to engage yourself with being Indigenous because of the fear and the oppression that you put upon yourself. I feel like that maybe one of the biggest steps to overcome. (Stefan Piercey, personal communication, May 19, 2020)

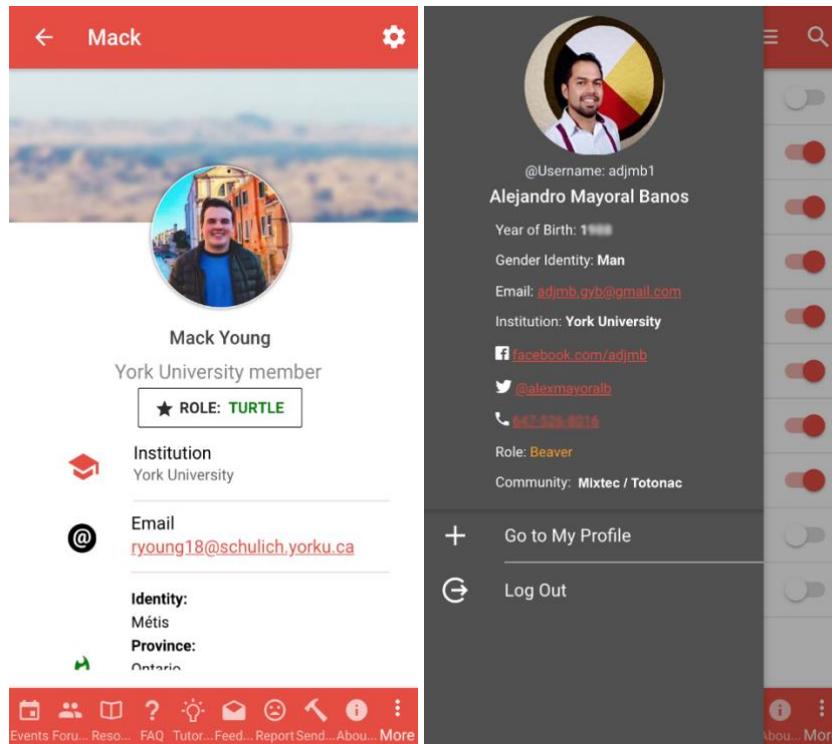
To improve the safety of the space throughout a long process of negotiation and deliberation with Apple Inc, the community and I decided to create a Membership Screen to restrict the access of the sign-up process of the app through a code tag. We created a mechanism that allowed only Indigenous peoples and non-Indigenous allies entrance to this space (Figure 5B and 5C). This student tag is a "code" completely free of charge for community members and was expected to be shared by the Indigenous centres of postsecondary educational institutions through their emailing list and social media platforms. In the case of non-members of educational institutions, a contact email address is provided for more information.²⁹

²⁸ Elder Blu Waters, personal communication, October 28, 2014.

²⁹ In the case of York University, the membership tags are managed by the Centre for Aboriginal Student Services.

Figure 6

The Profile Picture (A) and the Sidebar with Profile Information (B)



Note. Indigenous Friends Platform 2018. Copyright 2020 by the Indigenous Friends Association.

Despite this first layer of intentional security, community members stated that some Indigenous individuals might also be potentially harmful (e.g., sexist, racist) towards other members. Therefore, community members and I designed another layer of safety based on the users' virtual bodies. Through their virtual bodies, each of the users belongs to a "cyber" animal clan (in the case of First Nations and Métis peoples) or color group (in the case of Inuit peoples). Each of these seven clans or colours has a responsibility inside this virtual community.³⁰ The seven clans or color groups are Eagle–Yellow, Owl–Red, Wolf–Black, Bear–Blue, Marten–White, Turtle–Green and Beaver–Orange.³¹ The Wolf–Black and

³⁰ In the real world, most Indigenous peoples belong to a clan or group, which are instrumental in traditional occupations, intertribal relations, and marriages.

³¹ This kind of system of roles significantly differs from the common IT systems roles based just on administrators and users. Specifically, the SDLC approach proposes to create a decision-making analysis trees and process specifications forms to generate different roles and process manuals (Kendall & Kendall, 2011, p. 266-373). This

Bear–Blue clans–groups are the members who have accepted responsibility to take care of this virtual space and make it safer, watching that all the public spaces are free of harassment and discrimination. Any member who feels threatened in any private or public environment can send a report to the members of these clans (see Figure 6A and 6B). The Eagle–Yellow and the Owl–Red clans–groups are Elders and Traditional Knowledge Keepers who take care of the Indigenous teachings and knowledge(s) inside the virtual Tipi. Alina Rivi, the Tech Lead at IFA, explains the importance of the different clans:

[The Eagle–Yellow, Owl–Red, Wolf–Black, Bear–Blue] would be the people who are giving out the privileges to these different roles. A new person comes in, “Yeah, you can come in, but you don't necessarily create content, nor are you someone who necessarily needs to moderate. You can just be a part of the general public for now. [Or] I know you’re someone who can help me moderate everything that’s going on” or “Yeah, you're someone who can create content.” (Alina Rizvi, personal communication, May 4, 2020).

In version 2 of the *Indigenous Friends Platform*, two new features were created in order to increase the engagement and the presence within the platform: Bingo (Figure 7A, 7B and 7C) and Trivia (Figure 8A, 8B and 8C). These features were proposed as a form of bringing community members together into the digital space and increasing the presence of the community. As a user of the *Indigenous Friends Platform*, Lisa Maracle mentioned:

Yes, there's data, but sometimes you don't need information that much. To get members to login to it every day, maybe like the Facebook app, you need something to draw them in. So, then that's when the IFA came up with the Trivia and Bingo, which was really good. I enjoyed it. I enjoyed the Bingo. I didn't play too much of the Trivia because I am more of a Bingo person. I wish a little more people would have joined and took it on how I did, and User_X did, right? Because once User_X joined, there was actually someone to play against, right, or challenge who's going to get it, right? (Lisa Maracle, personal

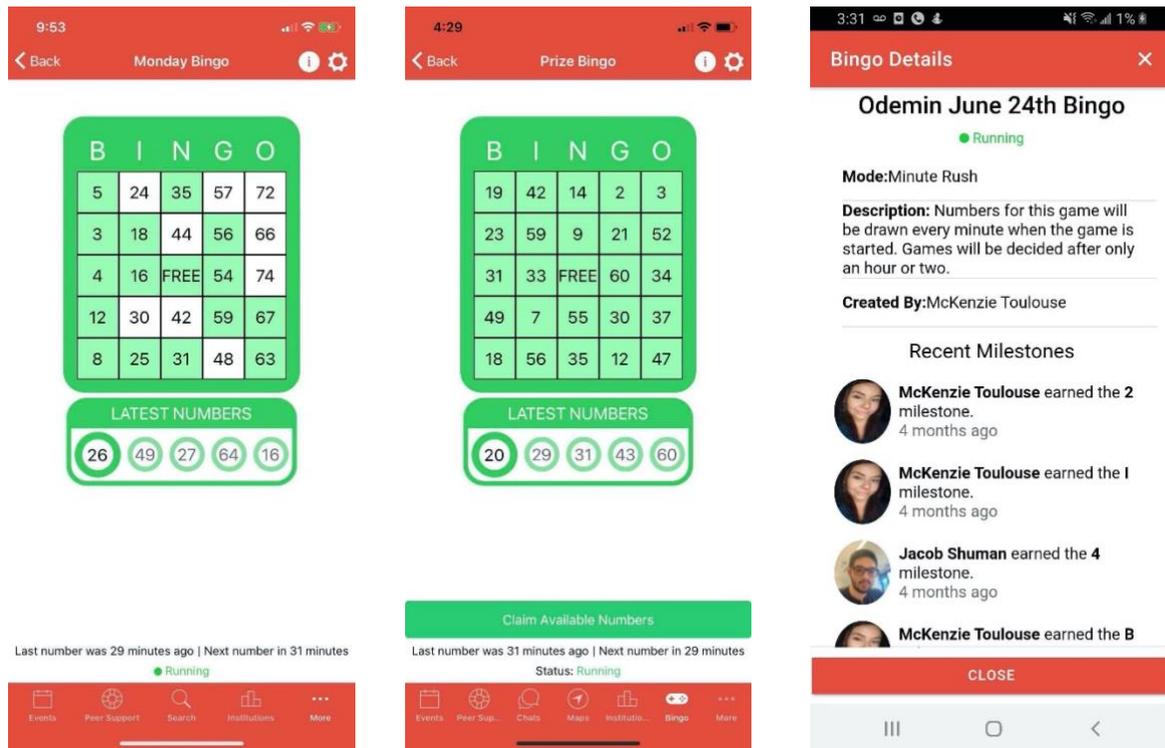
common type of settings in IT would not fit into the traditional forms of thinking of Indigenous peoples because they would adapt business rules to traditional responsibilities. The system created on the mobile application wants to incorporate the Indigenous roles into the functionality of the application. Furthermore, these roles are trying to balance the levels of power inside mobile application/Tipi. There is not a “superuser” role, which can do all the actions within the app. The responsibilities and duties are distributed among the partners. To see the full description of the responsibilities and duties of the seven clans or groups consult Mayoral-Baños, 2016, 128-130.

communication, May 12, 2020)

In Bingo, every signed-up user had the opportunity to enroll themselves into the games and start playing with a card of numbers. Numbers were pulled out every minute or every hour.

Figure 7

User playing Bingo (A), Full card in Bingo (B) and Bingo Milestones (C)



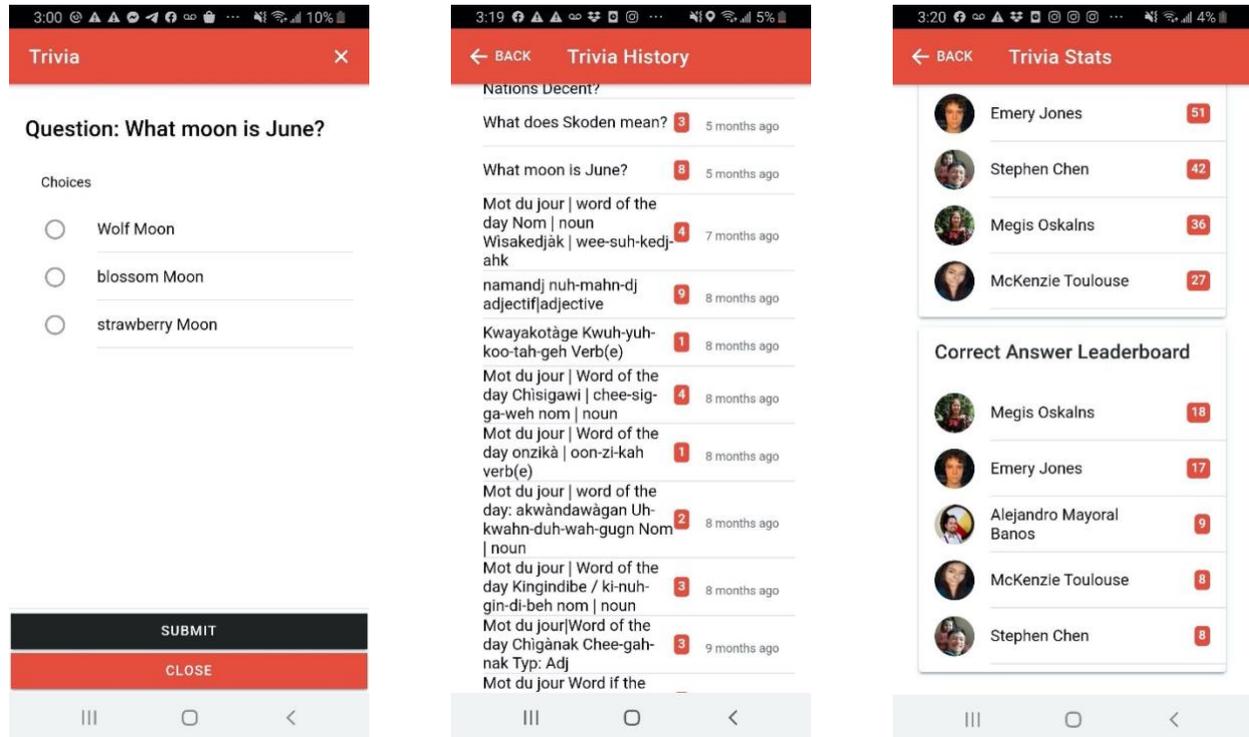
Note. Indigenous Friends Platform 2019. Copyright 2020 by the Indigenous Friends Association.

Bingo increased the engagement of the users, and some of them commented about the feature: “it’s really cool with this app. I like this app a lot. And even with the bingo too. I think that’s really cool. Bingo, I’m all about bingo. I love bingo” (Faith Desmoulin, personal communication, May 23, 2020).

In the case of Trivia, questions were popped up on the landing page of the signed-up users in order for them to answer the correct multiple-choice option. The user with the correct answers won prizes.

Figure 8

Trivia Question Screen (A), Trivia History (B) and Trivia Stats (C)



Note. Indigenous Friends Platform 2019. Copyright 2020 by the Indigenous Friends Association.

In this regard, several users such as McKenzie Toulouse, Tsista Kennedy, Bonnie Rogers, and Faith Desmoulin claim the potential of healing through technology relies on the connection with culture and identity (a Two-eyed Seeing perspective of digital technologies and identity), but most importantly, the connection back to the land. Finally, when the people’s presence is addressed, and they begin the process of embodiment, the possibility for healing begins through the reclamation of the digital space and the care of one another.

2.3.3 Caring: Healing within the Indigenous Friends Platform

One of the most important teachings that this virtual Cree Tipi inherited from Traditional Knowledge was the caring value. This value entails that users can look after one another to create

resilience in the community. The incorporation and recognition of this teaching and its origin are essential in order to develop the platform in a *good way*. In the case of the virtual Tipi, the caring component started being recognized through the graphical progression of the logo, which in its first version displayed the Anishinaabe Medicine Wheel within a Tipi, which had a correspondence with the colours in the menus and interfaces in version 1 of the platform (Figure 9A). In the last version of the platform's logo, the caring is expressed through the two characters and the sacred fire in the Tipi centre (Figure 9B). These logos have the purpose of conveying the caring of the members and the safety that can be triggered within the space.

Figure 9

The 2016-2019 IFA Logo (A) and the 2020 onwards Logo (B).



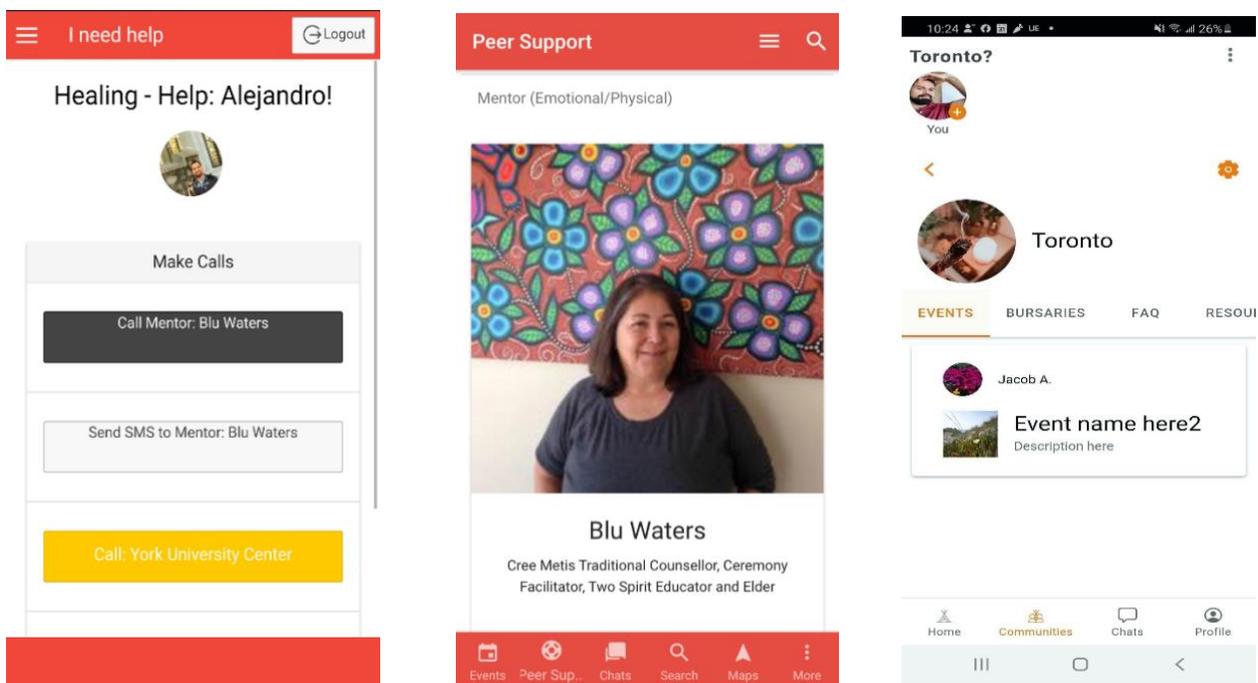
Note. Copyright 2020 by the Indigenous Friends Association.

Second, the base of the caring for Indigenous youth and their bodies in the app was conveyed in a traditional manner, through intergenerational communication within a digital environment. The platform was designed to host youth and Elders and Knowledge keepers who could take care of the community members within the digital space. The purpose of creating a space that triggers the healing process of community members entails designing a network of support among peers. As a first feature to support this caring process within the *Indigenous Friends Platform*, the community and I decided to generate the Peer Support feature (Figure 9A and 9B). The Peer Support system was intended to provide an initial point of contact for youth to connect with Elders and Knowledge keepers within the postsecondary institutions. This feature's objective was that the youth could access someone in the institution to find support as soon as they were signed into the platform. The people listed on that screen are Elders, who belong to the Eagles–

Yellow clan–groups and Traditional Knowledge Keepers, who belong to the Owl–Red clan–group. In the Profile Screen, the user could select their mentors and guides (they must belong to the Eagle–Yellow and Owl–Red clan–group). In version 3, the peer support system will be moved to the Communities Tab (Figure 9C), where depending on which community the users belong to, the appropriate peers will be listed.

Figure 10

Peer Support v1.0 (A), Peer Support v2.0 (B) and Community Tab v3.0 (C)



Note. Indigenous Friends Platform 2019. Copyright 2020 by the Indigenous Friends Association.

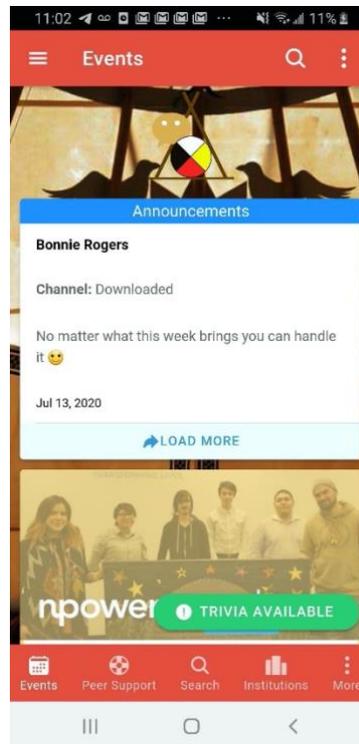
These Elders and Knowledge Keepers had the responsibility of caring for Indigenous peers within this space. The healing process, which is possible through the Indigenous embodiment in this virtual space, is based on the human dimensions’ mutual balance (i.e., physical, emotional, intellectual, and spiritual). This balance is promoted through traditional intergenerational communication among Elders, Knowledge Keepers, and youth members in the real world. In this way, the process of healing follows Traditional Knowledge and protocols. As stated earlier, the *Indigenous Friends Platform* is merely a space where this healing process might begin in a form reflected in the real and physical world.

Alongside the peer support system, IFA designed a new feature of caring based on push notifications.³² This form of caring consists of interacting with the users to inquire about their physical, intellectual, emotional, and spiritual status and offer any needed support. In other words, when someone is not feeling well, they could send a notification to their mentors or guides. Then an Eagle–Yellow or Owl–Red could contact the member to start, or continue, a healing process. Moreover, this push notification system enables Elders and Knowledge Keepers to send information, or teachings, to the users in specific moments or regularly scheduled messages. In this respect, in the release of version 2, the Bear–Blue and Wolf–Black members started to send a daily motivational quote to all members via the push notification system (Figure 11). This motivational quote appeared on the landing page under the “Announcements” section of the platform when the users opened the app and were logged in the space.

³² Push Notification is “the delivery of information from a software application to a computing device without a specific request from the client. Push notifications let applications notify users of new messages, updates or events, even when the users are not actively using such applications” (quoted in Mayoral-Baños, 2016, p. 98).

Figure 11

The daily quote on the Landing Page



Note. Indigenous Friends Platform 2019. Copyright 2020 by the Indigenous Friends Association.

In this regard, Faith Desmoulin affirmed the caring character within the app through the daily quote and the connection among members:

Yeah, just every now and then, you get a notification: “Hey, hope everybody’s okay,” I’ll click on it, and then that also gets me to scroll down and see what’s going on or what programs are going to be run, or workshops. And it’s really cool. And then, yeah, it’s just... I think it’s a really good app for people to stay connected, and just Indigenous based too. I just like that its Indigenous students, so it’s just like urban Indigenous settings; we need something to keep us connected still because it’s harder when, let’s say, something... I don’t know. You’re still around. (Faith Desmoulin, personal communication, May 23, 2020)

In other words, the caring principle through the hospitality within the digital space is reflected in the real world through a process of engagement and responsibility. The users start the process in the online world and continue their process in the analogue/non-digital world.

The caring character is an essential aspect that continues to be developed throughout the versions of the app. The app as a Spirit and Electronic Buffalo has the purpose of connecting different generations of Indigenous peoples who are located in different geographical spaces. Therefore, this virtual space can be one more medium through which healing and sharing can happen regardless of the physical location.

2.3.4 Sharing: Providing Others within the Indigenous Friends Platform

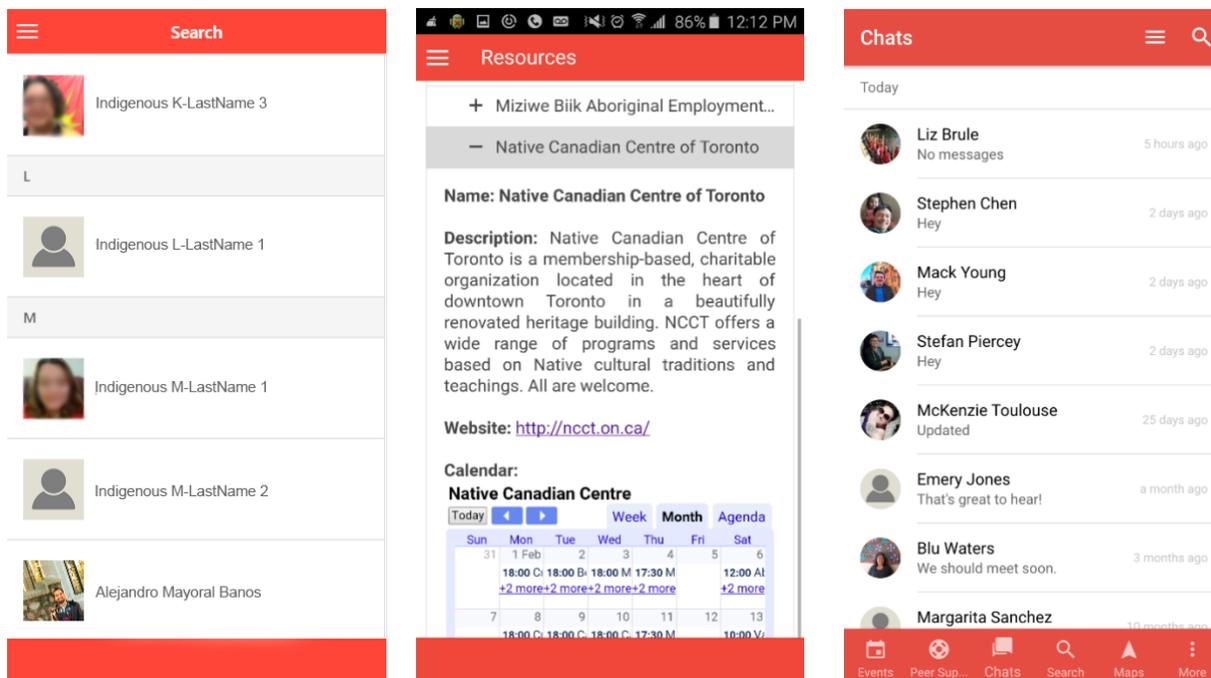
According to the Elder Blu Waters, the *Indigenous Friends Platform* is a space to share and support Indigenous identity, cultural connection, and intergenerational communication. In the same way, when people gather inside a Tipi, they share experiences, knowledge, and food (Elder Blu Waters, personal communication, October 5, 2016). It is a natural space for sharing.

[The IFP] gives you access to other people. It gives you access to build friends, to build relationships, gives you access to teachings; it gives you access to elders, it gives you access to organizations that you can go and volunteer at so that you can become immersed in, so it's not just an entry point. It's a point that can carry you through until you receive the information you need and then continue on with your journey. And maybe you're going to be the one that starts important things back in. You'll be the one that says, "Hey, I got this information from this app. Now, I'm going to give back to this app by saying, 'Hey, did you ever think about adding this in it?'" (Elder Blu Waters, personal communication, May 6, 2020)

Indigenous worldview is looking at how, and that's something that the [Indigenous Friends Association] platform does as well is looking at, when we're building this platform, it's not even really about profit, it's about how the community benefits and how we benefit the education of these individuals that are being a part of it. (Mitchelle Gegwetch, personal communication, May 4, 2020).

The sharing between members and partners is promoted through several tools in order to foster healing processes in this digital space. First, in the Directory Screen, users search for peers from the same community of belonging or educational institution (Figure 12A). This feature's objective is to promote the sharing of information between members so that they may find people with whom they feel comfortable and who can support them and build relationships around them. They may not necessarily

find people from the same location, but they can discover peers from contiguous communities. There is an opportunity to continue that conversation through the Chats Feature (Figure 12C).



Moreover, users can share information about the community through the features of Frequently Asked Questions and Community Resources. In Frequently Asked Questions, Wolf–Black and Bear–Blue clans–groups can share common inquiries that Indigenous members have about the area where they live or the educational institution where partners are studying. In the Community Resources, a list of Indigenous organizations, collectives, and institutions that are located in the geographical area around the educational institution is provided (Figure 12B). As shared in the previous section of caring, in the new design of the app (version 3), the shared information will be found under the Community Tab.

Figure 12

The Directory Screen v.1 (A), Resources Screen v.1 (B) and Chats v.2 (C)

Note. Indigenous Friends Platform 2018. Copyright 2020 by the Indigenous Friends Association.

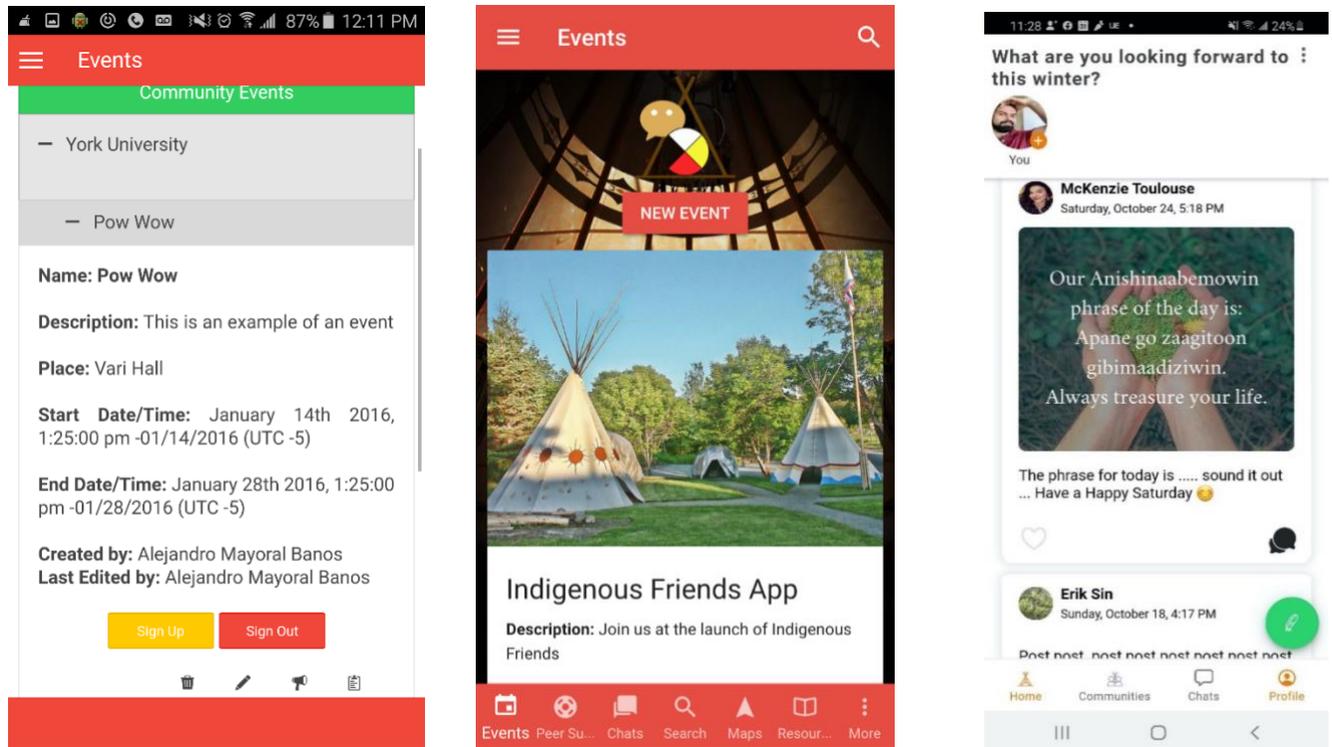
Stefan Piercey expressed how the information supported his embodiment within the platform:

First of all, I have to say downloading the app, then seeing all the researching, finding resources, putting them on the app, being a part of that developmental stage, growing the database of the app, I felt really cool adding to ... I guess you can call it a community digital bundle, you know. Prior to having the app on my phone, I couldn't just go; you know what? I know a great place. It's called native women's something; you know what? Let me just open the app and find the resource for you. Here's their email; here's their phone; here's their app. So, having the app with its resources was the number one immediate access that I always used while working with Indigenous youth. And especially first-year students. Even more so, students that are from out of the [Toronto] GTA. Having that information was a really important part of my reliance, the way that I used the app as a support system. Another thing with the contacts, now it might sound a little whatever, but when I download the app, and I looked at the contacts, and I saw familiar faces, this was an opportunity for me to have direct contact with people. (Stefan Piercey, personal communication, May 19, 2020)

The Events feature in version 1 (Figure 13A), and version 2 (Figure 13B), Wolf-Black and Bear-Blue clans-groups could invite other users to physical events that are performed within the surrounding communities. These events could also be initiatives of political action or resistance. In the last redesign of the app (version 3), the sharing aspect of the embodiment was completely redesigned and rethought to include more visual and communal elements and allow all clans-groups to share their experiences in a common space (Figure 13B). It is important to highlight that institutions and communities will continue sharing their specific events under the profile community tab (Figure 13C).

Figure 13

The Events Tab v.1 (A), the Events Tab v.2 (B), The NewsFeed v.3 (C)



Note. Indigenous Friends Platform 2019. Copyright 2020 by the Indigenous Friends Association.

In this regard, former student McKenzie Toulouse affirmed:

[IFP] impacted my life by giving me the resources and making me being a part of something and actually supporting me in my studies with success through different kinds of resources, through the maps, which I helped me along with campus to have active engagement and to be aware of different events that are in the surrounding areas of Toronto. So it was very resourceful, and it helped me find a balance and to know that I was actually supported. (McKenzie Toulouse, personal communication, May 13, 2020)

In addition to these features, community members can share and express ideas through public spaces such as the forums (version 1 and 2) or the newsfeed (version 3). The sharing of Traditional Knowledge and meaningful information between members is promoted in these spaces. The Wolf–Black clan–group regulates these virtual places. Elder Blu Waters mentions this aspect as something really

important:

The app is a method, a tool to use for the current part of your journey to access information from reliable sources from people that have been vetted and are known to be of a good nature, a good mind to work in a *good way*. [...] This app is already all vetted for you, right? So, somebody is taking the time to put in there, say resources. Somebody can use the app for just resources. If they're new to the area, they want to know where the Friendship Centre is, where the hospital is, where the library is, where the youth centre is, where the childcare is, so they just go on there and they say, "Okay, this is what I'm looking for childcare." Boom! Here are ten organizations you can go to for childcare, right? So, it gives you that resource, but it gives you more than that. It gives you more than just finding out where our location is for something you're looking for. (Elder Blu Waters, personal communication, May 6, 2020)

In the same aspect, Faith Desmoulin commented:

"A really good, reliable resource. It has to be looked through by somebody else, a trusted source, because I just don't want to be learning something and having it be from someone who probably isn't Indigenous or somebody who has the intention who hasn't really gained the knowledge, the specific type of knowledge, and changes it a little bit, and it's just... I don't know. I'd rather hear it from somebody who's... well, who's probably been doing it all their lives and just are a really good source, are a really good reliable source. And not change anything about it or anything... like adding something in it. (Faith Desmoulin, personal communication, May 23, 2020)

Finally, as a last aspect of sharing, the talking circles were designed and created in version 3 of the platform. These talking circles are directly related to integrating the oral aspect into the sharing experience.

2.3.5 Orality: The Role of Media within Indigenous Friends Platform

Oral stories are fundamental means of knowledge transmission for Indigenous worldviews and ways of knowing. In this respect, McKenzie Toulouse mentioned the importance of oral tradition among Indigenous peoples: "The way that we kept our traditions going is through storytelling, from mouth to mouth, sharing sacred teachings, sharing experiences. So oral storytelling is something that's not valued

in Western culture. It's like it's said, but it's not written. It's not signed. It's not documented. So, therefore, storytelling is something that was never considered to be a known fact of keeping tradition and knowledge alive. But in our culture, it is" (McKenzie Toulouse, personal communication, May 13, 2020).

Regarding digital technologies, Molyneaux et al. (2014) have mentioned that mobiles and social media offer Indigenous peoples a forum to embrace and preserve the traditional culture based on nature through images, sounds, and videos (Molyneaux et al. 2014; Kemper 2015). The embodiment that is possible through the oral characteristics of digital communications is now perceived by Elders and Knowledge Keepers as a new possible form to trigger a healing process:

How are we going to support somebody that lives... I live in Peterborough; how will I support somebody who lives in Toronto unless I physically get in my car and drive there? Right? Then I can support them, but through digital technology, I can do a Zoom meeting, and I can have somebody sitting on the other side of my vision field, looking at them saying, "You know what?" And they're like, "You know I'm crying, and I'm sorry, I'm crying." And I'm like, "No, I can see you crying. It's beautiful to let go of those tears," right? That's a form of cleansing. So, I can see them with my eyes, I can hear them with my ears, I just can't touch them, right? I can't put my hands on them and say, "Oh, it's okay," right? I can't let them know that physical touch in a *good way* that's not intrusive, and that has given permission to be done as a form of comforting; that's all that's missing. But I can see them, I can hear them, I can speak with them, and I can understand them because I can see them. Without digital technology, that wouldn't be happening, right? It would just be over the phone, so I'd be able to hear them, but I can't see their expressions. I can't see whether or not what I'm saying is reaching them; what I'm saying is meaningful to them because they could be on the other end of the phone like this. Right? (Elder Blu Waters, personal communication, May 6, 2020).

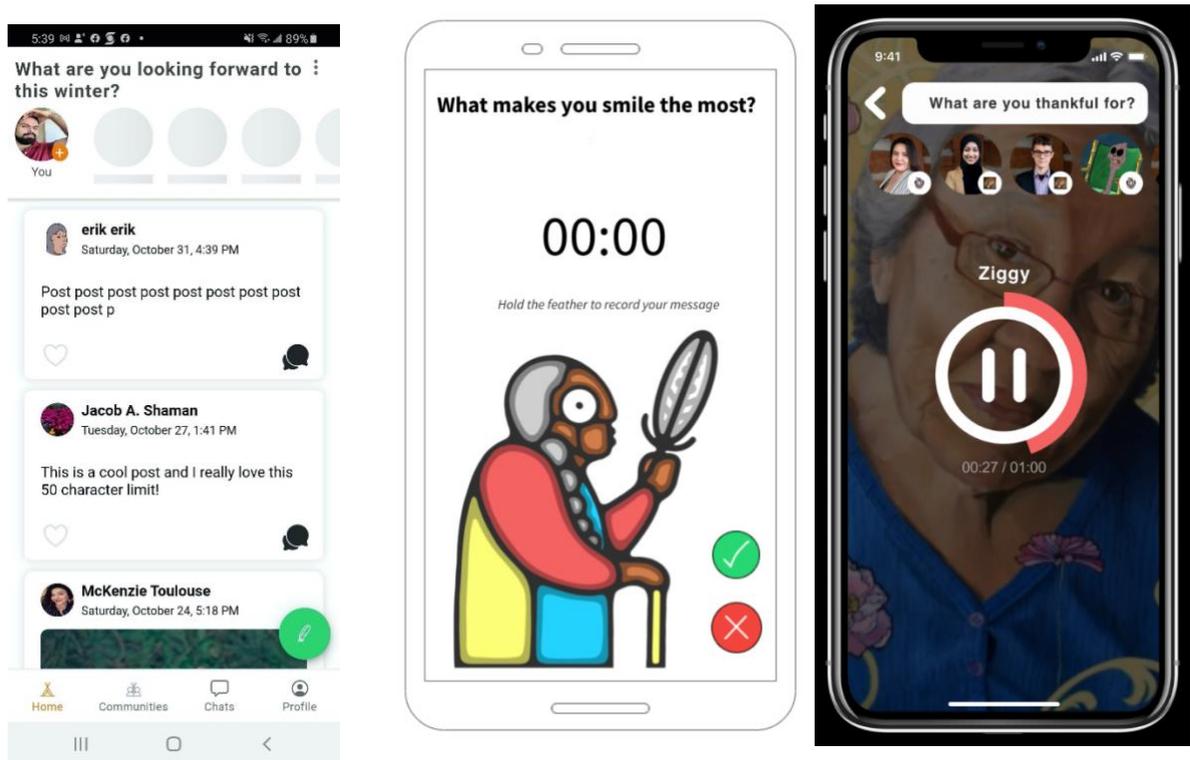
Even though the *Indigenous Friends Platform* could not store all of these media types, the digital mobile application provided initial receptacle storage for all the media's links and addresses within the Community Resources and public forums.

As part of the enhancements of version 3.0, the new interface will integrate the possibility of talking circles at the top of the screen (Figure 14A). Each person has the opportunity to share through

one-minute audios stories of themselves and share them in a digital talking circle with others (Figure 14B). These sharing experiences are guided by a question at the top of the screen (Figure 14A and Figure 14C). The idea of these digital circles is to integrate the oral tradition of the communities as part of healing through a process of sharing with others taking advantage of multimedia. This initial trial aims to understand the needs of the community members and allow them to have a space to share their experiences. This talking circle emulates the circle that exists within a ceremonial Tipi.

Figure 14

The Sharing Circles in the Newsfeed (A); Recording a Thought (B) and Prototype (C)



Note. Indigenous Friends Platform 2018. Copyright 2020 by the Indigenous Friends Association.

Regarding the importance of this feature, McKenzie Farrah Toulouse mentioned:

The role of it is to stay connected and give them that resources of what's coming forward are our different expansions of the digital, our new sharing circle, and our medicine bundles. It's like keeping that interest and that relationship going, right? And it's giving

those people that ability to stay connected and give the resources that they need, even though everyone's isolated. You know what I mean? It's a resourceful tool that's available if you need it. It's up to that person. (McKenzie Toulouse, personal communication, May 13, 2020)

Relying on the humility principle of Indigenous paradigms, the *Indigenous Friends Platform* is just the starting point for storytelling on these types of media. IFA recognizes that Indigenous and non-Indigenous organizations, communities, governments, educational institutions, and even individuals invest a significant number of resources to create and design better ways to store this type of information. Therefore, this virtual Tipi follows the principle articulated by Beaton et al. (2015) in the First Mile approach, which is based on the research OCAP principles—Ownership, Control, Access and Possession—developed by the First Nations Information Governance Centre (see chapter 9 for further information in this regard).

2.4 The Embodiment of the Spirit

During Fall 2016, as I described in the last sections, I developed (doing) and published (thinking) the idea that Indigenous peoples can embody themselves in digital spaces, which means that a possibility emerges for virtual environments to start healing spaces. The four values of presence, caring, sharing, and orality brought initial understandings of how Indigenous peoples in Toronto are transferring and using virtual applications as spaces of encounter. The possibility of this comprehension brought the initial possibility of conceiving the app as a Spirit. This second step of doing through thinking and thinking through doing implied a two-way conversation between the epistemic framework of embodiment and the praxis of user design. A crucial value of Indigeneity and decoloniality was still missing in this rationale, however, because it has scarcely been discussed in academia and digital environments: the relationship and correlation between land and digital spaces. The denial of the land in the digital space would signify the neglect of Indigenous self-determination and the erasure of the historical processes of land reclamation. The answer was not simple, and it took me three years to develop it based on the experiences of several community members and the continuous process of doing through thinking and thinking

through doing. Digital spaces are not a replacement for land (which means that there is always a need to go back to the real world), but they offer a space for education and political action. In other words, it is a way to embody back the digital into the real world.

Although the journey of finishing the master's thesis and starting the Ph.D. program was challenging to overcome, the requirements of the mobile application continued to increase throughout 2016. In order to sustain the development of the app after the master's thesis, I was required to find an entity or community to hold the app's rights and data. I looked for guidance at the York Innovation department of York University in November 2015 in order to understand the possibilities and the processes involved. At that moment, I was legally the only owner of the software and data generated by the app. I initially proposed to the CASS community members and staff members about transferring the rights and data to a York University department (e.g., CASS or an academic department). However, York University could not invest enough human and technical resources to maintain a mobile application that would serve a limited number of students. I needed to look for resources outside the institution to sustain the app. There were also the ethical questions of an educational institution holding the software's rights or personal data of Indigenous students. The solution was complex. Although I have legal rights, the community members of York University morally owned the app.

2.5 Conclusion: The Spirit of the Technical Being

In this chapter, I described the initial journey of the *Indigenous Friends Platform*. I departed from my personal story and connected it to the central role that community members had in my individual development as a person, but then, through different communal actions, those needs were transformed into a digital idea to support Indigenous youth. The birthing ceremony of a technical being disrupts traditional forms of conceiving Indigenous knowledge and brings the opportunity to re-evaluate and create tailored solutions for Indigenous digital platforms. The idea of following a Cree Tipi raising ceremony as a form of software creation allows bringing the ethical protocols of communities into digital spaces and allowed us to connect and start the process of Indigenous embodiment into virtual spaces.

Moreover, this type of process increases the participation of Indigenous community members throughout the process of digital design through solid cultural connections and several worldviews. After the digital space is conceived, the values of presence, caring, sharing, and orality are incorporated as forms of Indigenous embodiment and as a way to behave within the digital space. Finally, the conception and awareness of the land within the digital spaces become fundamental in this form of Indigenous resurgence and form of technological appropriation.

Chapter 3

Indigenous Friends Association as a Tech-Community

Figure 15

The Indigenous Friends Association as a tech-community



Note. This illustration was created by Anishinaabe Onyota'aka artist Tsista Kennedy based on the story of creation of the app. Copyright 2021 by the Indigenous Friends Association.

After the embodiment of Indigeneity and Spirit in the *Indigenous Friends Platform*, several institutional challenges and requirements needed to be addressed. Diverse inquiries about data management and infrastructure were a result of the public exposure of the first version of the mobile application. The objective of this chapter is to describe the creation of a not-for-profit organization, the Indigenous Friends Association (IFA), as a holder of the *Indigenous Friends Platform* (IFP) through a process of storytelling that brings the experiences of different institutional allies, community members, collaborators, knowledge keepers, developers, staff members, and volunteers forward. In order to aspire to frame design principles of decoloniality and digital technologies, the accountability and clarity of the ownership of the data and infrastructure are essential aspects to analyze the ethical and political

implications of such technical solution. In five years, the *Indigenous Friends Platform* was transformed from a piece of digital software to be a “tech community” (Figure 15). This transformation story is reflected in Figure 1 by artist Tsista Kennedy when he heard about several challenges to maintain the Spirit of the app and to distinguish the IFP from other social media apps. In this respect, Keith Sujo states:

As opposed to Facebook or other social media platforms that are just very visually oriented, very consumer-oriented with the *Indigenous Friends Platform*, I find it’s more of a space a Spiritual digital space. One that is more calm, slower, one that encourages connection at a human level, and with this Spirit, if that makes sense of what Indigeneity means and to create bridges between indigenous and non-Indigenous peoples. (Keith González-Sujo, personal communication, May 6, 2020)

The vast amount of information and experiences, and numbers of peoples and voices in the maintenance, adaptation, and growth of the IFA have created several separate side stories to the one expressed in this narrative. Those narratives are not included in this chapter to facilitate the analysis of this scholarly work in the upcoming chapters. The purpose of this part of the story is to provide a detailed comprehension on the inquiries that the management of the mobile application implies around infrastructure, data and training.

This journey of the IFA is explained based on several critical defining moments in the management of the digital space and the organization itself. These important junctures transfer the project from a purely academic proposal to an operational activist project through a grassroots organization. This form of arranging the story refers to significant stages in the growth of the organization and provides timepoints in the evolution of the space as a community and a digital tool. Moreover, the different stages of growth shaped the findings of this research through the interrelation of the IFP’s principles and the teachings of the Anishinaabe Medicine Wheel.

In the first part, this story starts with York University’s role in supporting the mobile application’s relationship building. I trace the story of engaging with different departments across the university and how my doctoral studies’ academic journey influenced the reflection of this space. Second, with the release of version 2 and the incorporation of a not-for-profit, the interactions and dynamics in the

recently created organization are illustrated to illustrate the digital space's interdisciplinary requirements to share knowledge and data. Finally, I will share the vision of version 3 of the app and its relationship with the INDIGital program and the current scope of the *Indigenous Friends Platform*.

3.1 The Not-for-profit as a Home for the App Spirit

3.1.1 Building Relationships

In April 2016, I met McKenzie Farrah Toulouse (McKenzie), who at the time was a first-year Anishinaabe student from Sagamok First Nation. Our relationship and interactions would change the course of the app and provide a different approach than I predicted. McKenzie has always centred the challenges that Indigenous students face when they require moving from a community to a larger city. The day I met her, I invited her to sign up for the app, and she became a volunteer by inviting other Indigenous students into the digital space.

In the same way, during my first semester in ITEC in Fall 2016, I worked with Stephen Chen, the undergraduate program director. He helped advance the app by working with fourth-year undergraduate students to apply their knowledge to the social project through a research-based course called ITEC4000: Independent Research Project in Information Technology. This course aims to apply knowledge learned in the classroom to a real-life problem in the industry and produce a research project from the lived experience. On September 30, 2016, I met Emery Horace Jones (Emery). Emery is a non-Indigenous ally who was interested in putting his learning into a project that could benefit society.³³ Although Emery had previous coding experience, it was his first experience working with/for Indigenous peoples. I did the onboarding of Emery and other ITEC4000 students in the early weeks of the Fall 2016 semester.³⁴ Through the onboarding process, I started to compile materials and the story of development in order to

³³ Initially, Emery was not eligible for the ITEC4000 course because he was still in his second year of university. He became part of the initiative as a volunteer for the next six months, learning about mobile development. After he fulfilled the requirements, he joined as an ITEC4000 student and then as a paid collaborator.

³⁴ October 5, 12, 14 & December 20, 2016

expedite his learning process and replicate this practice.³⁵ On October 12, 2016, Emery and I participated in the Tipi Ceremony at Seneca College Newnham campus. As the Tipi was raised, we discussed the similarities between the Tipi ceremony protocols and the software creation process: the importance of listening to Elders, the role of community and understanding of Indigenous ways of knowing and doing. After that experience, Emery and I started working on the code in an asynchronous form, with a copy of it in a shared cloud folder. Due to the limited resources, people, and time, I decided to focus on the backend migration while Emery supported the app by dealing with technical bugs in the front end and in some features.

While teaching in the ITEC department in September 2016, I met Stefan Piercey, a first-year student from CASS that came from Winnipeg, Manitoba. Stefan is Sauteaux-Ojibway from Fort Alexander of the Sagkeeng First Nation. The first day I talked to him, we had an in-depth conversation about the struggles of studying in a postsecondary educational institution in Canada at the Tipi of York University. We together thanked the Creator for a decisive moment. Stefan became a friend and an essential supporter of developing the app by inviting other members to join the app and proving new ideas of improvement.

McKenzie, Emery, and Stefan became the supporters and builders in the app after the release of version 1. Together, as a team, we continued developing the space and tried to think about how this space could reach more youth and support more community members.

3.1.2 The Growth of the App: Version 2.0

The first question raised about the growth of the app happened on August 3, 2016, when the *Toronto Star* published an article about the recently released app, which created significant momentum for the development process. At least 13 postsecondary institutions contacted us to ask if it was possible

³⁵ One day after, on October 1, in expanding the relationships, Professor Stephen Chen contacted Carolyn Bennett, the Federal Minister of Indigenous and Northern Affairs. She presented in a public library in Toronto, and I met her in person to talk about the app's potential uses. She was interested in the app, but the meeting did not go anywhere. However, this opportunity left a door open for future potential funding opportunities and collaborations.

to offer the app to their student communities. The problem was that they did not want to enter into any legal agreements with an individual, plus each of the institutions had their particular community protocols. How to accommodate all the different worldviews within one space? Although there were several offers to transfer the rights and data to other institutions, Elder Blu Waters and Ruth asserted that the York University Indigenous community needed to be responsible for the mobile application. In other words, transferring the rights of the app to an organization or institution would not be a way to respect the app's Spirit and the purpose of the community work. Therefore, the struggle to find an organizational home for the app continued. Elder Blu asked me to put some tobacco down to find an answer and to avoid making rushed decisions.

Although McKenzie, Stefan, Emery, and I started working together in collaboration, the mobile application's legal and admin entity was not defined. I decided to bring this concern to my supervisor, Professor Barbara Crow, as it was delaying the development and partnerships process. In this regard, on January 9, 2017, Professor Crow helped with setting meetings with different departments to discuss the possibilities of using the university's infrastructure to support the maintenance and development of the app. In these meetings, several questions were raised about the physical location and ownership of the data (i.e., the private information of users within Canada is required to reside in Canada to be PIPEDA compliant),³⁶ the possibilities of technology infrastructure within the institution, the liability of the features, and the importance of intellectual property rights. At that moment, without knowing it, the IFA Spirit found her first auntie³⁷ in her journey: Barbara.³⁸

³⁶ The Personal Information Protection and Electronic Documents Act (PIPEDA) "applies to private-sector organizations across Canada that collect, use or disclose personal information in the course of a commercial activity" (source pending).

³⁷ In most Indigenous communities across North America and South Asia, "auntie" is a term of respect for older women or non-binary folks. They do not have to be blood-related, but everyone is kin, and they refer to them in a respectful way when they are looking for guidance and support on their life journey. In this way, no one in the community is ever truly alone because they always have someone they can turn to in case of a crisis. The term "aunty" is used for people held in esteem who have earned that respect. Without planning it, the Spirit of the app needed to find their "organizational aunties."

³⁸ Previous to this meeting, Barbara had already invested in funding to pay for the development fees of the Apple

At the same time that the administrative and legal dimensions were evolving, the visual and technical aspect started to have a significant change. On March 1, 2017, ChengDa Zheng (ChengDa) and Lun Zhang (Lun), two international students, showed interest in applying for the ITEC4000 course. The initial work with both of them was to introduce them to the context of Indigeneity in Canada, as well as to share the experiences of creating the *Indigenous Friends Platform*. When I presented the app to them, they showed immediate interest in supporting the mobile application's visual interface.

ChengDa and Lun proposed to redesign the user experience within the mobile app while at the same time upgrading the Ionic framework's version from version 1 to version 3. For this purpose, I arranged a meeting between ChengDa and Lun and two CASS students: Stefan Piercey (who was already part of the collaboration team) and Brandon Bear-Jeanes, on May 10, 2017. During that session, Stefan and Brandon shared with ChengDa and Lun their expectations around the app's interface and its visual appeal. The interaction and storytelling among the app's frequent users and the developers allowed a better understanding of the user experience and what was required for further engagement. After that session, three priorities emerged: (a) the new design of the user interface; (b) the upgrade of the app to Ionic Framework 3; and (c) the migration of the data into a Canadian infrastructure. During that summer, ChengDa and Lun dedicated themselves to learning the recent Ionic Framework version 3 and developing the mobile application interface. In other words, they invested in changing the poles of the virtual Tipi. The significance of changing the poles and maintaining the Spirit of the app in good shape signifies to nurture and take care of the Spirit. This renewal's objective was to present version 2 of the mobile app during the CASS's welcoming event on September 18, 2017.³⁹ In mid-August, ChengDa and Lun finished the visual section of the upgrade, but several connections between the visuals and the database were missing in order to have the new version ready. Therefore, for three weeks prior to the mid-

Store and Google Play Store for the platform.

³⁹ Each academic year, the Centre for Aboriginal Student Services hosts an event to welcome new Indigenous students at York University. All the Indigenous members in the university are invited for a pray, a feast, and a welcome gathering.

September deadline, I started coding at least 10 to 15 hours per day. After an exhausting development process, version 2.0 was released in the early morning of September 18, 2017. CASS's welcome event offered a perfect opportunity to invite new members and continue the journey of development. Ruth, McKenzie, and Stefan were present in the room, encouraging other students to join the app. Several new students were invited and joined the app during that event. At that event, among the students, the IFA team met Robert Mack Young (Mack), a Métis professional, who at the time was an undergrad student at the Schulich School of Business interested in participating in the initiative as an active volunteer.

3.1.3 The Legal Aspect: Intellectual Property and the Not-for-profit Incorporation

While ChengDa and Lun focused on the visuals in the summer, I started a new course in the Ph.D. program, which certainly changed my perspective on data and its implications: The Politics of Intellectual Property, taught by Professor Rosemary Coombe. During this course, I learned the basics of Intellectual Property Laws and their implications in the global sphere. The course had a substantial component on the landscape and difficulties in protecting Traditional Knowledge under Intellectual Property and several examples of how several Indigenous communities around the world are trying to preserve and own their data and information. This course of intellectual property shaped my perspective on infrastructure and data. Professor Coombe introduced me to Joseph Turcotte, the Innovation Clinic Coordinator on the Intellectual Property Law & Technology Program at Osgoode Hall Law School (York University). This clinic helped the IFP team to explore the possibilities, boundaries, and scopes of intellectual property regarding the app and Traditional Knowledge.

At the same time, with the release of version 2, the administrative, technical, and legal requirements of the mobile application significantly increased. It was evident that more developers were needed to accomplish the app goals. I had the opportunity to meet several managers and senior staff at York University that guided me on several legal and administrative requirements. What are the elements that guarantee the community ownership and control of the *Indigenous Friends Platform*? How to support this process of creation in the long term? The main concern was that all the information and mobile

infrastructure at that point, in June 2017, were owned by one individual (myself), and decisions could possibly be made in the wrong direction. Through a journey between January 2016 and December 2017, a legal consultation process started to provide full control of the mobile application to the community members at York University. Several options were explored through different stakeholders inside and outside of the community:

- Transfer the mobile application and all its derived rights to a First Nation. The designated Nation would have complete ownership and control of the mobile application. This option was discarded because the community members in the city belong to diverse First Nation communities, and several members expressed their concern about their band council representatives.
- Transfer the mobile application and all its derived rights to the Assembly of First Nations. The assembly would have complete ownership and control of the mobile application. This alternative was discarded due to the political climate that commonly happened at this level and the low priority that the app would have had in the current context of several First Nations. Moreover, community members at York University did not trust that a body as the assembly would take care of the *Indigenous Friends Platform*.
- Transfer the mobile application and all its derived rights to an established not-for-profit that works with Indigenous communities.⁴⁰ The board of directors of that not-for-profit would have complete ownership and control of the mobile application. The choice of transferring the app to an established not-for-profit got discarded due to the hidden agendas of several board members already in the organizations, the possibility of non-Indigenous ownership and the distrust of urban Indigenous members to work with/for this type of institutions.
- Transfer the mobile application and all its derived rights to York University. A department within the

⁴⁰ A not-for-profit organization is a public entity “not intended to make a profit, but to make money for a social or political purpose or to provide a service that people need” (non-profit, n.d.). Although the not-for-profit organizations are part of the colonial structures, they provide all the legal structures required to navigate the colonial systems if they are correctly used. They are entities that are recognized by law, and they provide the possibility of community ownership and control.

university would have complete control of the mobile application; however, the ownership would be held by the institution. The option of University as an owner of the app was highly positively assessed because, as a public institution, any educational entity needs to be accountable for their decisions to the general public. A crucial factor, however, was the sustainability of the application in the medium and long term. York University would not have taken the app as administrative student service, but as a research asset within a department. This approach would have opened the mobile application as a research space rather than an active virtual support system. Plus, there was no formal guarantee that the tool's control would be led by community members.

- Transfer partial distributing rights to York University. Anyone can have mobile application ownership, but the area of Research and Innovation of the university would be in charge of commercializing and distributing the mobile application. The option of York University as a distributor was also a tentative alternative due to the possible quick outcomes. However, the ownership problem was not resolved (i.e., the mobile app would have continued legally belonging to me), and the commercialization would have required the marketization and possibly profitization of the space.

In May 2017, these five options were discarded. In the summer of 2017, the IP Clinic alongside Sarah Howe and Christopher Schwartz of York Innovation, helped me and the community to conclude that the best option to host and protect the Spirit of the app was incorporating a not-for-profit organization. In other words, creating a new not-for-profit organization with board members who belong to the Indigenous community of York University was raised as a primary option. The organization will hold the ownership and control of the mobile application, and the board of directors will make the decisions of such entity. With the guidance of Christopher and the Pro Bono Services from the Osgoode Innovation Clinic, the Indigenous Friends Association / Association d'Amis Autochtones (the IFA) was legally and officially incorporated on September 1, 2017. This new legal entity received all the mobile application's copyrights and derived rights. Most importantly, this new legal organization has the responsibility to take care of the Spirit of the application. The members of the first board of directors of

this organization were Elder Blu Waters, Professor Ruth Koleszar-Green, Professor Stephen Chen, Stefan Piercey, McKenzie Toulouse, and me. Emery became the first paid staff of the organization. The first meeting of the board happened on October 4, 2017, at York University.

As a collective, the new board of directors decided that it would always be required that the majority of its members were Indigenous peoples in Canada (First Nation, Métis, or Inuit). The first board of directors was confirmed by six members: four Indigenous members from what is called Canada, one Indigenous member from Mexico (myself), and one non-Indigenous member. In this respect, the IFA collaborator Michelle Gegwetch affirms that:

[T]hat's the difference between the Indigenous committee and the non-Indigenous committee. Non-Indigenous are more independent. They do decision making all by themselves, or they don't bother with the community. Whereas Indigenous, it's all about community. That's the entire methodology about going about life as well, is community, who's around you and who's supporting you. (Michelle Gegwetch, personal communication, May 4, 2020)

Beyond the legal structure, the incorporation also meant that the community could trust this digital space because it would be led and driven by community Indigenous members. This characteristic meant that decisions were going to be made for the benefit of the collective and the infrastructure is under the control of Indigenous peoples. In this regard, the IFA collaborator Michelle Gegwetch states the importance of the community factor in the development of the IFP:

So, at least in regards to IFA and the role of the community, I think it's very important to have because there's obviously going to be feedback points where they're going to be able to report things and stuff like that. But including them in the decision-making on how the app grows, I think it is going to be huge. Because that doesn't happen in a lot of spaces like Facebook, for example, people can send billions and billions in emails, and they'll never change anything. And they'll change entirely different from what the community wanted. And then everybody's upset [...] community, how decisions are made on a communal basis, not just one person. It's usually there's a whole couple layers of people that are involved in the decision process. It'll be similar to that where the community will have a voice. If they want to see something different or they want to see

a change, if they're able to voice those opinions, we can make that happen. We can change things in the app. We can test things out. There's a lot of things we can do [...] So, I think that part of it, too, is really cool that it's going to be community-driven rather than just a couple of people in an office making all the decisions. It's going to be community-driven, and everybody's going to be able to contribute. And it's going to turn into this huge, wonderful platform that everybody's going to love. (Mitchelle Gegwetch, personal communication, May 4, 2020)

In the same line, Faith Desmoulin asserts that:

[C]ommunity that you're with. Or even if you weren't there in a community, you could always bring something to the community. We're not people that'll turn people... that won't turn our own away. We won't turn our own people away, even if they haven't lived on the reserve for so many years, or even if they've never even lived on the reserve. Maybe they only stayed there for a year, and then the mother was like, "Oh, okay, now I want to leave." You don't get a chance to experience that. (Faith Desmoulin, personal communication, May 23, 2020)

The organizational infrastructure is where the *Indigenous Friends Platform* diverged from other software applications and framed the third moment of doing through thinking and thinking through doing. The complexities of incorporating the not-for-profit, i.e., finding an organizational home for the mobile application, framed the different aspects of the infrastructure of the space and marked the form of considering several community aspects over the control of the space.

3.1.4 Situating the App in Academia

The incorporation of the not-for-profit alongside the development and coding process of version 2 marked a new departure of the Spirit of the digital application because it required a new understanding of how to take care of this virtual Tipi. Furthermore, these processes also started several academic inquiries from different disciplines about the location of the app within academia. The intellectual property course offered a new perspective on the meaning of data and collective intellectual rights, but also this epistemic approach was not enough to locate the mobile application within academia.

At the time of the not-for-profit incorporation, I started the journey of my Comprehensive Exams

of the Ph.D. (COMS), which required me to write three short essays in 72 hours that explore several academic areas of knowledge around Communication & Culture in order to prove my expertise in these epistemic domains. The three areas that my supervisory committee and I decided to explore were: (a) the colonial Internet, (b) Indigenous peoples and digital technologies, and (c) Intellectual Property Rights and Traditional Knowledge. My departure was to find other examples around the world about how Indigenous peoples are embracing or neglecting digital technologies. In this intellectual process, I became aware that digital technologies are used in several ways to expedite colonial processes. Moreover, I discovered that there are few academic resources that have a transdisciplinary approach to these issue as I discuss in Chapters 4 and 5. The most important conclusion of this inquiry, however, was that there is significant research about critical responses to digital technologies from different disciplines (e.g., Indigenous studies, intellectual property, digital embodiment, digital humanities, digital pedagogies, software engineering, information and communication technologies development) that intersect in several forms with the development process of the *Indigenous Friends Platform*. These approaches are typically not linked directly to Indigeneity, but at the same time, they offered the opportunity to incorporate Indigenous knowledge(s) into the discussions of digital humanities and critical technology. This epistemic discussion frames the second part of this research (presented in Chapter 3 onwards) and provided more insights on how to manage the data within the mobile application.

3.2 Sharing knowledge and Data within the App

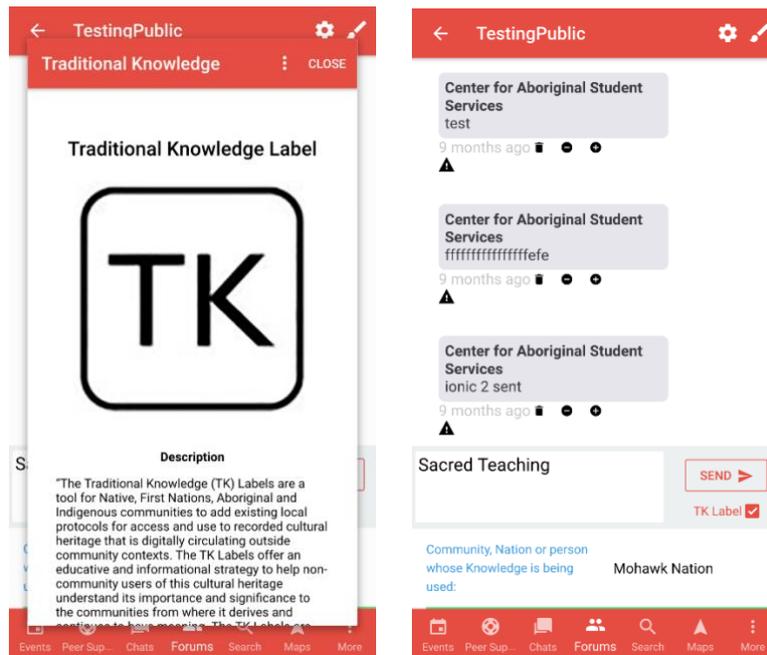
3.2.1 Technical Challenges: Local Contexts and Canadian Infrastructure

In May 2017, I started exploring in the intellectual property course the protection of Indigenous data in digital spaces. During this course, Professor Coombe introduced her class to the “Local Contexts” project by Professor Jane Anderson and Professor Kim Christen, an initiative in the context of galleries, libraries, archives, and museums (GLAM) to educate and protect digital content regarding Traditional Knowledge (TK) through several digital labels and licenses. These resources were created as educational and legal options for the awareness and protection of Traditional Knowledge.

Professor Coombe introduced me to Professor Anderson via email. I had several conversations by phone and audioconference with Professor Anderson, who recommended using specific tools within the initiative. In the case of the mobile app, Professor Anderson recommended the use of the TK Notice, which is an educational resource to indicate that community members protect the teachings or Traditional Knowledge that are being shared within the app. Although this notice is not legally binding, it offers an educational resource to protect expressions within digital spaces (see Chapter 8 for more details). On October 24th, 2017 one month after the release of version 2.0, the TK Notice was included within the app in the communal spaces (e.g., SignUp, Home Page, Events Page, Forums, Frequently Asked Questions) in order to create awareness of the stewardship of Indigenous data and Traditional Knowledge (Figure 16).

Figure 16

Screenshots of the TK Label in the IFP Version 2.1



Note. Indigenous Friends Platform 2018. Copyright 2020 by the Indigenous Friends Association.

Alongside the possible protection of data content, the critical aspect that was still pending from my conversations at the beginning of the year was the residency and location of this data. In other words, the users' personal data needed to be moved from the US Cloud Services that were used in the previous

versions to a server in Canada. Although I explored options within the university for almost six months, a vital consideration made a meaningful change in this decision. During the Intellectual Property course, I decided to abandon the idea of hosting the infrastructure within York University because the Indigenous Friends Association required full control of the infrastructure and data. Transferring the data into the university infrastructure would mean that the data and access of the data would be under the policies and guidelines of an external entity and protocols that would require a full process of legal agreements and logistics, which implied a limited access to the digital technology implemented (i.e., partial control of the data).

Regarding this aspect, in August 2017, Weixiang Lou (Weixiang), another international student at York University, showed interest in applying for the course ITEC4000. Weixiang actively engaged with the app during fall 2017 and winter 2018 to explore the possibilities on the backend and how to migrate the information from US infrastructure to Canadian infrastructure. The objective of using Canadian infrastructure was based on the need to store the personal information of users under Canadian jurisdiction. Through a long process of research and learning about databases, containers, and virtual servers, the migration of the database to the service CloudA was completed on March 2, 2018.

3.2.2 Finding a Second Auntie: YOF and YWCA Canada

In the premise of developing version 2.0 of the app, the financial challenges started. The IFA was required to pay a full stack developer as well as an engagement coordinator to continue the IFA outreach work. In preparation for the app release, the Ontario Trillium Foundation opened a call for proposals for grassroots organizations working with youth in Ontario to submit applications for a three-year project funding (Youth Ontario Fund [YOF]). With the recent infrastructure changes, it was urgent to find funding to sustain the whole initiative. I decided to submit an expression of interest on August 2, 2017. In September 2017, IFA was notified that the project was selected to submit a full application in November. The detailed application was developed during September and October 2017, with the board members and Emery participating in framing the grant and objectives. Although all sections and parts were completed,

the IFA required a fiduciary/mentor organization to be able to submit the full proposal as part of the grant requirements.

I started a quest to find an organization willing to sign as a mentor/fiduciary organization. After a long research process, Ruth put the IFA in contact with Maya Roy, the YWCA Canada CEO. YWCA Canada is “a leading voice for women, girls, Two-Spirit and gender diverse people” (YWCA Canada, 2020). Several of their campaigns target the digital spaces trying to create safer digital spaces for marginalized youth. Ruth and I met Maya in person on November 11, 2017, and Maya immediately accepted and supported the grant project’s submission. IFA Spirit found her second aunty at that meeting. Since then, Maya has become a strong ally in delivering the projects and the organization’s growth.

The main objective within the grant proposal was to engage Indigenous youth in creating and enhancing decolonizing digital tools within the information society through the ownership, control, access, possession, and promotion of an Indigenous mobile application that integrates Indigeneity and Traditional Knowledge. The full version of the grant was successfully submitted on November 15, 2017, we had a phone interview on December 5, 2017, and it was finally approved on March 6, 2018. After IFA received the good news of receiving the YOF grant, the app’s deadlines and goals accelerated several of the internal processes within the organization. First, Robert Mack Young joined the board of directors of the IFA on February 27, 2018 to help with the finances (see section 2.4.4). Since then, Mack has been and continues to be the treasurer of the IFA, keeping our finances and supporting the IFA development in several capacities.

The board of directors of the Indigenous Friends Association decided that Emery and Stefan would be hired to support the app (the first one as a developer, the second one as an engagement coordinator) on May 1, 2018. Emery, Stefan, and I had several meetings in May and June 2018 to plan the next app development steps. The priority was to increase awareness of the app by inviting other members from the university to join the space and search for other post-secondary educational institutions to partner with IFA. Stefan started to reach out to different student leaders within the institution, and Emery continued to organize and prioritize the software requirements in the app.

In May, June and July 2018, Stefan, McKenzie, and I reached out to other post-secondary institutions in Ontario to join the *Indigenous Friends Platform*. In at least four cases, however, the institutions' protocols and procedures impeded the creation of partnerships. In our experience, the Indigenous student services within post-secondary institutions did not have the fiscal or personal resources to invest in this type of technical platform. Furthermore, due to academic institutions' hierarchical nature, we found that several Indigenous spaces were limited in their decision-making autonomy within their institutional administration. Over and over again, the Indigenous student services at the institutions rejected the offer of the IFA. Although McKenzie, Stefan, and I presented by phone and in-person several times to the institutions, the continual rejection represented stress and disappointment to the entire team for the effort, time and resources invested in trying to create these partnerships. As Stefan mentioned to me, the understandings of institutions are very distinct:

[C]reating an app in traditional ways and traditional ways of knowing, traditional ways of walking through this time, and trying to focus on having a spirit of the app move forward in such a digital world, in an institutionalized world that is always pushing back. I think that is one of the hardest things to move forward with. Especially, honestly, allyship. Finding that allyship, like true allyship, that's very, very difficult. As a community engagement coordinator, I found it very difficult because each centre for student services has their own framework, their own idea of moving forward. (Stefan Piercey, personal communication, May 19, 2020)

During this time, Stefan, McKenzie, and I met for the first time Michelle Gegwetch (Mitch) and his collective called ReadyUp Canada⁴¹ on May 28, 2018. Mitch is also from Sagamok First Nation, the same community as McKenzie. Although we could not come to an agreement due to a lack of resources and funding, the relationship between Mitch and the IFA was only starting at that point.

3.2.3 The Service Corps' Application

Through one of my classes in the master's degree in 2015, I met Margarita Sanchez (Margarita)

⁴¹ At that time, Mitch was in the process of incorporating his organization, which later was going to be named "Mikinaak."

who was a master's student in the Development Studies' program. In March 2018, Margarita expressed to me that she was interested in gaining more experience in the not-for-profit sector through collaborating and supporting organizations. I decided to invite Margarita to continue collaborating with the IFA community as a volunteer ally. At the time, Margarita started an online certificate in not-for-profit management, and the skills taught by that program had the potential to become an asset for the recently created Indigenous Friends Association.

At the same time that Margarita joined the IFA, the Canadian Ministry of Employment, Workforce Development and Labour, opened a call for proposals for the Canada Service Corps' program. This program aimed to encourage youth to get involved in service to their communities and gain skills and experience through volunteering opportunities. This program was launched by the Liberal government under Justin Trudeau in January 2018. Stephen Chen learned of this opportunity and shared it with the members of the board of directors. The board of directors agreed to proceed with the grant application. As one of her first tasks to support the organization, I asked Margarita to help me write this application.

Because we were a newly incorporated entity, the IFA initially looked to apply for this grant via other fiduciary organizations, such as York University or YWCA Canada. Neither of these options were possible because York University had already developed their own proposal, and Maya Roy was outside of the country. On March 3, 2018, Stephen Chen, Margarita Sanchez, and I met downtown to start brainstorming about how a volunteerism project could relate to mobile app development. Over and over again, the idea of education came back to the table, and most importantly, the notion of training youth in digital skills by giving back the lessons learned in the years of mobile development. Moreover, incorporating my experience and skills developed as a teaching assistant had an essential role in the conception and framing of this proposed project. Margarita brought back the idea of the digital tools' classes in the context of Development Studies and how much it was required to create new safe(r) spaces. The basic idea was to use the YWCA Canada's network to reach out to Indigenous and non-Indigenous youth to train them on digital skills by creating collaborative community digital projects in different

locations across Canada. The IFA officially applied to Canada Service Corps on March 14, 2018, and without knowing it, this grant application was the seed for the next phase of IFA as a mobile application and as an institution.

3.2.4 The International Arena: RightsCon Summit Series

One of the first actions after starting the YOF grant is that the IFA got involved in several academic and activist events in anti-colonial movements.⁴² On May 14, 2018, IFA got an invitation to participate in the RightsCon Toronto 2018 via our YOF capacity building specialist, and now friend, Justin Wiebe. This event significantly changed the scope of IFA's outreach in the not-for-profit sector and the initiative's exposure. The RightsCon Summit Series is an annual international event on human rights in the digital age. In this conference, activists, academics, not-for-profit organizations, companies, policymakers, politicians, and community representatives, among other stakeholders, come together to discuss and reflect on human rights within digital spaces.

Justin was participating in the event's organization and they were looking for Indigenous panellists to talk about Indigenous peoples and digital spaces in the context of Tkaronto. Although this invitation was two days before the event, I decided to present IFA, and it launched her presence in the international arena. Moreover, this presentation forced us to continue thinking about the journey of development, positioning the app with respect to other international movements and the continual discovery of technical and decolonial considerations within the digital space. Also, these interactions helped to shape several considerations about the protection of Traditional Knowledge within digital spaces.

I found several individuals and organizations reflecting and finding solutions to digital technologies' challenges at that event. In one of the panels, where YWCA Canada was presenting, I was

⁴² It was the beginning of May, after three weeks of defending my Ph.D. Comprehensive Exams where I had reflected on the role of digital technologies as colonial tools in the global context and the role of Indigenous peoples. This event allowed me to experience and rationalize several thoughts and learnings that I concluded one month earlier.

introduced to the community of IntersectTO by Nasma Ahmed. IntersectTO is a “Toronto-based community group for people who identify as Black, Indigenous, and people of colour (BIPOC), who are interested in technology” (IntersectTO, 2018). This introduction ended in a local presentation in Tkaronto for IntersectTO on November 12, 2018, in a public event where future collaborators saw the potential of a tech community: Race, Power, and Colonialism in Tech: A night of BIPOC Community Talks. Lluvia Machuca-Ruelas who is introduced in the next section knew about IFA through this event.⁴³

As a second impact for the IFA, I was included as part of the leading organizations on the RightsCon Committees around Indigeneity and digital spaces within the subsequent summit series.⁴⁴ In June 2019, IFA participated in RightsCon Tunis 2019, where IFA organized several discussions and tables around Indigenous data sovereignty and its implications across regional and local contexts. In 2020, IFA led a discussion about education and digital skills in the context of Indigenous communities in RightsCon Online.⁴⁵

Finally, at this conference, I met Professor Stéphane Couture. At the time, Professor Couture was a professor in the program in Communications at Glendon Campus of York University, interested in the social and political dimensions of digital media and the Internet. After my presentation at the conference in RightsCon Toronto, he and I developed a mentor/mentee relationship due to the commonalities in our respective academic work. During fall 2018, I participated in a seminar series organized by Professor

⁴³ Based on this presentation, IFA was invited to an event on Facebook Canada via YWCA Canada on November 22, 2018 to discuss the safety of this space.

⁴⁴ An interesting interconnection related to this experience unfolded in September 2018. At the beginning of that month, my ITEC teaching assistantship position as a JAVA instructor was finalized due to a new administrative requirement in the ITEC department at York University. In search of a position, Ruth shared a job posting from the department of Equity Studies. Professor Bonita Lawrence was looking for a teaching assistant for her course: “HREQ 1960: Indigenous Resistance in the Global Contexts.” An essential component of this course understood the history and struggles of Indigenous peoples worldwide, finding commonalities and differences in their resistance movements at the regional and national levels. Moreover, this course was taught to an international audience, which is composed of more than a hundred people from around the world. The understandings and considerations of this course were fundamental in organizing events within the RightsCon Series, and the intersections with digital technologies were vital for the framing of this academic work.

⁴⁵ Alina Rizvi and Mitch Gegwetch are presenting at this conference.

Couture around digital media research. Stéphane became part of my Ph.D. Supervisory committee at the beginning of April 2019.

3.2.5 Difficult Times

While IFA was waiting for the response of the Service Corps grant and the different post-secondary educational institutions, as well as participating in several events, a difficult time started during summer 2018.

In July 2018, Margarita decided to leave IFA to pursue her career endeavours in Latin America. The next month, Stefan Piercey also decided to leave IFA due to personal and health issues. Throughout the summer and fall of 2018, Elder Blu could not be present within the community because she participated in the national inquiry on the Missing and Murdered Indigenous Women and Girls as the Grandmother of one of the commissioners. In other words, the caretakers of the app were rotating, and those movements triggered several conversations and tensions within the community. Due to these factors, I asked Emery to focus on the technical aspect (i.e., the debugging and improvement of the visual interface) while I only focused on organizing the other areas of the organization.

Due to Margarita and Stefan's departures from the board of directors, a new call for board members was open during fall 2018. Shane Young, a social work scholar from Ryerson University, applied for the position and joined the board of directors on January 16, 2019. The idea was that from his expertise and experience, he could bring fresh ideas of how to keep the space safer and comfortable for Indigenous students. Moreover, McKenzie took over Stefan's position in August 2018, leading the conversation with several post-secondary institutions and users. From this position, McKenzie helped me hold several conversations with students and users of the app to receive feedback during the fall of 2018: Indigenous students at York University were looking to have more resources within the app and find the app more entertaining. Also, McKenzie and I continued working with Christopher Schwartze from York Innovation, trying to find forms to sustain the mobile application in the long term, mainly because the resources available via YOF were not enough and the Service Corps was still in pending deliberation.

Alongside guiding those conversations, during the summer and fall of 2018, I upgraded the website and centred my attention on recruiting new caretakers of the app via ITEC4000. In August 2018, Alina Rizvi (Alina) and Eva Yang (Eva), alongside other two students, showed interest in this course. As a means of onboarding new students, I used the resources created by ChengDa, and McKenzie supported the students' learning with an introductory workshop on Indigeneity and decolonization. I trained the students on ITEC4000 on the different technical frameworks required to develop and maintain the app in the same month. All the students created different new features for the app, but only Eva and Alina's creations ended up being implemented. Eva focused on redesigning the app's tutorial section, trying to replicate the logo of the Indigenous Friends App (the final layout changed to simple buttons due to visual compatibility issues). In the case of Alina, she focused on the creation of the institutional layouts (version 2.3). These tabs allowed us to separate the resources from different institutions and organizations in several sections and respect institutional protocols. This feature allowed us to arrange the information better and enable the inclusion of other entities within the app.

In other technical aspects, after finishing debugging in fall 2018, Emery started the long journey of creating new features to make the app more engaging and entertaining based on students' feedback. On February 28, 2019, he finished the Trivia Feature, allowing us to create surveys and trivia within the app. On May 2, 2019, he finalized the Bingo Feature, which allowed the mobile app to host games within the app.

In the administrative dimension, from September 2018 to November 2018, I started a long communication process regarding the Canada Service Corps grant application that IFA submitted in March 2018. Employment and Social Development of Canada wanted several changes to the original project that was submitted. The objectives, outcomes, and budget were significantly changed during these three months, and as a team, we hoped that the IFA would meet all the expectations to get the grant. During all this time, several quotes and community consultations were required to check if the project was still valid, and most importantly if IFA was going to be able to deliver the outcomes. Maya supported this process, consulting with YWCA Member Associations to inquire about the viability of the project.

By December 2018, the IFA had not received a decision about this grant.

3.3 Educating Others: INDIGital Program

3.3.1 From Service Corps to INDIGital

On the morning of January 10, 2019, I received a call from Employment and Social Development Canada to congratulate me on IFA's successful application. This news excited and worried me at the same time. Canada Service Corps provided five times more resources for IFA than the Youth Ontario Fund, but it also presupposed five times more work and responsibilities. After a negotiation process of six months, the project ended up consisting of providing 100 First Nations, Inuit, Métis, and non-Indigenous youth with the skills and training needed to close educational and employment gaps in the area of digital technologies while engaging in community projects in at least three different locations across the country: Regina (SK), Prince Albert (SK), and Toronto (ON). These locations were based on three locations where YWCA member associations showed interest in partnering with IFA and YWCA Canada to deliver the program.

The main problem was that, at the same time this process was required, my dissertation writing timelines were approaching. This project also included the challenge of developing and deploying an entire curriculum to teach digital technologies to Indigenous youth. All this news was exciting for the IFA community and surroundings because it was a way to give back to the communities the lessons learned in the journey and have the opportunity to start hiring the participants of the program as developers for the mobile application. I did not exactly know how to start this project while also coordinating a mobile application deployment. I did not know whether or not to reject this grant opportunity. I sought advice from IFA's aunts—Professor Barbara Crow and Maya Roy—as well as the board of directors, to find a possible path for a solution. All of us agreed that it was a fantastic opportunity for the organization and to potentialize her Spirit's impact, but IFA needed to hire a manager to coordinate this effort while I could focus on the other tasks. In the next couple of weeks, I hired Keith González-Sujo, to support me with all the administration tasks of the organization.

In February 2019, the IFA embarked on the task of finding a project manager that could hold such responsibility. Maya directly got involved in the hiring process, providing support in the specifications of the job description, hiring advice as well as facilitating the office space at YWCA Canada. After a month, IFA, in a collective decision with YWCA Canada, resolved to hire Lluvia Machuca-Ruelas (Lluvia Nizaye), who is an Indigenous Zapotec woman from Oaxaca, Mexico. Lluvia had worked in several collectives to design and facilitate workshops around food justice that centred on Indigenous knowledge and food systems. Furthermore, Lluvia was part of a computer programming and analysis at Seneca College.

By March 2019, the IFA bought 63 computers and 60 mobile phones that needed to get set up and ready. By the end of April, the IFA had a digital design jam where 15 young developers and artists gathered to share experiences and start designing the curriculum. In May, after attending a YOF end summit event in Rama First Nation (Geneva Park), McKenzie proposed that one of the possible alternative locations for the Canada Service Corps' project could be her community, Sagamok First Nation, in August 2019.

Shortly after that proposal in May, Lluvia and McKenzie travelled to Regina and Prince Albert in Saskatchewan to create the required partnerships in the province. Moreover, during that month, McKenzie coordinated several meetings with leader representatives from Sagamok First Nation to organize the programming's logistics. To our great surprise, Sagamok administrative leaders let us know that Mitch Gegwetch and his organization Mikinaak (formerly ReadyUp Canada) were going to be delivering programming to the youth in the same period. Therefore, IFA and Mikinaak coordinated efforts to deliver programming in the community.

During June and July, Lluvia led a long process of logistics and curriculum development in order to prepare an iteration of the Service Corps' educational program in Sagamok. The curriculum consisted of the following modules:

1. Module 1: Land teachings & History of your community
2. Module 2: Turtle Island + Indigenizing tech/Indigenous futures + Afrofuturism

3. Module 3: Programming logic + Coding

4. Module 4: Design + Project Planning

5. Module 5: Community Projects

Along these modules created by Lluvia and the digital design team, the INDIGital program model included the following principles: sharing circles, seven Grandparents Teachings, traditional medicine, accessible & visual language, storytelling, BIPOC trainers and laughter as medicine. On August 6, 2019, IFA started the program with 29 students from Sagamok First Nation, and 26 students graduated from the program three weeks after. In this iteration of the program, several new members joined IFA as youth-tech trainers. Alina and McKenzie participated in the deployment of different workshops. After a storytelling anecdote from Mitch, while flying a drone, the participants in Sagamok decided to start calling the program: the INDIGital program (the fusion between the word “Indigenous” and “digital”). Hence, since that day, IFA decided to change the project's name and objective to the INDIGital program. This program consists of a pedagogical and educational training to develop digital skills through the worldviews of Indigenous peoples. The idea behind this project was to share with community members the experience and learning of the IFP, as well as to train Indigenous youth to be active creators of the app and web applications. The first deployment of the project was a success and presented the results to the members of Sagamok at the Community Hall. Several members repeatedly mentioned how important it was for them to link traditional teachings with digital technologies because it meant that they could pursue a digital career without being disconnected from culture. Also, several of them repeatedly mentioned that providing a space with food, transportation, and childcare allowed them to focus on their learning process.

After the INDIGital program's deployment in Sagamok First Nation, Lluvia flew to Prince Albert in rural Saskatchewan at the end of September 2019. In that iteration, 29 students started the course on September 21, and 27 of them successfully finished it three weeks after. In this iteration, at least three youth members mentioned several times that the investment in time in a project supported their healing process over addictions and substance abuse. During the graduation ceremony, Elders from different

reserves around Prince Albert came together to celebrate participants' achievements; they thanked the IFA for bringing the community together and knowledge about digital technology to the youth while uplifting their spirits by taking them closer to their culture.

After this event, in November 2019, Lluvia and several team members flew to Regina to deliver a third iteration of the program. This iteration started on November 2 with 28 students and ended on November 19, with 22 graduates. During the iteration of the course, participants found a safe(r) space, an attractive curriculum and approachable facilitators that support an educational environment to learn more about technical skills and engage with their culture. Indigenous INDIGital participants could focus on the creativity of their projects and they did not to worry about childcare or food. At this particular site, eight participants applied to return to high school or start post-secondary school by the end of the program.

Finally, the last iteration of this cycle of the INDIGital program happened in Toronto from February 10, 2020, to March 6, 2020. This iteration started with 20 students and ended with 12 graduates. Regularly, Lluvia and the team members received comments from participants regarding their high productivity during their time in the INDIGital program rather than a whole year in their high schools. The work, dedication and care that IFA put into participants enabled them to focus on their work objectives. Participants commonly begin as seemingly disengaged youth in the first couple of days and quickly turn into curious and productive content creators, digital artists, and developers. Furthermore, the project management and organization skills that they learn during the course come in handy when tackling any project in their near future.

The INDIGital program's deployment in Regina and Prince Albert in Saskatchewan signified to bring back the knowledge acquired in the Cree Tipi ceremony of software creation of the IFP to the traditional lands of Cree and Sioux peoples. The cycle of giving back was been fulfilled.

3.3.2 The App as a Tech-community

While the INDIGital program was deployed in several locations, many changes were developed and implemented within the mobile application. First, different language labels within the app were

added, starting with French (September 26, 2019). Significant fixes for the Apple version of the app were developed due to an essential update on its operating system. Later, a bursary feature was added, and the resources tab was reworked (November 10, 2019). The Trivia feature was modified to create a Survey capability and other spaces were modified to be capable of being hosted by a particular post-secondary institution (January 7, 2020). Finally, a new framework migration from Ionic 3 to Ionic 4 happened from January to March 20, 2020.

Although these changes allowed the maintenance of the virtual Tipi and the INDIGital program's feedback was incredibly positive from participants, there was an issue regarding the IFA Spirit as a whole. Throughout the first year of the INDIGital program, i.e., the Canada Service Corps grant, the Indigenous Friends App's development was disconnected from the INDIGital program and participants. Although the app development topics were conveyed in different sections of the program curriculum, the INDIGital participants were not joining the mobile platform based on the principle that the mobile application was only for post-secondary Indigenous students. A significant process of refining the goals and vision of the IFP was required.

Therefore, at the same time that the programming of INDIGital was happening, IFA began a process of strategic planning within the organization. On September 7, 2019, the board of directors, alongside IFA staff members, created the strategic planning for the next years based on the experience brought by the previous years of deployment and the first iteration of the INDIGital program. This process was guided by Andrea L. K. Johnston, an Indigenous consultant, member of the Athabasca Chipewyan First Nation. Throughout that strategic planning, it was decided that the mobile app and the INDIGital program were our main two priorities. Moreover, the need for the safety and joy created within the INDIGital program needed to be transmitted within the mobile app. With this prioritization, the idea was to narrow down the IFA's scope and start creating a common ground to measure the entire initiative's impact. During this session, the idea of reclamation and engagement within digital technologies was incorporated within the Indigenous Friends Association's mission and vision statements as a form to reflect the values and considerations of both projects:

IFA Vision: Igniting the Spirit of Indigenous communities to engage and reclaim digital technology.

IFA Mission: Inspire and support the imagination of Indigenous communities to create and maintain their digital technology to further their autonomy

This strategic planning continued in several tactic meetings on October 26, 2019, November 2, 2019, January 11, 2020, and throughout several days of the fourth iteration of INDIGital in Tkaronto.⁴⁶ In those meetings, the board of directors, Elder Blu, staff members, Mitch Gegwetch, and INDIGital participants provided feedback about the journey of IFA and what it means to create and engage with digital technologies in the context of Indigenous peoples in Canada. One crucial aspect that was evaluated on those meetings was that although the mobile app users continued to increase slowly, the engagement after the sign-up process was significantly low. However, with the support of the INDIGital program's youth and their excellent feedback, the IFA team could start envisioning a new form of redefining these spaces. Throughout these multiple and diverse conversations, IFA concluded that although the INDIGital program and the app are two different steps, they belong to the same journey: the INDIGital program creates an offline, safer space to develop digital skills, and the *Indigenous Friends Platform* is a digital space to continue that journey even when people are not in the same space. Simultaneously, the mobile app allows people to start conversations with each other and provides the users with the possibility to become active members of the community and participate in future INDIGital programming. The fundamental idea is that the *Indigenous Friends Platform* is the virtual space where the INDIGital participants can continue learning about digital tools. In other words, the *Indigenous Friends Platform* became a "tech community" where members interact with each other in the usage and creation of the space. This tech community has interacted in different digital space channels, such as the app, email, social media private groups, phone, video meetings, the institutional website, and Slack communication platform.

⁴⁶ Having a physical space for four weeks for the INDIGital program allowed IFA to have organic meetings throughout this period.

Other institutions and organizations have recognized the *Indigenous Friends Platform* as a tech community. In this sense, IFA received a request from the Niagara Peninsula Aboriginal Area Management Board (NPAAMB) in March 2020 to create their mobile application to share services and information among their members. The IFA is releasing this app in December 2020. Furthermore, Employment and Social Development Canada approved another year of funding for the INDIGITAL program during 2020 and 2021.⁴⁷

3.3.3 Design as Storytelling

As part of this new perspective, IFA decided to start a complete redesign of the *Indigenous Friends Platform* to be released in September 2020. Version 3 will employ a new form of interaction and perspective of the lessons learned throughout five years of development. First and most importantly, this new version will be open for Indigenous youth (16 years and older) rather than only Indigenous post-secondary students. After the experiences of reaching out to several post-secondary institutions and the frequent contrasting reactions from them, the app will be open to self-identified Indigenous youth that accept to follow the protocols and guidelines of the space. In any case, the app will be organized by different “digital communities.” Every member by default will belong to the “Indigenous Friends Community” with the possibility of belonging to other communities based on their institutional affiliation, location, or community, for example, “York University Community,” “Sagamok First Nation,” “Regina,” “Toronto.” With this new capability, the plurality within the Indigenous communities in Canada will be acknowledged and enabled to showcase different points of views on similar issues and topics in the same space.

In this new digital development phase, space and user experience design are critical parts of the storytelling. This version’s idea is that the experiences of the users within the app can be conveyed throughout the design of the app. In this new version, the IFA members will have more opportunities to interact with each other through audio sharing circles and news feeds based on the “digital communities”

⁴⁷ This version is going to be delivered online due to the COVID19 pandemic.

they belong to within the app.

This new reframing of the experience includes incorporating the story of the app within the design. For that purpose, several Indigenous young artists joined the team to create the graphics that reflect this journey of several years, such as Tsista Kennedy. Tsista Kennedy is a young self-taught Anishinaabe Onyota'aka artist from Beausoleil First Nation and Oneida Nation of the Thames. Furthermore, a critical part of this process is the systematic removal of the data providers that do not reflect the values of the IFA and IFP. The most significant provider that has been removed is Firebase, owned by Google Inc (June 11, 2020). The idea of this new version is that Indigenous youth find new places where they can share their life experiences and find important information about their surroundings.

While this story was being written the design of the new logo of the Indigenous Friends Association was being created by Tsista Kennedy (Figure 17). This new logo represents the values and history of the *Indigenous Friends Platform* and how the Cree Tipi Ceremony framed the work within the organization.

Figure 17

Logo of the Indigenous Friends Association by Tsista Kennedy



Note. Indigenous Friends Platform 2020. Copyright 2020 by the Indigenous Friends Association.

This new version 3 will reflect the lessons learned about infrastructure, software, space, and data.

The gradual progression of the mobile application allowed the incorporation of several decolonial aspects within digital technologies. The reflection process triggered by the participants of INDIGital aimed to trace several fundamental elements of the rethinking of the conceptualization of the digital as a safe space for Indigenous youth.

3.4 Conclusion: The Tech-Community

The story of this digital creation continues until 2021. Although I decided to stop writing about the story in early 2020 for this research, it is essential to clarify that the mobile application continues to grow and adapt itself to the current circumstances of communities and digital environments. The story's initial description offers a general understanding and picture of how this space was created and the community members involved. In this section, the story shifted to the instrumental and practical components of how the different stakeholders helped frame the infrastructure and the information stored and shared.

The not-for-profit, the data policies, and the creation of the educational program marked a significant departure for the Indigenous Friends Association because this digital solution is not only a form of digital technology, but it became a tech-community that supports each of its members and embraces Indigeneity in the digital space. In other words, the *Indigenous Friends Platform* departed from the digital world and embodied itself back into the non-digital world through a community of people.

The *Indigenous Friends Platform's* storytelling offered a starting point to explore the components of the technological solution and analyze the different implications of this digital space. However, as I explained within the story, the relationship between the story and academia required to be unfolded further in order to place this research in academia and aspire to formulate methodological principles of decoloniality within digital technologies. This research's transdisciplinary character and its decolonial character imply that different epistemic lenses and authors are required. In the next two chapters, the discussion is centred on situating the story and research in academia. In Chapter 4, I present a general framework to understand the conceptualizations and exploration of coloniality within digital technologies.

In Chapter 5, several decolonial practices are distinguished as reactive forms to coloniality within the digital in order to recognize Indigenous responses.

Part 3: Situating the Story and Research in Academia

In Part 3, I situate the story and research in academia through a literature review of digital technologies and decolonization. First, I present a general framework to understand the conceptualizations and exploration of coloniality within digital technologies. Then, several practices are distinguished as reactive forms to coloniality within the digital, but it is demonstrated that there is an absence of decolonial ways of doing for deploying digital technologies at the local level.

Chapter 4

Mobile Technologies and Digital Coloniality

During the methodological analysis and implementation of the *Indigenous Friends Platform* (IFP), exploring the significant range of disciplines initiated a critical consideration and assessment of the colonial implications of digital technologies, mobile devices, and the encrusted power relations of such technologies. Moreover, several decolonial authors have claimed that to comprehend decoloniality or Indigenous alternatives in this case, colonialism must first be defined and analyzed (Crawford, 2002, p. 135; Gray et al., 2008, p. 284; Tuck & Yang, 2012). Therefore, in order to understand new forms of alternative decolonial options, such as the IFP, it is necessary to locate such an alternative in respect to contemporary colonial structures of power as well as analyze its transdisciplinary character. Thereby, the objective of this chapter is to situate this research project in academia through a literature review of the colonial and hegemonic⁴⁸ forms of power that are currently exercised in the digital world, and their level of penetration, in order to analyze the characteristics of different responses and locate the characteristics of Indigenous digital options.

The aspiration to understand and design methodological principles obliged me to do a fundamental reflection on the colonial aspects of these tools in individuals, communities, and societies and explore the degree of penetration of current technologies. Interestingly, the vast majority of authors in media studies, digital humanities, and decolonial studies agree that digital technologies have accelerated several colonial processes and transformed the strategies of oppression over specific populations (Feenberg, 2012; Heeks, 2018; Morozov, 2011; Mosco, 2017; Rodriguez-Prieto & Martinez-Cabezudo, 2016). Avoiding recognizing these aspects would imply that I consider digital technologies as politically neutral and acultural, which would provide these tools with an emancipatory power to override any

⁴⁸ In digital terms, hegemony is “greater power to shape cyberculture in the hands of certain cultural groups and the default subject position” (Reed, 2019, p. 297). This default position is “typically white, male, heterosexual and middle class, who mostly inadvertently programmed their particular, inevitably limited, world view into digital culture” (Reed, 2019, p. 294).

cultural and identity aspects and impose Western forms of domination.

Before unfolding this discussion about colonial dynamics in the digital space, it is crucial to understand the scope of several concepts within digital technologies, such as *social media*, *the Internet*, *mobile*, *ICTs*, and others that require delineation to find a common epistemic base. The colloquial usages of these terms are confusing or interchangeable, and they might take the analysis to a simplistic linguistic debate, undermining their implied power dynamics in particular spaces and for different identities. Moreover, the interdisciplinary nature of the research presents a theoretical challenge to delimit the scope of these conceptions across disciplines, such as Media Studies, Digital Humanities, Educational Studies, Science and Technology Studies, Computer Science, and Information and Communication Technology (ICT). Appendix A: Glossary presents full definitions of these concepts.

To expand the analysis between coloniality and digital technologies, I divide this chapter into four main sections. In the first section, I analyze the distinct forms of exercising power in current digital technologies, presented based on their repercussions over local and regional environments: sociopolitical, economic, and environmental dimensions, as well as a historical overview of the most prominent designing trends of digital technologies. In the second section, I provide an overall perspective on how specifically mobile technologies can potentially become a colonial tool. Next, I provide the framework of digital coloniality. Finally, I conclude how digital technologies are not only colonially used but they are also colonially designed.

4.1 The Framework of Digital Coloniality: The Implications of Digital Technologies

Since the expansion of mobile technologies in the global market, the encounters between marginalized groups and the digital world have dramatically changed. The statistics show that communities in all corners of the world, regardless of their geographical position, are participants of the mobile revolution, and they are using this technology to get connected to the electronic highway. The number of internet users has consistently increased in the last 15 years. From 1.024 billion users in 2005,

the number has almost quadruplicated by 2018, with 3.896 billion users (ITU, 2018c).⁴⁹

All indicators of digital access and usage (e.g., Internet, mobile infrastructure, the number of users) continue to increase except for fixed telephony that has been replaced by mobile technologies (ITU, 2018a, p. 2). These days, there are more mobile subscriptions than people on the planet (ITU, 2018a, p. 5). At the end of 2017, there were 102.953 mobile subscriptions⁵⁰ for 100 inhabitants globally, which means that the global penetration rate of mobile cellular subscriptions stands above 100% (WB, 2019). In Canada, as of January 2019, it is estimated that there are 34.56 million (93% of penetration) mobile users (with & without internet access). At the same time, it is estimated that there are 33.84 million Internet users (91 of penetration), of which 27.64 million are active mobile internet users.⁵¹

As it was previously stated, the level of penetration of digital technologies continues expanding at high rates, and therefore, these technologies have created several forms of exercising power over others. Understanding the power structures is the initial and fundamental step for aspiring to decolonial action. The social and political aspirations of digital technologies have shaped the discourse and historical paths of humanity in the last 30 years. In the late 2000s, several disruptive new concepts and forms of the digital, such as social media, big data, online outsourcing (OO), and cloud computing, were formally developed and deployed during Web 2.0 (Bauerlein, 2011, pp. 215–220). These new forms of doing computing changed the scope and purpose of several technologies across sectors due to the strong influence that personalized devices and applications have on the general population. These digital tools impacted societies worldwide through novel systems for doing politics and businesses that created new forms of exclusion and discrimination and new forms of understanding privacy and how to take care about the environment.

Furthermore, digital technologies have been rich in technicalities and symbolism, as well as

⁴⁹ Refer to Appendix B for further details.

⁵⁰ Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service that provides access to the Public Switched Telephone Network (PSTN) using cellular technology (WB, 2019).

⁵¹ Refer to Appendix C for further details.

social and political aspirations since their conception. In the last three decades, digital technologies have played a vital role in the world's ideological conception by generating contemporary economic, social, and political structures of power. The complexity between Indigenous peoples and digital technologies cannot be understood without grasping the power dynamics and violence that these tools have caused over different sectors in several societies and the environment. Although digital technologies and the Internet have supported some aspects of equity and access to information, the Internet of things (IoT), artificial intelligence, cloud computing, online outsourcing (OO), big data, and social media have significantly contributed to the diverse colonial implications of several digital solutions and platforms (refer to Appendix A: Glossary for the definition of these terms in the context of this research). The recognition and examination of these oppressive characters of digital technologies would allow an analysis to frame the conceptualization of digital coloniality⁵² in order to identify alternative solutions to it. In the next sections, three overall categories of the implications of digital technologies are proposed in order to locate and distinguish the consequences of digital coloniality. Subsequently, an overview of fundamental historical inventions in the digital world is examined to provide the cultural context of digital design.

4.1.1 The Sociopolitical Dimension

“We are all users, consumers and audiences before we are citizens” (Mosco, 2017, p. 130).

One of the most controversial areas in the study of digital technologies is around the politics to gain authority or power. When the usage of social media and sharing of knowledge started to increase among several regions and sectors, the question of political engagement was raised because these tools were seen

⁵² It is essential to highlight the political differentiation between coloniality and colonialism/colonization. Colonialism/colonization implies the acquirement of full or partial political control over another country or national states occupying it with settlers (Grosfoguel, 2008, p. 8; Quijano, 2000). However, coloniality is not reducible to the presence of a colonial administration or the political/economic structures, but also includes cultural and social imposition over the oppressed. Coloniality involves the linking and imposition of a knowledge system over another (Grosfoguel, 2008, p. 8-10). Ramon Grosfoguel (2008) claims that humanity has crossed from global colonialism to global coloniality. The differentiation was required because the imposition of a postcolonial world's myth through national liberation and socialist strategies was fostered in the last century (Grosfoguel, 2018, p.8).

as the democratic instruments to interconnect with the members in the society at different levels. The role of social media in the Arab Spring in 2011 and the United States electoral campaigns in 2016, however, gave rise to an extensive debate about the political role of digital technologies as a democratizing force (Ali, 2011, p. 187; Elder et al., 2014, p. 47; Feenberg, 2012, p. 3; Heeks, 2018, p. 275; Morozov, 2011, pp. 1–4; Mosco, 2017, p. 190; Rodriguez-Prieto & Martinez-Cabezudo, 2016, p. 223).

Digital technologies and the Internet have provided the opportunity to potentially have a two-way conversation with the people in power through social media in contrast to the well-spread media of radio and television (Bauerlein, 2011, pp. 28–31; Feenberg, 2012, p. 6). This interaction seemingly provides a voice to the silent and excluded marginalized groups in societies, such as women and youth (Elder et al., 2014, pp. 41–45). Castells and Himanen (2016) state that “the social networks promote the knowledge and the free exchange of ideas and allow the transformation of demands in real changes in the heart of the social networks themselves” (p. 276–277). Furthermore, Castells considers these advantages and develops a moral responsibility to show compassion to the underprivileged, sustaining that digital technologies and the Internet can make real the ideals of Enlightenment and reconcile humanity with Spirituality (as cited in Rodriguez-Prieto & Martinez-Cabezudo, 2016, p. 224). In other words, according to these authors, digital technologies empower individuals in developing nations (Ali, 2011, pp.188, 219) and hence, the Internet and digital technologies have helped the democratization of countries (Ali, 2011, p. 211; Heeks, 2018, pp. 273–278). However, the Internet and digital technologies have become a contested democratic paradox. The political aspiration in social media is contested, as large numbers of discourses on the Internet are not allowing the marginalized voices to be heard (Bauerlein, 2011, p. x; Morozov, 2011, pp. 16–17). Only people with a certain number of followers or subscribers on social media (or those who can pay for them) are considered part of the political debate. Alongside this phenomenon, cyberbullying and online hate-speech promote new forms of violence against those voices (Bauerlein, 2011, p. xiii; Morozov, 2011, p. 72). In other words, oppressive and exclusionary practices are replicated and amplified in several digital spaces, and social divisions are maintained. In this regard, for the journalist Riccardo Luna, the Internet is a “weapon of mass construction, which we can deploy to destroy hate and conflict

and to propagate peace and democracy” (as cited in Morozov, 2011, p. 20).

Similarly, digital technologies have increased the world’s securitization through the use of Internet tools: the cloud, artificial intelligence, big data, social media and IoT (Mosco, 2017, pp. 5,8). This factor is happening in various nation-states through exploiting technology for surveillance, biometric scanners, and radio frequency identification tags (Elder et al., 2014, p. 74). Mosco (2017) sustains that connected online devices can provide billions of eyes to the US Department of Defense, National Security Agency, and the Central Intelligence Agency for global surveillance (p. 43). Moreover, several dissident voices against authoritarian regimes have been censored (e.g., incarceration, assassination, disappearances) with Internet tools (Elder et al., 2014, p. 74; Morozov, 2011, pp. 85-103). In this matter, several authors have linked big data, IoT, cloud computing and social media to the Foucauldian application of the panopticon⁵³ and Orwell’s concept of Big Brother⁵⁴ because these technologies shape perfect forms of surveillance and power (Morozov, 2011, p. 76; Mosco, 2017, p. 104). In other words, from these perspectives, digital technologies are used as oppressive tools to maintain control and surveillance over citizens. Paradoxically to the possibility of totalitarian state power, however, crime has also found a new place of growth in the Dark Web⁵⁵ of the Internet enabling this type of crime to exist outside of the scope of the Panopticon and Big Brother of the national totalitarian states because of the anonymity and privacy features that are attributed to the Dark Web (Morozov, 2011, p. 221; Unwin, 2017, pp. 156-164).

In the view of Mosco (2017), the cloud, big data, and the IoT are accelerating the decline of the

⁵³ Panopticon: Jeremy Bentham initially conceived this concept. Panopticon is a prison building with a tower at the center where it is possible to observe each cell in which a prisoner is incarcerated. This artifact induces a sense of permanent visibility that ensures the functioning of power. The prisoner can always look at the tower but never knows where she/he is being observed (Semple, 1993).

⁵⁴ Big Brother: He is a fictional character created by George Orwell. This character is a totalitarian state leader where every citizen is under surveillance by the authorities (Palmer, 2002).

⁵⁵ Dark Web: The Dark Web is a term that refers to “parts of the internet that are encrypted (= use a secret code), that cannot be found using ordinary search engines, and that are sometimes used for criminal activity” (dark web, n.d.).

“democratized, decentralized and open-source Internet” due to the concentration and commodification of information (p. 5). This transformation is due to the economic and technical power of a few global companies or GAFAM (Mosco calls them the “Big Five”)⁵⁶ and the national jurisdiction that rules these companies, i.e., the United States government. This concentration of power and decision-making is one of the signs of the oppressive character of digital technologies. Transnational American tech companies have significant implications on how global data is managed and controlled across various jurisdictions. Concerning this issue, Nick Couldry and Ulises Mejias (2019) claim that transnational tech companies replicate practices from the extractive industries (e.g., mining, logging) through big data and the cloud, becoming a new form of digital colonization. Moreover, the mining of information from these companies through big data continues to be criticized for its level of inaccuracy and lack of objectivity (boyd & Crawford, 2011, p. 6;⁵⁷ Mosco, 2017, pp. 36–39).

At the institutional level, the debates are focused on whether or not the Internet and digital technologies are fostering political involvement. On the one hand, civil society movements such as Amnesty International and Human Rights Watch rely on the Internet to mobilize their members for social action (Ali, 2011, p. 195). However, there is extensive research that this type of involvement is fostering “slacktivism:” People prefer to do online support, which requires little associated effort and cost, rather than actively engaging and participating in the real world (e.g., What would have happened to Fidel Castro if he had had Twitter or Facebook?) (Andrejevic, 2016; Kristofferson et al., 2013, p. 1150; Morozov, 2011, pp. xii, 24, 26, 179–203; Rodriguez-Prieto & Martinez-Cabezudo, 2016, p. 226). Some scholars are claiming that the Internet has neutralized reflection and critical thinking (Bauerlein, 2011, pp. 18–19), and also that if more user-data is captured (i.e., big data), then less participatory the process will be in social media because the democratic engagement can be predicted (Andrejevic, 2016, pp. 202–203).

⁵⁶ In 2016, the Big Five companies were (1) Apple, (2) Google, (3) Microsoft, (4) Amazon and (5) Facebook, ordered by value (Mosco, 2017, p.66, 75).

⁵⁷ Scholar, activist, and researcher danah michele boyd uses lower case for all her publications (<http://www.danah.org/name.html>).

Moreover, social media has proven that it creates a new form of narcissist self-promotion in social content instead of being a real form of political action (Bauerlein, 2011, pp. 172–203; Flaherty, 2016, p. 577; Morozov, 2011, p. 187). According to the later authors, digital applications, especially social media, have become a form of neutralizing the oppressed populations without promoting social and action in the real world.

Even though all the previous political factors have been envisioned and analyzed by several activists and academic authors for decades (e.g., hate-speech, surveillance, censorship, centralization, political engagement), privacy has become the most leading concern in today's online world (Bauerlein, 2011, pp. 184–187; boyd & Crawford, 2011, pp. 10-11; Morozov, 2011, pp. 144–148; Mosco, 2017, p. 157). The success of social media platforms has relied on offering services that users see as being free, such as the ability to share information and to build online communities, while generating revenue primarily through the personal data of the users using big data and advertising (Ávila-Pinto, 2018, p. 16; Unwin, 2017, p. 57). Paradoxically, neoliberal approaches are interested in protecting privacy, but they recognize that “privacy is dead” (Elder et al., 2014, p. 75).

The revelations of Edward Snowden in May 2013 opened a global debate about individual privacy.⁵⁸ Five years after this scandal, Cambridge Analytica expanded the debate from the individual to the political arena. Cambridge Analytica (CA) refers to a data mining company created in the United Kingdom (UK) to influence mass audiences through individual profiling based on big data obtained from mainstream social media networks (Isaak & Hanna, 2018). Using this data, CA employed web-based communications, event promotions, web apps, native advertising, and social media ads to influence voters' decisions in various political campaigns (Persily, 2017, p. 65). The most notorious elections in which this enterprise participated were the Brexit Campaign in the UK (June 2016) and the Trump campaign in the US election (November 2016); however, CA influenced national elections in several

⁵⁸ Edward Snowden was a CIA employee and subcontractor that disclosed global surveillance programs run by the National Security Agency of the United States, the Five Eyes Intelligence Alliance, and several European governments (Fidler, 2015).

other countries, such as Kenya, Mexico, India, Australia, Malta, and the Philippines. During the campaigns, one of the most questionable CA tactics was that they used the mentioned marketing tool—Facebook—based on the psychographic profiling of users but fuelled with fake news and hate speech rhetoric to switch the intention of voters. In March 2018, *The Guardian and the Observer* in the UK revealed that voters’ profiling was based on a data breach of 50 million users from Facebook (one of the Big Five companies mentioned earlier). CA used this personal information without authorization in early 2014 to build a system to harvest millions of people’s profiles (Cadwalladr & Graham-Harrison, 2018). Ironically, in April 2018, Mark Zuckerberg, one of the pioneers of the aspirational intentions of the Internet, was called to testify in front of the US Congress, accused of being aware of the data outreach and economically benefiting from the political implications of his platform and this type of tactics. David Noble warned in 2006 in the increase of big data and the use of cloud computing that: “visions of democratization and popular empowerment via the [N]et are dangerous; whatever the gains, they are overwhelmingly overshadowed and more than nullified by the losses. As the computer screens brighten with promise for the few, the light at the end of the tunnel grows dimmer for the many” (as cited in Feenberg, 2012, pp. 4–5).

Although the CA scandal details are out of this research scope, this incident exposed several of the concerns that several digital rights activists and academics had raised in previous years. First, it exposed how private enterprises have an essential role in influencing democratic elections in various countries based on Internet data and social media (Isaak & Hanna, 2018). Second, it exhibited how technologies that initially had liberal democratic aspirations have become instruments of oppression and coercion. Finally, it also exposed how big data and social media are being used to promote hate speech and spread fake news. This issue reframed the panopticon and the Big Brother concepts because the national states are not in charge of those power instruments, but they are private entities who are surveilling and moving the masses.

The utopia that digital technologies were neutral regarding gender, race, class, religion, language, and other identity categories has been remarkably disproven by all types of power demonstrations across

countries, regions, and platforms (Nakamura, 2010, p. 336). As a recent example, during 2018, the United Nations called out Facebook for its function in inciting racist violence and hate speech in Myanmar that led to the Rohingya genocide (Miles, 2018). In 2009, Apartha Ray asserted that the United Nations digital programs have imposed “Western processes or structures upon Indigenous recipients,” constituting a form of “Computer-mediated colonialism” (as cited in Mukaro-Borrero, 2013, p. 2). In the same regard, Salazar (2002) asserts that digital technologies are mainly written in English, and they do not adapt to other communities’ language necessities (p. 75). Ultimately, studies have concluded that digital technologies are culturally and socially dominated by patriarchy and male biases because of the digital hegemony (Nakamura, 2010, pp. 336–339, Reed, 2019, p. 294).

Do marginalized identities and political participation have a future within social media and big data? This exploration has shown that although digital technologies have opened up the participation and engagement of different groups in societies worldwide, they have also uncovered new forms of sociopolitical power and oppression. Moreover, digital technologies continue to replicate the exclusionary practices of the “Other” through the differentiation based on the identities of digital users. Thereby, digital technologies demonstrate that these tools are political, not neutral, and have had a significant role in maintaining different forms of control and replicating imperialist structures.

4.1.2 The Economic Dimension

According to several authors, digital technologies have led to economic empowerment. Manuel Castells and Pekka Himanen (2016) claim that “[the] Internet enhances sociability, freedom and empowerment, and these conditions lead to a higher level of happiness, the subjective indicator of human well-being” (p. 35). In this respect, Luyt (2004) states that government and intergovernmental organizations see ICTs as a “ticket to everlasting peace, progress, and prosperity” (p. 1). Heeks (2018) claims that the cloud, big data, IoT, social media and OO will positively change the dynamic with “the poor” because they will help to improve their livelihood conditions (p. 319). Laurent Elder, Rohan Samarajiva, Alison Gillwald, and Hernan Galperin (2014) emphasize that the Internet reduces poverty

among the very poor (p. X). In the same regard, several authors claim that the usage of several Internet services and ICTs support the economic growth across the world at the micro-, meso- and macro-level (Avgerou, 2017, p. 11; Elder et al., 2014, pp. 47–54; Heeks, 2018, pp. 135–170) as well as reducing global financial poverty (Elder et al., 2014, p. 59; Heeks, 2018, pp.173–192). Several business publications claim that data's economic value has become a new revenue source that has surpassed the value of natural fossil fuels (Dance et al., 2018; Matsakis, 2019; The Economist, 2017).

Ali (2011) believes that the Internet reduces traditional trade barriers, allowing businesses in developing nations to sell products to developed countries (p. 190). In the same line, Heeks (2018) argues that the poor are becoming richer (regarding income) and buying more ICT goods and services in industrialized economies (p. 3). In this regard, Elder et al. (2014) claim the poorest of the poor now use phones, they have become new markets for telecommunication companies, and 70% of the poorest people in the world are expending a significant percentage of their income on telecommunications (Elder et al., 2014, pp. xiv, x). Additionally, according to some authors, mobile communications have provided significant access to the Internet due to its simplicity, flexibility, low-cost, and portability (Elder et al., 2014, p. 2; Heeks, 2018, p. 48). Then, under this rhetoric, the Internet provides access to education across marginalized communities, which allows them to access employment and new markets (Heeks, 2018, pp. 226–233; Elder et al., 2014, p. 46).

Regarding online outsourcing (OO) and economic growth, Heeks (2018) asserts that the replacement of jobs with digital labour is bringing reduced costs and higher quality working (p. 14). According to Elder et al., online jobs help small businesses thrive (Elder et al., 2014, p. 51). In the same regard, Malik et al. (2017) agree that OO helps marginalized groups such as women and youth develop new income sources.

Despite these arguments, several authors strongly differ with this assumption of economic and social prosperity. Unwin (2017) disagrees with these notions, claiming that the benefits of the digital economy have been less than expected and have not been equally distributed. He argues that global inequality within countries is matched by increasing inequality on a global scale (p. 9, 20). According to

the *World Development Report 2016: Digital Dividends*, the benefits of the digital economy have been low and have not been equally distributed among minorities (as stated by Unwin, 2007, p. 9). In the same line, Hughes (2016) asserts that global inequality is about the same as the late Middle Ages (p. 56). The Big Five tech companies or GAFAM have become the largest companies in the world's history, accumulating the profit in few hands (Mosco, 2017, p. 8). In this regard, Pinto (2018) asserts that "entire nations and their industries are fully dependent on critical infrastructure, software, and hardware provided by a handful of companies based in a small group of countries" (p. 19). Unwin (2017) agrees that this form of development is fostering a hegemonic economic growth agenda (p. 18, 76), and he highlights that a significant portion of that "economic growth" has been through exploiting global differences in taxation regimes, with the Big Five/GAFAM the principal operators (p. 164). The concept of *terra nullius* (i.e. nobody's land) that was imposed by Christopher Columbus in the American context to take the land of Indigenous peoples in the fifteenth century is reflected in the new economy within the digital culture of "democratic culture," "open knowledge," "creative commons" that is inflicted on Indigenous knowledge practices, biodiversities, and sacred sites where knowledge can be just taken (Stingl, 2015, p. 65).

Moreover, Mosco (2017) claims that the economic growth of the Big Five/GAFAM through cloud computing and big data is intimately connected to the reliance on quantitative analysis that allows companies to profit from packing and selling data (p. 8,58). The danger of this factor is that cloud computing and big data are offering to radically renew the philosophy of positivism and capital of the nineteenth century and accelerate commodification (Mosco, 2017, pp. 29, 58). With the appropriate legal framework, big data develops and accelerates the commodification processes by expanding data storage and processing capacity in cloud centres by enhancing the capability to supplement marketing value and increase data collection by IoT devices. Moreover, these technologies perfectly commodify users by sharing their preferences and identities to advertisers and politicians in real-time (Mosco, 2017, pp. 58–59). When the cloud, big data, and IoT work together, users decrease the ability to control their consumer habits, as well as their political decisions (Mosco, 2017, pp. 46, 58). Renata Ávila-Pinto (2018) asserts

that commercial organizations are susceptible to political pressure, such as in the WikiLeaks' affair⁵⁹ when Visa, MasterCard, American Express, Paypal, and Western Union blocked all the transactions to the organization (p. 20).

This form of capital economic growth not only boosts the commodification at the consumer level, but also within the tech industry itself. Mosco (2017) claims that cloud computing is replacing entire departments in traditional business, cutting off many jobs (p. 23), and gig workers are getting no benefits and low salaries (p. 119). The commodification of labour without union or labour associations is possible in and around the tech industry (Mosco, 2017, p. 58). In this regard, Malik et al. (2018) have acknowledged the decrease in employee benefits in OO, such as the absence of holiday pay, sickness benefits, health insurance, minimum wage, retirement benefits, and compensation in the case of injury (p. 430). Moreover, connected to OO, the online experiences have failed because the content creators commonly are not paid in the long term because there are no labour relationships (Unwin, 2017, pp. 53–56).

As it was explained, digital technologies have fostered several economic processes around the globe that opened a polemical debate about the possible economic impacts at the micro, meso, and macro level. The constant drive for information and the constant economic value exchange creates intense expectations and movements around industries and sectors. Nonetheless, the economic impact of digital technologies and the potential power to improve or to worsen the livelihood of marginalized communities are undeniable.

4.1.3 The Environmental Dimension

The intangible character of digital spaces has created the fantasy that digital technologies do not impact the environment, territories, and natural resources. For some authors, the Internet was conceived

⁵⁹ “Bradley/Chelsea Manning was convicted in 2013 by a military court of various criminal charges, including violations of the Espionage Act, for his role in disseminating classified documents in what became known as the Wikileaks affair.” (Fidler, 2015, pp. 85)

as an ecologically sustainable tool due to its ethereal character (Castells & Himanen, 2016, p. 38; Mosco, 2017, p. 26; Rodriguez-Prieto & Martinez-Cabezudo, 2016, p. 18). The logic behind this claim is that the Internet is part of the “weightless economy”; therefore, the effects on the environment were near zero (Hughes, 2016, p. 191). In different levels of society, the Internet is still conceived as “a clean and sustainable industry related to California’s ecologic counterculture” (Rodriguez-Prieto & Martinez-Cabezudo, 2016, p. 110).

The link between the Internet’s hardware and sourcing raw materials in developing countries is now being recognized by critical thinkers, however (Luyt, 2004, p. 3; Hughes, 2016, p. 18; Mosco, 2017, p. 74). Several metals are extracted every day to produce ICTs, including tin, silver, gold, and rare-earth metals (e.g., coltan, cobalt, niobium, tantalum, and tungsten). Key producers include China, Brazil, and the Democratic Republic of Congo (Heeks, 2018, p. 285; Hughes, 2016, p. 198). This connection involves the direct destruction of natural habitat and Indigenous lands from the mining itself, pollution from the chemicals used for extraction, and indirect destruction of habitat due to the infrastructure required to support mining in rural areas (Heeks, 2018, p. 286). Furthermore, the Internet has increased its negative impact through its high-quantity consumption of energy (e.g., power supply and air conditioning) required to maintain the cloud and big data (Mosco, 2017, pp. 12, 148–149; Unwin, 2017, p. 34). On top of this factor, the generation of e-waste has dramatically increased (Mosco, 2017, p. 200). An estimated 42m tonnes of electronic waste is produced per year, of which roughly one-quarter—about 10m tonnes—is made up of digital devices (e.g. mobile phones, monitors, PCs, laptops, printers, tablets, servers) (Heeks, 2018, p. 287).

Ironically, digital technologies are being used to track the changes related to climate change, such as the migration of fauna species (Pereira, 2019; Tsai et al., 2021), the alteration of climate variables (e.g., humidity, dust, temperature) to forecast better agricultural conditions (Chattopadhyay, 2017), the level of pollution in air and water ecosystems (Saravanan et al., 2018), the tracking of deforestation and melting glaciers (de Magalhães et al., 2019; Singh et al., 2021), among many other applications. This data allows scientists and policymakers to predict and create solutions for the shifting ecosystems across the world

due to climate change.

The role of digital technologies in the environment and ecosystems of different regions is tangible, and lately, their interconnections have increasingly expanded due to the high level of resource consumption and the potentialities of environmental research. The decisions made around the usage rates and applications of digital technologies directly affect ecosystems and natural environments.

As was explored in the previous sections, digital technologies are not neutral, and they are impacting societies in different forms. A provocative finding in the analysis of the sociopolitical, economic, and environmental dimensions of digital technologies is that these forms of technology have a massive cultural component embedded in their designs' historical processes. The most revolutionary technological developments, such as the microcomputer, the Internet, and social media, started as emancipatory forms of sharing knowledge to find possible alternatives for the social, political, and economic disparities of their contexts. These factors become significant in the context of tech design, especially if there is a decolonial aspiration. Therefore, it is necessary to explore the cultural implications and relationships of the historical processes of digital creation and design.

4.1.4 The Historical Analysis in Digital Technologies

In this section, a historical analysis of digital technologies is developed to identify possible cultural ideologies inserted into the digital world. It is argued that these cultural and political constructions remain as hegemonic apparatuses because they were promoted and supported by several individuals due to the technical and organizational advancements that they implied. These cultural ideologies have influenced the distinct forms of exercising power within the digital and have forced several discourses into the ways of doing computing with/by marginalized communities.

Several authors who have explored the implications of the digital agree that there were critical moments in the last 80 years that influenced the construction of the digital's cultural ideologies (Haas, 2007; Hughes, 2016; Morozov, 2011; Rodriguez-Prieto & Martinez-Cabezudo, 2016). Several inventors and engineers framed this transformative but aspirational character in digital history through their ideas and

values that were embedded in their contraptions. Based on the exploration of these authors, the computer architecture, the Internet, the protocol, the free and open-source software, and social media I found were the most significant conceptions that generated the cultural ideologies of current digital technologies.

The Computer Architecture. John Von Neumann, who was a Hungarian mathematician, published the first report in 1945 on the Electronic Discrete Variable Automatic Computer (EDVAC) that was the first binary stored-program mainframe computer. This report nullified the patent purposes of Presper Eckert and John Mauchly, whose objective was to profit from academic research (Hughes, 2016, pp. 40–41). As a result, Neumann promoted the first open hardware development in the history of computing and conceived what is called Von Neumann architecture. This structure formed the basis of modern computing hardware. Although Von Neumann never intended to generate a form of doing computing, this model marked the continuous and public development of computing technology as an “open” and “free” form of knowledge. Later, this architecture created millions of dollars in profit for manufacturers and software companies.

The Internet. In 1945, Vannevar Bush imagined the Internet in “As We May Think,” where he visualized the first idea of the Internet (also known as the Net) and “hypertext” through its concept of “Memex.” This notion was a form of indexing, storing, retrieving, and delivering all types of information (Haas, 2007, pp. 81–82; Hughes, 2016, p. 2018; Rodriguez-Prieto & Martinez-Cabezudo, 2016, p. 40). The purpose of this conceptual invention was a group of machines that would allow the access of all types of information from anywhere without having technical skills. The vision of Bush was that knowledge should be available for everyone to pursue the truth. This vision fostered decentralization and openness as primordial values in the global network. Therefore, no entity such as a government, corporation, organization, or individual should have absolute power over the infrastructure and the information stored on the Internet (Malik et al., 2018, p. 427; Mosco, 2017, pp. 7, 63). The possibility of exchanging data with any person in the world created new imaginaries and political optimism. Furthermore, the Internet was created to benefit from openness, disorganization, and decentralization. As Rodriguez-Prieto and Martinez-Cabezudo (2016) claim, the Internet was conceived as a revolutionary product and way of doing

technology based on its pioneers' disobedience concerning their bosses (p. 291). Brett Gaylor in his analysis of the copyleft movement, claims that the Internet positively changed the rules of copyright and intellectual property to allow the democratization of knowledge (as cited by Heeks, 2009, p. 9). In the same regard, Professor Jyh-An Lee (2014) argues that the Internet alongside the non-profit organizations have shifted the meaning of common knowledge. Despite these idealistic visions, as it was explained in the last section, the largest multimillion-dollar industries worldwide operate on the Internet and create different economic, social, political, and cultural oppressions to different populations globally.

The Protocol. In December of 1970, the Network Working Group (i.e., the first open, collaborative and inclusive developer team) led by Steve Croker implemented and deployed the Network Control Protocol (NPC), which would become the basis of the current Transmission Control Protocol / Internet Protocol (TCP/IP), (Rodriguez-Prieto & Martinez-Cabezudo, 2016, pp. 49–50). This protocol is the existing communication base of the Internet around the globe, and beyond a technical specification, this group created a new way of collective technical collaboration and open standards (Mosco, 2017, p. 63). The Network Working Group implemented a new form of creative collaboration to solve technical problems. This form of partnership promoted groups of collaborative work to develop new technological developments. These days, a protocol in the context of digital technologies means standards that are “universally and freely available, do not discriminate or enable predatory practices, and they, therefore, enable the interoperability and openness of technologies” (Heeks, 2018, p. 342). According to Jaijit Bhattacharya (2010), however, the imposition of technology standards and protocols by developed countries is a form of propagating the economic and social disparities around the globe. Moreover, it is a form of fostering a form of digital colonization by implying technical requirements that are difficult to meet in developing countries.

The Free and Open-Source Software (FOSS). Almost two decades later, in 1983, left-thinkers led by Richard Stallman incorporated social values and community concepts as collaboration and freedom into software development through the Free Software Movement, which two years later became the Free Software Foundation (FSF), (Heeks, 2009, p. 9; Hughes, 2016, p. 18; Lee, 2014, p. 339; Rodriguez-Prieto

& Martinez-Cabezudo, 2016, pp.176–182; Stallman, 2009; Unwin, 2017, p. 69). This movement fostered the decentralization of information by sharing lower-cost, more-robust, and more local solutions (Heeks, 2009, p. 9; Lee, 2014). FSF has advocated for open and free knowledge across several legislations around the world. The FOSS allowed the competition between models of access, ownership, and control of information between advocates of copyright/open-source and the copyleft movements (Chow-White, 2012, pp. 293–294). However, this form of knowledge sharing had fostered the usage and misappropriation of knowledge from small and marginalized communities by individuals, corporations, or organizations for the only purpose of sharing all the human knowledge.

Social Media. Mark Zuckerberg, the creator of the social media platform Facebook, stated several times that the purpose of his platform was to “open information flow for people” (Phillips Exeter Academy [PEA], 2007, p. 2) and “making the world open” (Singel, 2010, p. 13). Moreover, Zuckerberg was convinced that a model based on decentralization is how digital technologies should work (Singel, 2010, p. 40). Facebook currently has 2.41 billion monthly active users on Facebook as of June 30, 2019 (Facebook, 2020) and has become one of the biggest repositories of data and knowledge worldwide; however, social media worldwide has become a multimillion-dollar industry that has benefited from the data of users and created significant concerns about privacy and safety.

A common thread in these phases is that all of them have emphasized the importance of “sharing” and “exchanging” knowledge as forms of emancipation (Feenberg, 2012, p. 4; Rodriguez-Prieto & Martinez-Cabezudo, 2016, pp. 45–57). The designers and engineers producing digital technologies have commonly been enthusiastic about the digital world’s emancipatory global power that is organized by sharing data and information. This enthusiasm was magnified when the global system of computer networks, i.e., the Internet, was accessible to the middle class in the First World in the 1990s. The accessibility of information “from everywhere by everyone at any time” promoted digital technologies as an ideal democratic solution for people to be informed. Despite these historical and political aspirations, these technologies did not disrupt the inequalities.

On the contrary, this ambition of open and free knowledge has increased the economic and social

differences among regions faster than ever before because of the speed of the transactions and the economic value of information. Capitalist and neoliberal transnational entities neglect to directly address the disparities and negative consequences across sectors and regions; however, they engage in the narrative that the interchange of information and its economic value would be forms of democratic emancipation only because people have access to information. Therefore, the interchange of information or sharing knowledge across digital technologies by transnational entities, the data commodification, has become a new ideology to exercise digital power. This ideology has culturally shaped the forms of how digital technologies are conceived and the consequences in society.

How do these dimensions and historical analyses relate to the colonial discourse? The sociopolitical, economic, and environmental analyses of these tools have shown that power hierarchies have been transferred into digital technologies. The ideologies based on the European/capitalist/military/-Christian/patriarchal/white/heterosexual/male/colonial continue to dominate several spaces and discussions. As it is shown in the previous analyses, the action of domination is across different roles within the digital: the creative process (how to design the digital), in the form of being within the space (how to act in the digital) and the way of conceiving the digital (how to think about the digital). Moreover, the digital is being used to replicate and expand various strategies that colonial powers used to oppress different groups in the last five centuries, such as censorship, control of democratic decision-making, and militarization. Data, as a new form of a commodity has replaced the natural resources to justify and explain the new types of exploitation and exclusion worldwide. Moreover, the global hierarchies have remained and expanded across sectors by holding the position of domination across the different roles within digital spaces. The next chapter will explain, however, that there are several potential uses of digital technologies to open dialogue spaces and create new forms of reclaiming power and generating reparations.

4.2 Mobile Technologies and their Consequences

After the release of the first version of the mobile application in February 2016, several questions

about colonial power started to be raised in conversations with community members around mobile technologies. Are mobile phones passive technical apparatuses without consequences? What are the implications of using mobile phones within communities that historically have suffered the struggles of colonization? In the research process, I found that mobile devices have had an overrated emancipatory character from the Western perspective because most marginalized communities embrace and use these technologies.

As mentioned in the previous sections, digital technologies have increased their penetration around the world. Some authors argue that mobile infrastructures (i.e., hardware and software platform) have been seen as emancipatory tools to solve disparities worldwide at the international political level. According to Shade (1998), the “universal access to communication and information services must be recognized as an essential human right for maintaining basic democratic values” (p. 33). Muhammed Yunus, a Nobel Peace Laureate and Founder of the Grameen Bank, claimed that “the quickest way to get out of poverty right now is to have one mobile telephone” (as cited by ITU, 2018a, p. 12). According to the ITU Telecommunication Development Bureau in 2015, mobile devices are mobile miracles (as stated by Dyson, 2016, p. 18). In the same regard, Smith, Spence, and Rashid claim that mobile phones increase population capabilities, i.e., empower them, through accessing relevant and timely information (as cited by Svensson & Wamala-Larsson, 2016, p. 207). Dyson et al. (2016) assert that “mobiles empower!” through improving the economic well-being and employment opportunities of people (p. 379). According to Elder et al. (2013), there is proof that mobile phones and access to the Internet can help the “poor” increase their earning opportunities (p.3). They claim that “wireless signals changed lives” when they refer to mobile technologies (p. 1). Jeffrey Sachs described mobile phones as the single most transformative technology for development (as cited by Elder et al., 2014, p. xvi). Moreover, based on the notion of these authors, mobile phones have helped small and home-based businesses to sustain themselves while the mobile industry has created many jobs (Elder et al., 2014, p. x).

The improvements in this technology have been significant in the last decade. The third, fourth, and fifth generations of mobile devices have enabled new multimedia forms (audio, video, images),

applications, and platforms that extend mobiles' capabilities beyond talking and texting (Herman et al., 2014, p. 1). Moreover, unlike desktop or laptop, mobile phones are regularly with their users, ready for use (Jarvenpaa & Lang, 2005 p. 7). Mobile devices are capable of "improv[ing] the flow of information—how it is collected, stored, accessed and used" (Niang & Scharff, 2014). However, the impact of mobile technologies can be questioned from several perspectives.

As Svensson and Wamala-Larsson (2016) state, there is no doubt that mobile phones have improved access quickly to information and provide a tool for communication. However, these authors affirm that mobile phones do not empower people, they only facilitate social change under certain circumstances, and they are not free of relations of power, gender structures, or sociocultural rules (p. 209–210). Moreover, although the most disadvantaged of the disadvantaged now use phones for several activities, they have become a new economic target for telecommunications operators in the developing world (Elder et al., 2014, p. xiv). In several communities, a significant part of the household income goes to mobile acquisition and communication services (Dyson, 2016, p. 23). Powell (2014) asserts that users experience limits on the type of mobile devices they can choose because the global market has only three or four leading suppliers. As the devices are attached to the operating systems, the kinds of things the users can do with mobile devices is also limited (p. 34).

According to Dean (2014), mobile apps are fasteners because they "fasten" people to the tablets and phones. This factor is due to the personal, individual, and customizable content that mobile apps can deliver on mobile devices. Mobiles apps extended three animating fantasies: (a) abundance: everything is out there and available (i.e., "there is an app for that"); (b) participation: the sense that one is active, connected and involved when you are in-call; and (c) wholeness: the sense that the person is part of a whole, integrated into a world (p. 234, 241). Moreover, app analytics were developed to motivate and increase the usage and fastening factor of mobile apps (Dean, 2014, p. 245). This type of analytics lets "developers see themselves being seen—they can see how their users, customers and clients see them, how they engage them. The interaction of consumer and app is not hidden" (Dean, 2014, p. 241). Dean claims that without mobile apps, smartphones will not be required (p. 234).

Herman et al. (2014) claim that humanity is at the stage of smartphone capitalism, where the specific arrays of social relations of power and exploitation are a distinctive social creation (p. 3). As a symptom of this phenomenon, mobile social entrepreneurs like to present apps as a “technological fix,” a remedy to weak economies through the generation of new markets (Dean, 2014, p. 241). Furthermore, this type of technology relies on enterprises that have benefited from globalization and capitalism. In the same regard, the fast advancement in technology is frequently providing “better” models, pushing consumers to change their smartphones every two years in developed countries and every three years in developing countries, generating a large number of waste streams. These days, the average life of a mobile phone is less than two years, and this waste may possess great value (Sarath et al., 2015, p. 537, 543). Furthermore, this technology brings significant changes in local economies and social dynamics. As Heeks (2009) states, most digital technologies within communities used to have communal ownership, and with mobile phones, this form of arrangement changed towards an individual or household ownership (p. 8). In other words, mobiles transformed how general infrastructure was organized towards an individualistic/capitalist approach. Regarding the gender bias, Shade and Crow (2005) claim that none of the types of digital divides and ICT agendas, including mobile technology, policies include a gender perspective, and they continue to replicate patriarchal violence against women. Their analysis originated from the issues raised during the World Summit on the Information Society of 2005.

Despite the previous arguments of the colonial character of digital technology, I claim that these implications are attached to the lack of involvement of marginalized and excluded populations in digital technology design, especially in the conception of infrastructure. I argue that the individualistic/capitalist approach of mobile technologies can be transformed and redefined by communal values. Although the factors that dismantle mobile technologies’ emancipatory character are significant, the usage of this technology is generating new discourses and forms of reappropriation in communities within the margins. As Brady and Dyson (2016) assert, mobile technologies are not passive entities, but they transmit effects on their forms, offering opportunities while disabling other actors through their design (p. 66). In the case of Indigenous peoples, Indigenous youth are using a diverse form of mobile technologies to reclaim their

identities and embrace their cultures (Dyson, 2016, p. 18). Are Indigenous people being colonized by mobile technologies, or are they reappropriating this type of technology for a decolonial and local purpose?

4.3 The Concept of Digital Coloniality

Digital coloniality is a recent term that is fostering several conversations across different sectors. The high level of digitalization around the world opens opportunities and threatens to disrupt and paradoxically perpetuate the consequences of colonialism. Therefore, several authors have tried to conceptualize the connection between colonization and digital technologies.

Based on the views of the decolonial author Ramón Grosfoguel, the historical process of colonization brought a European/capitalist/military/Christian/patriarchal/white/heterosexual/male to the Americas 500 years ago that established the current global hierarchies:

- a global class formation where diverse forms of labour were to coexist and be organized by capital as a source of production of surplus value through the selling of commodities.
- an international division of labour where capital organized labour at the periphery around oppressive and authoritarian forms.
- an inter-state system of politico-military organizations controlled by European males and institutionalized in colonial administrations.
- a global racial/ethnic hierarchy that privileged European Caucasian people over non-European or non-Caucasian people.
- a global gender hierarchy that privileged males over females/non-binary and European patriarchy over other forms of gender relations.
- a sexual hierarchy that privileged heterosexuals over other sexual preferences.
- a spiritual hierarchy that privileged Christians over non-Christian/non-Western spiritualities institutionalized in the globalization of the Christian.
- an epistemic hierarchy that privileged Western knowledge and cosmology over non-Western

knowledge and cosmologies and institutionalized in the global university system.

- a linguistic hierarchy between European and non-European languages that privileged communication and knowledge/theoretical production (Grosfoguel, 2008, p. 6).

Based on this context, Stingl (2015) argues that the digital coloniality of power is a simple transfer of power from existing institutions and actors outside of the digital (p. 135). Stingl (2015) states that the logic of colonization of creating “the Other” and invalidating their forms of knowledge has been extended in the digital sphere by creating a digital culture. In other words, digital culture is “the extension of the bourgeois civil society that has constituted the Global North, and it runs on an operating system that is not much written as a wonderful ‘networking’ culture but written in a cultural logic of *antagonism*. Digital culture is [...] merely the extension of the *coloniality of power and Being*” (p. xvii, xxxii).

Moreover, Stingl (2015) states that digital culture is truly epistemically linked to the culture of the Enlightenment of finding the “absolute” and “universal” truth in the base of Western science (p. xvi). He states that the story of world systems of trade and information have existed for centuries and allowed the rise of the hegemonic forces and the foundation of capitalism (Stingl, 2015, p. xxix). Therefore, Stingl (2015) claims that the coloniality of power is present remarkably unchanged from Western political-theological missions through Secularization/Enlightenment to Digitalization/Globalization, within each of the “development stages” and the objectification of class and identity (Stingl, 2015 p. 312). Based on this factor, he concludes that digital coloniality is embedded by possessive individualism, identity politics, and class struggles; thereby, these factors mean that in order to counteract this form of power, the reactions must go beyond the digital realm and regain the concept of power’s opportunity instead of a simple power transfer from offline to online services (Stingl, 2015, p. 301). Stingl (2015) concluded that digital coloniality reflects the established hegemonic ruling colonial structures of power.

In the same line, Rodriguez-Prieto & Martinez-Cabezudo (2016) state that the process of digital coloniality establishes a position of domination of some nations over others, which entails not only an exploitation of natural and human resources, but also the imposition of a privileged knowledge (i.e., the colonizer’s knowledge), and the disqualification of the subaltern (i.e. the colonized) through the Western

logic and cultural imposition in technical designs (p. 191-192).

From another lens, Nick Couldry and Ulises Mejias (2019) frame coloniality and digital technologies based on the concept of *data colonialism*. Data colonialism is “an emerging order for the appropriation of human life so that data can be continuously extracted from it for profit” (p. xiii). This concept is “the extension of a global process of extraction that started under colonialism and continued through industrial capitalism, culminating in today’s new form: instead of natural resources and labour, what is now being appropriated is human life through its conversion into data” (Couldry & Mejias, 2019, p. xix). According to them, this notion reflects several critical characteristics of historical colonialism: (a) the appropriation of resources; (b) the evolution of unequal relations that secured resource appropriation; (c) a massively unequal distribution of benefits of those resources; and (d) the spread of ideologies to make sense of all these processes (Couldry & Mejias, 2019, p. 4). Maori peoples claim that the deliberate gradual erasure of local technologies and their replacement with Eurocentric and for-profit digital solutions is part of the colonizing agenda for many centuries (as stated by Ávila-Pinto, 2018, p. 22).

In the same regard, Ricaurte (2019) asserts that colonization and digital technologies should be understood by capturing data relations as a new type of humans/object relations that allow commodification within the Internet of things (IoT), biodata, and infrastructure networks. Moreover, she claims that this type of data colonialism involves the “violent imposition of the being, thinking and feeling that leads to the expulsion of human beings from the social order” and neglects the existence of alternative worldviews and threatens life on Earth (p. 2). In other words, Ricaurte (2019) proposes digital coloniality through data as a “complex socio-technical assemblage that articulates material infrastructures as well as biological, emotional, ecological and symbolic dimensions that are generally ignored in theoretical debates” (p. 4).

Under these perspectives, the denial of colonization in digital technologies would signify the erasure of the historical struggles of different groups and identities and the neglect of the disparities that exist within the local contexts and digital technologies. Therefore, I frame digital coloniality as the structures of power, control, and hegemony that are exercised within the digital spaces through data, but

also the structures in the “real” world that create and design those spaces, such as infrastructure and software.

4.4 Conclusion: Digital technologies are Colonially Designed

The usage of digital technologies continues to increase significantly worldwide. Alongside this increase, the theoretical intersections between colonization and digital technologies show that different stakeholders within digital spaces apply the same resource exploitation logic as historical colonialism. Moreover, it is demonstrated that several digital technologies are not only colonial in their practices, but they are colonially created/designed. Therefore, although some digital technologies are used positively by several marginalized communities, the colonial character incorporated in the tools’ design remains unchanged.

This chapter started with the framework of digital coloniality through three-dimensional implications: sociopolitical, economic, and environmental. In the political arena, the exploration showed that digital technologies are politically non-neutral, but most importantly, they are actively generating hegemonic centres of power across government levels in several regions of the world. These political implications benefit privileged groups in different settings and foster oppressive practices across sectors. On the other hand, however, digital technologies benefit specific groups to mobilize their voices and gain political representation. In the social dimension, the discrimination within digital spaces replicates harmful and oppressive practices from the real world into the digital, but at the same time, the digital provides a space for marginalized groups to be represented and creates a form of connection among peers. In the economy, data mining has become a new form of extractivism and profit by violating privacy and increasing financial disparities between several actors in society. Nonetheless, digital technologies provide a path for underrepresented groups to access the global economy and create economic support networks. Finally, in the environmental dimension, digital technologies are a significant factor in climate change and environmental pollution through mineral extraction and energy consumption despite the fact that digital technologies are paradoxically also being used to fight climate change.

In the next section, these contrasting encounters are compared to the historical aspirations that digital technologies inventors tried to incorporate into their sociotechnical objects within the digital, proving that these technologies were designed with cultural ideologies about “democracy” and “progress” that interestingly have created a double group of effects and consequences (i.e., an essential element for understanding decolonization as a political framework). Therefore, as an initial conclusion of this analysis, I argued that several digital technologies are not only colonial in their practices, but they were colonially created/designed.

Understanding these practices is relevant to conceiving alternative options, because the acceptance of the colonial implications of digital technologies has fostered several types of reactions worldwide. Throughout my personal experience doing an extensive literature review, however, I found that several agendas are on the table in response to the colonial character of digital technologies. The majority of these forms of solutions are trying to impose their views as global standards of counteracting coloniality and, without noticing it, replicating hegemonic structures of power within unrepresented communities. In order to avoid impositions as well as shortcuts within digital technologies, in the next chapter, I make a categorization of such solutions to successfully identify the projects that comply with the principles of Indigeneity and can provide an initial state of the requirements of decoloniality and digital technologies in the context of Indigenous peoples. This categorization allowed me to isolate the particular characteristics that digital decolonial projects should consider in the context of Indigenous peoples. Moreover, this categorization also provided a general understanding of the main usages of digital technologies by Indigenous communities.

Chapter 5

The Responses to Digital Coloniality

Confronted with the fact that digital technologies can potentially activate, develop, foster, or weaken the comprehensions of the world (Rodriguez-Prieto & Martinez-Cabezudo, p. 277), different counteractions to digital technologies have emerged to hinder the threats of digital coloniality. The complexity of several social scenarios and the significant intimidation of these technologies over various populations are generating reactions from across cultures and groups worldwide to counteract colonial power and oppression. In this context, Indigenous peoples are finding attractive forms of using their experience with coloniality to create and design emancipatory contemporary digital tools and expressions. In order to correctly identify these decolonial/Indigenous reactions from other counteractive forms of design and avoid oversimplifications and misrepresentations, this chapter aims to categorize the different reactions to digital colonial power to facilitate their analysis and compare decolonial and Indigenous options. It would be a harmful transgression to take all forms of fighting the oppressive character of digital technologies as “decolonial,” because most of these counteractions do not comply with decolonial and Indigeneity’s principles. In other words, applying the principles of other frameworks to Indigenous contexts would newly impose outside values onto Indigenous Knowledge, and it would lead to new forms of oppression.

This chapter is structured based on the contemporary responses from different regions, groups, and actors to these colonial power processes according to the global futures proposed by the decolonial Argentinian academic Walter D. Mignolo to distinguish these alternatives from the decolonial options. In the first three sections, I present the non-decolonial options to coloniality: (a) rewesternization; (b) dewesternization; and (c) the contested left. Next, I present the concept of decoloniality, as well as provide an overview of the tensions with postcoloniality due to the contended intersections that these responses have implied. Then, I introduce what some authors have framed as “decolonial computing.” I argue that this theoretical definition is limited in the context of Indigeneity, and therefore, I require an

analysis of the diverse reactions to digital coloniality based on examples in the digital world to expose the differences between these responses compared to local practices of Indigenous peoples. Hence, in the last section, I introduce digital projects that are led by Indigenous peoples and why I consider them decolonial and spiritual options, based on the categories of Mignolo, to digital coloniality. This exploration of the responses is classified by the primary usage of the technologies and offers a first insight into the principles for decoloniality and digital technologies within the context of Indigenous peoples. During this analysis, I found an increase in the number of examples of Indigenous peoples worldwide engaging with digital technologies.

Outside of the digital context, according to Mignolo (2011), Tuck & Yang (2012), Crawford (2002), & Quijano (2000), the responses to coloniality are diverse. Mignolo (2011) offers a framework on the differentiation of coloniality responses and how Indigenous peoples participate in those particular actions through the decolonial and spiritual options. In order to delimit and distinguish the decolonial approaches within digital technologies, I applied a case analysis into several digital practices that collectives and individuals are implementing around the world as a reaction to digital structures of power based on an adaptation of the global futures established by Mignolo (2011): rewesternization, dewesternization, reaction of the left, and the decolonial and spiritual option. It is essential to clarify that although there are other ways to differentiate the responses to colonialism based on other diverse considerations, such as geographical location, intersectional characteristics, ruling power state, among others, the classification of Mignolo offers the possibility to connect several global phenomena of geopolitics that are being directly reflected within digital technologies. Therefore, I started exploring a diverse range of fields through an extensive literature review, departing from Indigenous studies, passing by Information and Communication Technologies for Development (ICT4D), Human-Computer Interaction (HCI), Development Studies, Communication/Media Studies, and Digital Humanities to find these responses.

5.1 Rewesternization: ICT4D

The government of George W. Bush marked the end of the contentious image of leadership that the United States and neoliberalism had over global affairs. The Iraq invasion, unilateralism in several global issues, and the collapse of Wall Street in 2008 contributed to this disruption (Mignolo, 2011, pp. 35–36). Moreover, the disappointing overall outcomes of the Millennium Development Goals in 2015 raised skepticism in the neoliberal global actions for developing countries. Therefore, one of the main tasks that liberal political leaders have fostered in their political agendas since the early 2000s has been to rebuild the world's confidence in neoliberalism and development (Mignolo, 2011, p. 36). From the perspective of digital technologies, rewesternization continues to foster the idea that poverty and inequality reduction is still possible through a significant economic expansion via Information and Communication Technologies for Development.

In the mid-1990s, around the conception of the Millennium Development Goals, several academics motivated due to the significant momentum and political aspirations that the digital technologies received to develop and democratize the world created a new area of inquiry and exploration: Information and Communication Technologies for Development (ICT4D) (Heeks, 2009, p. 3). The academic area of Information and Communication for Development (ICT4D) is the field where several efforts around digital technologies and social and economic disparities worldwide are explored and analyzed in order to understand their outcomes and consequences (Castells & Himanen, 2016, pp. 30–31; Heeks, 2018, pp. 10–16).⁶⁰ Digital technologies are understood as emancipatory tools for social and economic change. This epistemic area is undoubtedly recent (from the early 1990s), and there are few institutions that explore this academic area as a single body of knowledge (Heeks, 2018, pp. 29–30). Different specific disciplinary approaches lead most of the research projects, and seldom are all the fields bound in a single interdisciplinary approach (Avgerou, 2017, p. 12; Heeks, 2009, p. 2; Heeks, 2018, p. 30; Raiti, 2007, pp.

⁶⁰ According to Heeks (2018), the first phase of ICT4D was based on the personal computer (ICT4D 1.0) and the second phase on mobile communications (ICT4D 2.0) (p. 48).

1–3; Unwin, 2017, p. 22). When I started the academic exploration of the *Indigenous Friends Platform*, I thought that this area of knowledge would be an adequate epistemic place to start my research inquiry.

In most studies, however, this new discipline around digital technologies and their application within marginalized communities has portrayed digital technologies as neutral and without acknowledging the historical power relations that they imply within regional and local contexts. Therefore, several academics and activists have contended that a neocolonial and capital agenda guide the studies around ICT4D because, in the majority of cases, they are not critical about the weaknesses and potential negative consequences of digital technologies within marginalized communities (Heeks, 2018, pp. 25, 26; Morozov, 2011, p. xiii; Unwin, 2017, p. 5). It wasn't until the early 2000s, due to the refugee crisis and the humanitarian disasters in Africa and the Middle East, that some ICT4D authors succeeded in including some insights into the adverse impacts of the Internet on democracy and development (Feenberg, 2012, pp. 15–16; Morozov, 2011; Mosco, 2017, Unwin, 2017). Before this period, only specific critical topics were initially explored from particular disciplinary lenses, e.g., the Intellectual Property Regime's controversies on digital content in developing countries, the e-Waste environmental problems, the psychological addiction to screens, among a few others.

Commonly, digital technologies are analyzed for their potential emancipatory power, but seldom are they explored from their destructive and oppressed nature (Rodriguez-Prieto & Martinez-Cabezudo, 2016, p. 7). This factor becomes significant as the ICT4D promoters have recognized that 70% of projects in ICT4D have failed in their objective (Heeks, 2018, p. 103). It is argued that as a field, it is interdisciplinary in nature, but at several levels is not always open to including disciplines such as critical theory, feminism, or Indigenous studies (Ali, 2014, p. 2; Heeks & Wall, 2017, p. 159; Moorosi et al., 2017, p. 234; Shade & Crow, 2005, pp. 1–2; Unwin, 2017, pp. 6–13).

In the context of Indigenous communities, some of these failed ICT4D projects that I found in the literature are:

- The Amazon Telehealth Program has provided medical care/advice to remote Indigenous communities in Brazil, which was led by the Brazilian Government (Del Alamo, 2003, p. 13).

- The use of mobile technologies in Latin America for the birth registration of Indigenous children by text (Kim et al., 2016).
- The National government in Australia implemented the Digital Education Revolution initiative to engage Indigenous peoples for cultural and educational purposes (Radoll, 2015, pp. 27–30).
- Internet.org by Facebook is an initiative to provide a mobile service called Free Basics, which “provides people with access to basic websites for free – like news, job postings, health and education information, and communication tools like Facebook” (Facebook, n.d.).
- The iconic project One Laptop Per Child which in the 2000s advocated “for the development of the capacities and literacy for the poor to be able to fully develop the ability to code, create hardware, and even build skills in robotics” (Ávila-Pinto, 2018, p. 18). This project involved the delivery of thousands of computers to developing countries, but due to the lack of the success of the project the foundation shut down in 2014.

In all these examples, the creation of the digital tools was created in alienation to local Indigenous knowledge without providing an integral perspective in the design of digital applications. The digital tool stopped being used after some time because it did not align with the Indigenous communities’ worldviews, and, on the contrary, the initiative was responding to external agendas that did not align with the self-determination of Indigenous peoples.

All the previous characteristics of rewesternization do not follow the principles of decoloniality because they do not challenge the positions of power between the “colonizer” and the “colonized.” As it was analyzed before, this type of approach reproduces the European missionaries’ mentality over Indigenous populations across the American continent. Moreover, ICT4D is based on the colonial concept of “development,” which perpetuates violence over the oppressed because it “identifies” what is suitable for the colonized. The idea of rewesternization is well-promoted in Western mainstream media channels and development agencies because it protects the established power systems. The idea of promoting digital technologies without a critical perspective tries to oversimplify the disparity of power and offer

simplified shortcuts for the historical colonial processes. In addition, while this phenomenon is being promoted in the West, a new colonial power has emerged in Asia, trying to become the new ruler force in the world: China.

5.2 Dewesternization

The dewesternization option is the same as rewesternization, but with the emergence of another hegemonic power. According to Mignolo (2011), this counter-reaction appeared in East and Southeast Asia in the late 1990s, but currently it is extended through China's economic, political, and epistemic support. Dewesternization is not anti-Western, but a movement in a different direction, a regaining of the confidence that the West destroyed from classifying China as the “yellow race” and the colonial wound of the Opium War (Mignolo, 2011, p. 34). Some radical authors call this approach the Beijing Consensus to react to the Washington Consensus (Morozov, 2011, p. ix). In other words, in this reaction to the colonial powers of Europe and the United States, the difference only relies on the change of the owner of the hegemonic power and infrastructure, shifting from what is known as the West to the East (i.e., China).

Concerning ICTs and digital technologies, the dewesternization response has been relentless:

1. The only country that can challenge the hegemony of American tech-companies is China. China has created the counterpart of the Big Five/GAFAM (i.e., Alibaba, Baidu, Tencent, Huawei, QQ, ZTE) (Mosco, 2017, pp. 86–89). These transnational companies have become the new digital rulers in Asia, counteracting many of the products and services of the West.
2. In China, foreign cloud businesses cannot invest directly in the cloud infrastructure. Moreover, domestic operators cannot share network data or personal information with their foreign partners (Mosco, 2017, pp. 91–92). Therefore, Chinese cloud services are growing, and they are taking advantage of big data and social media.
3. China is the leader in producing and selling solar panels (Mosco, 2017, p. 93). However, the solar panels are becoming toxic e-waste that affects the soil and water due to the high level of pollutants, such as lead and carcinogenic cadmium (Chen, 2017).

4. China has created the Asian Infrastructure Investment Bank, which provides an alternative to the International Monetary Fund, which the United States has led since its funding in 1945 (Mosco, 2017, p. 96). It is funding several technical infrastructure projects all over Asia and Africa. These projects are trying to overcome the monopoly of the United States in the Internet backbone and telecommunications.
5. China's environmental challenges are well-known. Specifically, regarding digital technologies, China contains the highest concentration of e-waste in the world (Heeks, 2018, p. 288; Mosco, 2017, p. 149).
6. The Chinese enterprise, Huawei, is the global leader in the fifth generation of cellular network technology (5G), (Kaska et al., 2019). This new technology promises to be the lead in mobile communications in the next five years. However, besides the exciting reaction of several technologists, there has been a significant number against this technology (Oxford Analytica, 2020).
7. The Chinese social media platform TikTok has massively increased its popularity across global markets in 2019 and 2020. The reaction of Western entities such as Facebook and the US Federal governments have echoed the expansion of this social media platform (Anderson, 2020).

Although the United States is still the leader in processors, semiconductors, and hardware, Chinese enterprises' important movements can significantly switch the momentum towards dewesternization. As a symptom of this colonial power shifting in the digital realm, several human rights activists have raised concerns about how, since 2017, around a million Uighur Muslims and other ethnic minorities have been detained in internment camps in the northwest region of Xinjiang, China. The detentions have been performed through mass surveillance using big data and all types of IoT devices, and people have forcibly been indoctrinated (Human Rights Watch, 2019). The Chinese government is legally enforcing manufacturers to share live-data with them for "public safety, facilitate industrial development and infrastructure, and prevent fraud in subsidy programs" (Kinetz, 2018). However, this data is allegedly used to unleash "war on dissent, marshalling [B]ig [D]ata, and artificial intelligence to

create a perfect kind of policing, capable of predicting and eliminating perceived threats to the stability of the ruling Communist Party” (Kinetz, 2018).

As this case exemplifies, dewesternization is becoming another hegemonic colonial power in the global context. This type of approach cannot be considered decolonial because it does not challenge the colonial structures, but, on the contrary, only shifts the concentration of power from one point to another region of the world without dismantling forms of coercion and violence.

5.3 The Contested Left

In this vision, Mignolo (2011) recognizes that although a “global left” began to consolidate after 9/11, the current spectrum of the left is vast (p.37). Although an in-depth exploration of the left is out of scope in this research, it is essential to mention that this intellectual movement has reoriented itself according to local histories, which interferes with European leftists’ universality. Today the Euro-American left, instead of positioning itself as the guiding light of the Third World, is looking for cooperation and dialogue across secular and theological lines; however, it has not yet unquestionably rejected universalism’s legacies (Mignolo, 2011, p. 38).

Moreover, several scholars who identify themselves with the left have contended to include the decolonial options within the left umbrella, but they have been challenged for several fundamental reasons. First, as it was mentioned earlier, the decolonial perspective rejects any claims of universalism or equalitarianism. The decolonial options are based on the localities and the community’s specific experience recognizing a pluriversality (Mignolo, 2011, pp. 38, 44). Decoloniality would never claim universal knowledge. Second, the European left has fostered and reconstructed the idea of “the commons” that reorientates previous socialism concepts.⁶¹ This view is problematic because it retakes resources from the margins and brings them to other groups for the sake of the open and shared “commons.” These groups commonly are privileged, such as intellectuals, researchers, politicians, or organizations in favour of open and “common” knowledge.

⁶¹ A further discussion of the tension with the commons will unfold in Chapter 9.

Third, the roots of capitalism (commonly known as the right) and communism (the left) are tied to the philosophy of the European Enlightenment. In contrast, the decolonial option starts from the local communal experience and recognizes the local/regional contexts limitations in other locations. Decolonial options reflect “to what extent Western political theories and political economy and Western universities (as institutions and curricula) shall be the model for socioeconomic organization and education” (Mignolo, 2011, pp. 43-44). Regarding the digital arena, there are several left projects that, although they do not directly confront the decolonial options, are differentiated by their origin. The most relevant examples are:

1. The Free Software Foundation (FSF) takes a political stand against proprietarian software and in favour of “the commons.” One of the most important innovations of this movement is the formal licensing procedure to share and develop “free” software (Lee, 2014, p. 339). This type of software “respects the user's essential freedoms: the freedom to run it, to study and change it, and to redistribute copies with or without changes” (Stallman, 2009).
2. Access Now is a global organization that “defends and extends the digital rights of users at risk around the world.” (AccessNow, n.d.). This organization provides direct technical support, comprehensive policy engagement, grassroots grantmaking, global advocacy, and convenings to fight for human rights in the digital age (AccessNow, n.d.).
3. On the other side of the spectrum, the radical cyber-realist collective rejects technology as an economic, social, and political solution to humanity's problems (Morozov, 2011, pp. 318–320).
4. South-South international collaboration in different ICTs projects related to health and education (Brown & Hussain, 2017, p. 804).
5. Wikileaks is an international organization that circulates secret information, news leaks, and classified media provided by anonymous sources and the Dark Web (Morozov, 2011, p. 121; Mosco, 2017, pp. 31–32; Rodriguez-Prieto & Martinez-Cabezudo, 2016, p. 259).
6. The Mukurtu Initiative, an open Content Management system built with Indigenous communities to manage and share digital cultural heritage by the Centre for Digital Scholarship and Curation at

Washington State University (Christen, 2012).

7. Decentralized and feminist alternatives for cloud computing (e.g. ZeroNet) using the devices of several users, such as personal computers and tablets (i.e. feminist infrastructures) (ZeroNet, n.d.).
8. Wikimedia Foundation is a not-for-profit organization with a “commitment to free knowledge” on behalf of all the communities and collectives worldwide. This organization is in charge of maintaining the Wikimedia sites (e.g. Wikipedia, Wikimedia, Wiktionary, Wikidata, among others) (Wikimedia Foundation, n.d.).

All the previous explorations are unusual reactions to coloniality that challenge transnational corporations’ hegemonic power and expect to decentralize the control of the Internet to more peoples and communities. As was explained previously, although these alternatives on the left have several commonalities with Indigenous peoples’ struggles, they are not framed in a decolonial framework and are not generated by/with/for Indigenous peoples. They might offer valuable lessons to the decolonizing movements within digital technologies, but Indigenous voices are not central in these proposals, and they do not offer emancipation and reattribution of Indigenous lands and forms of governance. Furthermore, the generalizations that are made by several universal leftist scholars do not allow other forms of knowledge to be incorporated in mainstream academia and society. In other words, the left accepts Indigeneity; however, the left does not reflect the ideals of decoloniality.

5.4 The Decolonial Options

We talk about decolonization, but we are talking about decolonization in a colonized context of learning, and so there is that inherent contradiction in what we are doing. (Kathleen Absolon as cited in Kovach, 2009, p. 85)

In the last decade, several academics and activists have been exploring the possibilities of the concept of decoloniality. These reactions are derived from examining the historical and current processes

of colonization across different contexts and times. However, decoloniality⁶² has grasped several epistemological areas of knowledge and acquired different meanings depending on the point of view where it is used (at the same time it is based on the principle of local experiences) (Mignolo, 2011). In other words, a universal definition of decoloniality would be an epistemic contradiction of the term itself.

Therefore, decoloniality is a multifaceted concept as groups around the world were oppressed and colonized in different forms and at different times (Crawford, 2002, p. 135). For Gray et al. (2008), decoloniality refers to the process of producing and consciously employing various tactics to liberate oneself from, or adapt to, or survive in oppressive circumstances (p. 284). In the same way, Wilson & Bird (2005) define decoloniality as “the intelligent, calculated and active resistance to the forces of colonialism that perpetuate the subjugation and/or exploitation of our minds, bodies and lands, and it is engaged for the ultimate purpose of overturning the colonial structure and realizing Indigenous liberation” (p. 5). Decoloniality is the rehabilitation of cultural practices, thinking, beliefs, and values that were abandoned, but are still relevant or necessary for survival and well-being (Gray et al, 2008, p. 284). Tuck and Yang (2012), however, assert that decoloniality “requires the repatriation of Indigenous land and life. Decolonization is not a metonym for social justice” (p.21). In the terms of Indigenous scholar Linda T. Smith, decoloniality means “long term processes involving the bureaucratic, cultural, linguistic, and psychological divesting of colonial power” (as cited by Mignolo, 2011, p. 52). In other words, decoloniality is accountable for Indigenous sovereignty and futurity (Tuck & Yang, 2012, p. 35). Moreover, Mignolo agrees that in the decolonial option, Indigenous communities recognize the opposing possibility, where they can coexist without denying each other or can become complementary dualisms.

⁶² The terms *decolonization* and *decoloniality* are used interchangeably in the context of this research. However, it is essential to mention that Walter Mignolo provides differentiation between the two concepts. Decolonization refers to the historical period when several imperial administrations were expelled from several territories, and they gained their independence as individual states (Mignolo, 2011, p. 53). Decoloniality is the “decolonization of knowledge” rather than expelling the colonizer from a territory, and it involves the delinking from the oppressive power of the authorities, economy, and subjectivity (Mignolo, 2011, p. 54). The mythology of the decolonization of the world hides the continuities between the colonial historical past and the current global colonial/racial hierarchies (Grosfoquel, 2008, p. 8).

In contrast, Western knowledge completely denies this option (as stated by Rodriguez-Prieto & Martinez-Cabezudo, 2016, p. 276).

In the same epistemic regard, Walter Mignolo claims that thinking decolonially avoids thinking disciplinarily (e.g., sociologically, economically, anthropologically, or artistically). Thinking decolonially is an-other thinking grounded in border epistemology rather than Greek philosophy (Mignolo, 2011, p. 11). It is to prevent using and locating Eurocentric knowledge in the centre of our understanding of reality. Various approximations to decoloniality might offer several commonalities; however, decoloniality is beyond a simple epistemic rehabilitation because its action-based origin includes a political and economic stand about self-determination, land, and nature. Decoloniality implies a separation, not just from the West, but also from approaches that encounter colonization differently than local experiences.

In the epistemic and academic realm, for Tuck and Yang (2012), decoloniality cannot merely be “grafted onto pre-existing discourses/frameworks, even if they are critical, even if they are anti-racist, even if they are justice frameworks” (p.3). Under this characteristic, decoloniality displaces itself from postcoloniality and left orientations because it goes beyond an only intellectual concept. Although Mignolo (2011) extensively displaces leftist reactions from decoloniality as possible differentiated scenarios for global futures (p. 35), he does not consider postcoloniality an option under those futures because of its epistemic construction and lack of materiality (p. 55–57). According to him, postcoloniality is only an option to postmodernity and poststructuralism (i.e., Western epistemic constructions). At the same time, decoloniality is a reaction to the discourse of “development and modernization” (the socioeconomic practice of capitalism in the majority of contexts) (p. xxviii).

5.4.1 Postcoloniality versus Decoloniality

Postcoloniality was born from the experience of British colonization of Egypt, India, and Palestine and the concept of postmodernity, a term coined in the late 1970s. In this respect, South Africa, South Asia, Australia, and other former British colonies naturally were included in the postcoloniality

discourse (except for the English- and the French-speaking Caribbean) (Mignolo, 2010, p. 16; Mignolo, 2011, p. xxvi). On the other hand, decoloniality is based on Indigenous peoples' historical presence and the massive African slave trade. Decoloniality and postcoloniality were linked to Islam and the decolonization of Asia and Africa during the Bandung Conference of 1955 as a form of resistance to capitalism and the West lifestyle (Mignolo, 2011, p. xxx, 55).⁶³ Postcoloniality focuses on the legacy of colonialism and imperialism, but it is grounded in the poststructuralism of Foucault, Lacan, and Derrida; therefore, it remains a project of critical transformation that remains epistemologically in Europe (Mignolo, 2010, p. 16).

The point of origin of the postcolonial is the experience of decolonization of India and owes much to the influence of Edward Said's influential *Orientalism*, Francois Lyotard's *The Postmodern Condition* and Gayatri Spivak's *Subaltern*, while decolonization originated from the experience of decolonization of the Third World and in the works of Afro and Afro Caribbean academics (Bhabra, 2014, p. 115; Mignolo, 2011, p. 55). Also, postcolonial prioritizes cultural issues over political-economic concerns, concluding in an idealistic perspective that obscures racial materiality (Ali, 2014, p. 2; Ali, 2016, p. 3; Mignolo, 2011, p. xxvii). In other words, postcolonial options generally do not consider land and occupations claims, and they do not seek for a political change in the hegemonic colonial structure: "the postcolonial pursuit of resources is fundamentally an anthropocentric model, as land, water, air, animals, and plants are never able to become postcolonial; they remain objects to be exploited by the empowered postcolonial subject" (Tuck & Yang, 2012, p. 19). Moreover, colonial English is the "natural" language of postcoloniality, while decoloniality originated in diverse languages in South America, the Caribbean, Latinxs in the United States, and Indigenous peoples in North America. As Mignolo (2011) and Bhabra (2014) agree, postcoloniality and decoloniality were built on a shared legacy of European coloniality; however, they followed different paths.

⁶³ The Bandung Conference was a conference from 18–24 April 1955, which took place in Bandung, Indonesia and gathered 29 countries from Asia and Africa (several of those countries were newly independent) (Indonesia: Ministry of Foreign Affairs, 1955).

Regarding technology, postcolonial thinkers incorporate the concept of intersectionality (e.g., race, gender, age, sexual orientation, and other identity categories) into the digital technology spaces. New academic research areas in digital humanities have emerged, such as postcolonial computing (Ali, 2016, p. 3) and critical code studies (Montfort et al., 2012; McPherson, 2012). Postcolonial computing examines culture and power issues at work in computing and some critical areas of Information and Communication Technologies for Development, Human–Computer Interaction, and design methods (Ali, 2016, p. 3).

An example of this type of reaction to digital coloniality is The Orlando Project, a database that “explores and harnesses the power of digital tools and methods to advance feminist literary scholarship” (The Orlando Project, 2019, p. 1). The Orlando Project is “full of interpretive information on women, literature, and culture, with about 8 million words of text in documents on the lives and writing of over 1400 authors, together with a great deal of contextual historical material on relevant subjects, such as education, politics, science, the law, and economics” (p. 4). The Orlando Project is an intersectional approach to digital literature that seeks to provide visibility to women's work. Another example is Palestine Open Maps, which is “a digital platform for map-based exploration and immersive storytelling” to visualize Palestine's historical maps before the occupation of their territory. This project seeks to combine digital map technologies to open and make searchable, for the first time, a uniquely detailed set of historic maps from the period of the British Mandate of Palestine and curate layered visual stories that bring to life absent and hidden geographies, in collaboration with data journalists, academic researchers, and civil society groups (Palestine Open Maps, 2019).

As these examples exemplify, postcoloniality and decoloniality have significant aspects in common, and the two terms are often taken as synonyms. As stated earlier, however, postcoloniality differs from decolonization in two central aspects. First, postcoloniality does not include a political stand on the reclamation of Indigenous lands and ways of life because postcoloniality only focuses on the repression's cultural and epistemic dimensions. Second, postcoloniality is based on Western philosophy and epistemology. Therefore, decolonizing digital technology must provide a unique and radical stance

based on Indigenous ways of being, knowing, and doing. After exploring the responses to digital colonization, the decolonial option appears as a disruptive form of reclaiming the digital spaces.

5.4.2 Decolonial Computing and Digital Decoloniality

Decolonial thinking “cannot be something other than the trajectory of a radical return of the control over labour/resources/product, over sex/resources/products, over authorities/institutions/violence, and over intersubjectivity/knowledge/communication to the daily life of the people” (Quijano, 2000, p. 573).

As shown in the previous sections, there are several reactions to digital coloniality around the world; however, these responses cannot be considered decolonial because of their different approaches, purposes, and epistemic departures. The decolonial option in any area of knowledge and application departs from local and “communal” experiences (Mignolo, 2011, p. 52). When the aspects of colonization and power dynamics intersect with digital technologies, the inquiry becomes a complex composition that is eager to harmonize the control, influence, and capabilities of the digital with the diasporadical and emancipatory character of the decolonial.

Digital technologies were imagined and conceived as emancipatory cultural instruments for progress and democracy. However, the current status of digital technologies worldwide proves that these tools have become modern forms of Western and dewestern colonization through the political, social, economic, and environmental value of data (i.e., data commodification). The possibility to imagine decolonial futures using and controlling digital technologies offers a new possibility of connecting local identities and reclaiming the digital future.

The following responses to digital coloniality are examples of how local communities react to the global power dynamics of digital technologies: (1) IntersectTO is a “community group for people who identify as Black, Indigenous, and people of colour (BIPOC) interested in technology.” IntersectTO wants to generate online and in-person spaces where BIPOCs can learn tech skills, find collaborators, and hold critical discussions on how technology affects colour communities (IntersectTO, 2018). (2) The Codex is

“a social media triptych” composed of three sites from scholar Jessica Marie Johnson: *African Diaspora PhD*, *Diaspora Hypertext*, and *Seeing Dark Matter* (as cited by Risam, 2015, p. 27). *African Diaspora* is a “curated blog highlighting scholarship and scholars in the field of Atlantic African Diaspora history” (Johnson, 2015). *Diaspora Hypertext* is a workspace of Johnson, a black feminist/radical woman of colour digital humanist and media maker interested in ways images and texts resonate across digital technologies (Johnson, 2015). Finally, *Seeing Dark Matter* explores “black visual culture across time and space. It is blogging black diasporic visual literacy” (Johnson, 2015). This postcolonial approach is an alternative digital creation to visualize black diasporas in virtual spaces and embody black identities on the Internet. (3) Mapping Black Futures is an “interactive resource and story mapping project, embedded in local Black geographies, and created for and by self-identified Black nonbinary youth and young women from across the G[reater] T[oronto] A[rea]. Through this project, participants have built and curated a living community archive of places, events, and memories meaningful to them and their communities. Using open-source mapping software and composed of a mixture of archival and original materials, Mapping Black Futures is a unique experiment in virtual placemaking and community building, while still grounded in real-life experiences and local Black histories” (Mapping Black Futures, 2020).

In the last five years, several initiatives have been launched to analyze the possibilities of decolonial options within digital technologies, surpassing various approaches discussed in the last sections. However, although the Indigenous responses to digital coloniality can be analyzed under this category, Walter D. Mignolo identifies a crucial factor to include in analyzing global futures. Although he includes Indigenous movements and responses within the decolonial option, he differentiates a fifth response called “spirituality” or “spiritual option.” This option is akin to the decolonial option, but he argues that “the spiritual option advocates decolonizing religion to liberate spirituality [...] [and] [t]he common ground for all these re-inscriptions of spirituality is the desire to find ways of life beyond capitalism and its magic of modernity of development that keep consumers caught in the promises of dreamworlds” (Mignolo, 2011, p. 62). The spiritual option is the one that links land, nature, and Spirit and does not aim to transform these entities into commodities or resources to be extracted. Mignolo

summarizes the spiritual option as “buen vivir/to live in harmony” that translates to different understandings and concepts in each Indigenous group (Mignolo, 2011, p. 63). For Indigenous authors, the decolonial option cannot be detached from this notion of Spirituality, and the responses cannot be disconnected from land and nature (Tuck & Yang, 2012; Kovach, 2009; Wilson, 2008; Absolon, 2011). Furthermore, the *Indigenous Friends Platform* development included Spirituality as a fundamental factor in developing digital space. In other words, Indigenous responses to coloniality are, under the perspective of Mignolo, decolonial, but also a spiritual option.

Mustafa Ali (2014, 2016) coined the concept and characteristics of *decolonial computing* based on the cultural definition of Mignolo. According to Ali (2016), decolonial computing is “a critical project, [that] is about interrogating who is doing computing, where they are doing it, and, thereby, what computing means both epistemologically (that is, in relation to knowing) and ontologically (that is, in relation to being)” (p. 5). This definition of decolonial computing centres the creator and territory in the digital creation and offers a disrupting form of conceiving digital technology. Paradoxically, Ali did not include empirical data and exemplification, locate the knowledge into the local context, or include other forms of knowledge creation that might imply a cultural hegemony.

In this regard, Rodriguez-Prieto & Martinez-Cabezudo (2016) started the analysis of decoloniality on the Internet through the proposal of the integration of other forms of digital design:

When considering the need to decolonize the Internet, we refer to the opening of new windows through which we participate in the Net. They involve not only new access or search systems but new products and the development of the voices that would participate in the more diverse design and understanding of the Net. [...] The Net is at risk of consolidating a neocolonial dynamic that excludes other cultural processes or approaches of life, not only of the voice on the Internet but the construction of it. (p. 274–275)

In the same line, Anita Say Chan (2018) asserts that one of the main complexities of decolonial computing is that this type of option includes diverse resonances and constructions within digital technologies that encounter the “digital universalist models that problematically elevate narrow versions

of Western and elite digital practice and innovation as the only relevant pathway for the future” (p. 2–3). As previously stated by Mignolo, the decolonial option rejects any form of universality, which commonly contradicts the notions that current socioeconomic models of digital technologies are promoting.

In relation to the communal nature of decolonial computing, Chan (2018) agrees that decolonial computing “foster[s] a decentering of the self as a generative asset towards the creative co-production of alternative futures” (p. 3). In other words, decolonial computing implies the transfer of the full control of those digital objects and the information within them from the individual to the communal level. Moreover, Chan claims that the decolonial computing projects do not emerge in any privileged innovation center (e.g., Silicon Valley, MIT, Wall Street), but in the “diverse lived realities and local complexities” (Chan, 2018, p. 3). Decolonial computing emerges in the margins of society, providing an emancipatory vehicle for marginalized identities who want to reclaim the digital as a tool for political action.

Finally, Chan (2018) urges scholars to “reimagine their roles as academic documentarians of movements (as actors still dedicated to a reproduction of dominant forms of modern epistemologies), but to decenter their own forms of knowledge practice by beginning to ‘think with [movements] theoretically and politically.’” (p. 2). Although her perspective provided a deeper understanding of the implications of decolonial computing, there is still a lack of knowledge of how digital technologies are created and designed. This conception and definitions are incomplete in the context of Indigenous peoples because they do not include the practical component of decoloniality and, more importantly, a clear path for implementation. This concept stays in Western academia without permeating into local communities and the analogue world. Therefore, this academic work aims to frame the decolonial reactions to coloniality, but moreover, wants to provide a map for how to create such forms of technology based on the local experience.

On the other side of the spectrum, critical theorist Alexandra Deem (2019) explores the politics of digital protest sociality in the No Dakota Access Pipeline movement using Elizabeth Povinelli's concept of geontopower as a form to connect decolonial and environmental interests. This author coins “digital decoloniality” at the boundary of the digital and analog spaces through the relationship between political

protest and land protection. She claims that this notion is “particularly relevant to the case of #NoDAPL, which I have argued works as an instance of digital decoloniality in its status not just as an act of resistance to the machinations of bio- and geontopower, but also of cross-conceptual and cross-ontological world-making” (Deem, 2019, p. 128). In this conception, Deem observes how digital technologies inflect the decolonial actions in the analogue world and how these intersections affect the environment. In this case, the practical component is included in the definition of digital decoloniality by considering the effects on the environment; however, the analysis does not reflect upon the consequences of digital tools and the politics involved in using these potentially oppressive tools. For example, the use of digital colonial tools such as Facebook and other social media instruments are not considered in the colonial context, with the result that digital platforms are portrayed as passive forms of engagement.

Interestingly, the authors of decolonial computing do not consider the practical relationships between the digital and the environment, while the author of digital decoloniality does not incorporate the implications of digital coloniality. This gap in the interconnectedness between both concepts has meaningful consequences in the conception of digital spaces for Indigenous peoples. On one side, the lack of connection to the analogue world solely focuses on the colonial instrumentality of digital technologies without positively impacting the communities and the environment. On the other side, the digital movements for land protesters portray social media and digital tools as neutral political and social actors.

Although the full analysis and relationships of this concept are in Chapter 10, the initial notion of decolonial computing and digital decoloniality frames the experiences created by Indigenous groups worldwide to differentiate them from other reactions. For this reason, in order to start the analysis of digital design, several decolonial and spiritual examples within the digital are framed in the next section. Last, in the next chapters, the analysis of decoloniality within the *Indigenous Friends Platform* story is incorporated.

5.5 Decolonial and Spiritual Options: Indigenous Resistances

As previously described, all the authors who explained the characteristics of decoloniality agree

that decolonization requires that the theory conceived in Western academia should be disrupted and displaced by the local and communal practices in order for being considered decolonial (Ali, 2016; Chan, 2018; Gray et al., 2008; Mignolo, 2011; Smith 2005; Tuck & Yang, 2012). Decolonial author Walter Mignolo calls this form of knowledge practice *Doing through Thinking and Thinking through Doing*. As I explained in the last section, Indigenous reactions to digital coloniality are not only decolonial but also Spiritual answers. In other words, the theoretical conception of decoloniality and digital technologies must be attached to the local (and communal) practice and the Spirit and land.

In this respect, Erica Wortham claims that digital technologies and Indigenous worldviews have a separation that has “played an impressive role, not just on the debates and understandings of ‘appropriation’ and ‘acceptance’ of digital technologies by Indigenous peoples around the world, but it marks the discourse and the history of colonization in a profound manner, and maybe, totally” (Wortham, 2016, p. 235). According to Bang et al. (2013), several academic scholars perceived that Indigenous peoples were anti-technological and that the exposure to new technologies would serve hegemonic functions and digital capitalism (p. 707). Dyson (2004) claims that these technological pessimists are trying to protect power hierarchies and keep Indigenous peoples isolated from technology (p. 69). Moreover, according to Landzelius (2006), Indigenous peoples are presently seeking political power and recognition of their human rights based on their cultural difference, and, to this end, digital technologies are giving them the opportunity for real-time dialogue (p. 17). Indigenous peoples are “reclaiming and repurposing” digital technologies towards meaningful communal goals. Moreover, communities are engaging and innovating digital technologies in the form of asserting the right to self-determination (Bang et al., 2013, pp. 707–708).

The *Indigenous Friends Platform* offers that practical component into this academic work and explains how the Spirit and land were incorporated into the digital design. Although the analysis and intertwining of this initiative are explained throughout the next chapters, recognizing common practical threads in the decolonial application of digital technologies by/with/for Indigenous communities is relevant to locating this project in relation to other localities and actions around the world. Without the

practical cases of decoloniality and digital technologies, the intersections of those concepts would not be fully covered, and the over-consideration of Western epistemologies would be fostered within the analysis.

The multiple cases presented in this chapter are organized into five categories according to their instrumentality/materiality (i.e., their primary purpose(s) for which they were developed or implemented). These categories are seeking sociopolitical organization and representation, communicating with people, revitalizing Indigenous cultures and knowledge(s), promoting economic development, and providing public services. It is essential to recognize that some of the aspects in each project and initiative might not be fully decolonial, especially in their design, but they still have the primary characteristics presented earlier in the chapter.

5.5.1 Sociopolitical Organization and Representation

The first category of usage that I found is how digital technologies support Indigenous collectives to organize themselves in several social and political forms. Some of these grassroots initiatives demand self-determination in the analog/real world, but others require digital/virtual sovereignty over their data and knowledge. These sociopolitical claims seek to increase the representation of Indigenous peoples at the national and international levels in the digital and the real world.

The most emblematic examples include:

1. In Latin America, the well-known Zapatista movement in Mexico disseminates their political claims and agendas, and raises money, through the Internet (Delgado & Becker, 1998; Salazar, 2007, p. 22).
2. Native use of geographic information systems (GIS) in the US to map and track problems and resources in their communities in order to make decisions about their future (Palmer, 2009).
3. In Asia, the approach of Tebtebba or Indigenous Peoples' International Centre for Policy research and education (the head office is located in Manila, the Philippines) uses social media to embrace Indigenous political activism in different regions such as the Philippines and Latin America

(Soriano, 2011).

4. The Guatemalan Mayan Organization works collectively to create consciousness about Mayan political rights and to support Mayan politicians to promote laws to benefit Indigenous communities through the Internet (Monasterios, 2003, p. 5).
5. The Confederation of Indigenous Nations of Ecuador was also able to coordinate and organize mass mobilizations to seek Indigenous representation through the Internet (Salazar, 2007, pp. 22–23).
6. Rainforest Connection Initiative, in a partnership with the Temb  Tribal Reserve in Northern Brazil, monitors the rainforest against illegal deforestation through Android Mobile Phones located on the trees (Rainforest Connection, n.d.).
7. FPIC.INFO is a website owned by Indigenous peoples in Canada that provides information and resources about the Free Prior and Informed Consent (FPIC) as a self-determination tool to assist Indigenous communities in decision-making. This portal is in English, French, and Spanish (Free Prior and Informed Consent [FPIC], 2017).
8. The First Nations Information Governance Centre in Canada is a non-profit organization operating with a mandate from the Assembly of First Nations to assure that every Indigenous Nation achieves data sovereignty in alignment with their worldview (First Nations Information Governance Centre, 2016).

Across all of these political approaches, several common strategies were found. First, it is common to create a pan-Indigenous conceptualization at the national and international levels in order to gain representation in different political and economic circles. Second, the ability of self-representation in virtual spaces allows breaking stereotypes and increasing the awareness of the Indigenous resurgences. As Soriano states, “Indigenous communities [in digital technologies] can articulate claims, express their identities and aspirations, strategically mobilize, and solicit broader support” (Soriano, 2011, p. 33). Most importantly, Indigenous communities are finding forms of political organization within the “digital” that support the organization of local communities and governments through the creation of digital networks.

5.5.2 Communicating with People

The migration of Indigenous populations to the cities is a phenomenon that is happening globally (Gundermann-Kröll and Gonzalez-Cortez, 2008). The continuous movement of peoples outside of their places of origin generates a continual disconnection between their identities. Therefore, people under these circumstances use digital technologies to connect to their communities because they offer the opportunity to connect using their traditional languages and worldviews. Some cases of digital initiatives that support Indigenous peoples to communicate with other members are the following:

1. Brady et al. (2008) examined how mobile phones are fitting with Indigenous cultures and orality in the remote island of Torres Strait in Australia where Indigenous peoples use phone calls and text messages in the local language Kala Kawa Ya to communicate with their families.
2. The Indigenous Internet users of the Sioux Lookout region of Northwest Ontario, who are using social networking sites to share their experiences with their families (Molyneaux et al., 2014).
3. The Indigenous villagers of Papua New Guinea who are using mobile technologies to communicate privately over vast distances to their relatives (Watson & Duffield, 2016).
4. The Northern Territory communities in Australia, where young Aboriginals are using mobile phones to access the Internet and interact with their family members when they are out of their villages (Taylor, 2012).
5. Cultural Technological Centre of Iktakop is an initiative in Chiapas (Mexico) that is offering Open Community Wi-Fi Networks to access the Internet and the ability to communicate with the members who live outside of the community (Iktakop, n.d.).

A common characteristic of all these communication experiences is that Indigenous peoples use digital technologies to maintain relationships and networks with relatives and friends who are far from them. With the proliferation of mobile technologies, members of a community can keep their identity and Traditional Knowledge through the usage of their Indigenous languages (e.g., for several community members it is the only way they can speak their mother tongue). Presently, this phenomenon is possible

because the technology is cheaper than in the early 2000s, and the infrastructure of cellular phones has improved since 2005 (Brady et al., 2008). In the words of Alia (2012), “networking is a process which indigenous peoples have used effectively to build relationships and disseminate knowledge and information. Networking by indigenous peoples is a form of resistance” (p. 19).

5.5.3 Revitalizing Indigenous Cultures and Knowledge(s)

Indigenous peoples are designing digital technologies to maintain the spatial, social, and cultural dimensions of Indigenous Knowledge. The preservation of this type of wisdom is possible due to digital technologies’ capability to store orality through video, image, and sound, which provides the opportunity to preserve the fundamental dimensions of such knowledge. Moreover, I found that social media is becoming a new form of archiving information about Indigenous peoples. Some examples of Indigenous revitalization include:

1. The Inuit initiative of ISUMA TV that uses the Internet to preserve, promote and revitalize Inuktitut language and culture (Alexander et al., 2009; Petersen, 2012).
2. The Nanisiniq Inuit Qaujimagatuqangit Adventure Website (literally translated as: “that which has long been known by Inuit”), which is being used to reconnect youth with their traditional Elders and make transnational connections with people around the world (Alexander et al., 2009, p. 240).
3. The Sioux Lookout region of Northwestern Ontario, where Ojibway, Oji-Cree, and Cree communities are using the Internet, creative hardware (e.g., a syllabic keyboard with a layout in Cree and Oji-Cree), and social networking sites to generate social capital and then community resilience (Molyneaux et al., 2014).
4. The Mapuche’s websites such as ADMALEN-KAXAWAI, FOLIL Foundation, XEG Centre and NEWEN Enterprise, which promote Mapuche culture through the creation of authentic content directly from the Mapuche people (Salazar, 2002, pp. 72–73).
5. The mobile Indigenous journalists (mojos) in the Northern Territory of Australia, who are trained

- to record, edit, and publish news stories from their iPhones to the Internet (Borum, 2016).
6. The InSight Sápmi, a mobile application that recreates a Sami linguistic landscape in Sweden (Cocq, 2016).
 7. The Kōrero Māori is a machine learning project to revitalize the Māori language. It consists of a web platform, multimedia broadcasting, and mobile applications to teach computers the pronunciation of the Indigenous language (Kōrero Māori, n.d.)
 8. IntraBach is a high school initiative to compile stories in Spanish and Tzeltal in the community of Ocosingo, Chiapas, Mexico using offline and online WordPress (Intrabach, 2018).
 9. Video Games in Africa are used as forms of storytelling and identity purposes (Turner, 2015, pp. 40–60).
 10. The CyberPowWow, where Indigenous peoples and allies virtually used to gather to meet and share knowledge and create networks (Gaertner, 2015).

A commonality among these cultural approaches is that most of them are located in Indigenous communities that are part of developed countries such as Australia, Canada, and the United States. The projects of Mapuches in South America and IntraBach in Mexico are hosted on servers located in developed countries and are subsidized by private foundations. Perhaps the first reason for this phenomenon is related to the infrastructure, as better technical conditions exist in developed contexts (e.g., accessibility to bandwidth, access to servers and qualified personnel to manage the technical support). Second, Indigenous peoples' extreme socioeconomic situations in developing countries may pressure Indigenous groups to use digital technologies for other objectives such as seeking social and political representation, maintaining contact with their communities, and improving their economic contexts.

5.5.4 Economic Development

Digital technologies are providing Indigenous peoples opportunities to market local products and services in the global society. Indigenous communities have decided to use digital technologies for their

economic growth. These initiatives are controversial regarding their decolonial character because although they are communal and local efforts, measuring their economic and financial values can imply an overlapping with Indigenous values and worldviews, and therefore, an embracement of capitalist Western epistemologies.

Some authors argue that this type of usage is not decolonial because it makes online spaces and Indigenous cultures more persistent into commercialization and commodification (Soriano, 2011, p. 34), embracing the oppressors capital and colonial structures, although the conditions of the communities might get improved. However, these initiatives have departed from the communal decision's self-determination, and they seek to respect Traditional Knowledge; therefore, I consider these examples under the umbrella of the decolonial option.

Some examples are:

1. Tosepan-Titataniske in Puebla, Mexico, which is a union of co-ops formed by more than 10,000 Indigenous peoples promoting local products to national and international markets through the Internet (Monasterios, 2001; Union de Cooperativas Tosepan [UCT], n.d.).
2. The Otavalo Initiative in Ecuador selling local products through a website (Del Alamo, 2003, p. 18).
3. The Guatemalan initiative of "Tesoros Mayas," seeking new markets online for artisanal products of Mayan women (Del Alamo, 2003, p. 19).
4. The MAZA Cryptocurrency Network Services allows "Sovereign Tribes Worldwide" to take advantage of cryptocurrencies (Alcantara & Dick, 2017).

5.5.5 Providing Public Services

A fifth usage category was integrated into this type of review in previous analyses: Access to Public Services (Mayoral-Baños, 2016), but a problematic common characteristic of this type of approach was found in most of the examples: most of the initiatives are conceived, owned, and controlled by organizations, governments, or individuals that are external to the Indigenous communities (i.e., a

rewesternization approach under ICT4D). This aspect means that these applications do not provide self-determination and sovereignty over the data or infrastructure because of the projects' paternalistic nature. Also, cultural assimilation processes might have quickly started during the stages of design and implementation (Brady et al., 2008). Therefore, in order for these initiatives to be considered part of a decolonial and spiritual option, they must demonstrate that they are providing full control of the service, data, and infrastructure to the Indigenous communities throughout the design, implementation, and maintenance.

In this category, the number of initiatives is significantly decreased due to the maintenance cost and financial investment required to acquire the initial infrastructure. Some of the initiatives are:

1. Kuhkenah Network [K-Net] is a network that “provides information and communication technologies (ICTs), telecommunication infrastructure and application support in First Nation communities across a vast, remote region of northwestern Ontario as well as in other remote regions in Canada. This private telecommunications network supports the development of online applications that combine video, voice, and data services requiring broadband and high-speed connectivity solutions” (Beaton et al., 2015; K-net, n.d.). K-net is owned by the First Nations council of Keewatinook Okimakanak (KO).
2. Community Mobile Telephony is an initiative where several Indigenous communities in several states in Mexico (mainly in Oaxaca) invest in community-built and community-owned mobile phone infrastructure (Rhizomatica, 2015); these collaborative initiatives own their infrastructure and employ community members to maintain and support the network.
3. The innovative Tamaani Satellite Internet in Northern Quebec led by Inuit people that provides internet connection to several communities (McMahon & Mangiok, 2014).

From the decolonial perspective, the initiatives to provide public services break the paternalistic cycle within several relationships between the national states and Indigenous communities. These initiatives provide full control of the digital objects and the data by keeping the infrastructure and the economic capital at the local and communal levels. As a common thread, I found that Indigenous peoples

are investing their resources into public digital infrastructure towards mobile communications under this category. This finding perfectly aligns with the perception that several community members expressed to me throughout the development of the *Indigenous Friends Platform*. Why are mobile communications being embraced by Indigenous peoples?

5.6 Conclusion: Towards Decolonial Computing and Digital Coloniality

In this chapter, I introduced the responses to digital coloniality through a case analysis of digital practices that collectives and individuals are implementing around the world as a reaction to structures of power based in the groups established by decolonial author Walter Mignolo. Through this exploration, I demonstrated that there are diverse responses to digital coloniality that are not decolonial nor spiritual experiences. However, I could distinguish some practices as examples of decoloniality in digital technologies, and in particular, I found diverse forms of Indigenous responses. In these cases, the details of the methodologies to create digital initiatives are not well described, the community members are not involved in the technical implementation, nor do the cases provide further results about their technical practices and design. In conclusion, in the literature, there are experiences of coloniality and decoloniality; however, there is an absence of decolonial *ways of doing* digital technologies.

Digital technologies, as hegemonic colonial forces, are generating several responses from different regions and identities. In the first place, two hegemonic digital powers are trying to emerge as the absolute leaders in the digital era: The United States fostering a new form of *rewesternization* and China that aims to generate a new global power in Asia through a *dewesternization*. In the middle of this battle, the different leftist collectives worldwide are trying to reimagine a universal progressive way of conceiving the digital future and the Internet. In the same way, postcolonial options emerged as forms of anti-oppressive, anti-racist, and anti-sexist theoretical reactions, commonly through initiatives in digital humanities. Thereafter, I presented the principles of decoloniality where I demonstrated that this complex concept firmly counteracts some general values of digital technologies, such as universality and standardization, because the decolonial option always moves towards the local and community

alternatives. Within this context, I presented the concepts of decolonial computing and digital decoloniality and offered an initial departure to differentiate the decolonial options. Several decolonial authors, such as Ali, Rodriguez-Prieto, Martínez-Cabezudo, and Chan, describe several characteristics of decolonial computing based on the definition of Mignolo, but paradoxically, they did not include any empirical data that might imply a cultural hegemony. In contrast, Deem, the author who coined digital decoloniality, explains the linkage between the digital spaces and environmental movements, but she does not consider the colonial aspect of digital technologies.

Nonetheless, the Indigenous responses to digital technologies could be differentiated as decolonial and spiritual options through the case analysis. After this exploration, several examples and practices of Indigenous peoples using digital technologies were explored and classified to facilitate the analysis. I found a significant number of digital projects that can be considered decolonial and spiritual under Mignolo classifications. These projects have been led by/with Indigenous peoples around the globe since approximately 2000 and are being used to embrace and engage the collectives' communal growth and adapted to local communities.

It is within these epistemic tensions that this project's location emerged to start responding to the analysis of the *ways of doing* decoloniality and digital technologies. This project's practicality locates the *Indigenous Friends Platform* in the global context as a local and communal response from Toronto's urban Indigenous community. Thereby, how is it possible to imagine a decolonial and spiritual option in digital technologies in this context? Throughout several years of reflection and an evident increase of academic material on the intersections between digital technologies and Indigenous communities, the transdisciplinary practical character of this digital tool became more insidious because various aspects of the technical design of the platform beyond the coding of the software were solidified: the need for infrastructure, policies around data protection, and the embodiment of Indigeneity within digital spaces. The previous theoretical exploration allowed me to have a process of reflection (thinking) in order to implement the changes into the digital tool (doing). In the next four chapters, the Tech Anishinaabe Medicine Wheel based on the four decolonial principles (i.e., Decolonial Infrastructure, Digital Software

Braid, Decolonial Cyberspace, and Indigenous Data Sovereignty) that were concluded through the local experience of the *Indigenous Friends Platform* aims to provide the conceptualization of decolonial forms of doing digital technologies.

Part 4: The Tech Anishinaabe Medicine Wheel as a Technical Framework

In Part 4, I introduce the Tech Anishinaabe Medicine Wheel and propose four design principles that should be considered in the conception of Indigenous digital technology based on the story of the development of the *Indigenous Friends Platform*:

1. Waabinong (East) – Digital Software Braid (Chapter 6),
2. Zhaawanong (South) – Embodiment of Indigeneity (Chapter 7),
3. Epanishmok (West) – Decolonial Infrastructure (Chapter 8) and
4. Kiiwedining (North) – Indigenous Data Sovereignty (Chapter 9).

For this purpose, I start this section with a rationale for how the story of the *Indigenous Friends Platform* (Part 2) was related to different academic authors (Part 3) and resulted in creating the Tech Anishinaabe Medicine Wheel.

Thinking through Doing the *Indigenous Friends Platform*

The storytelling of the *Indigenous Friends Platform* describes how in the context of Indigenous youth in Toronto, the decolonial design of an Indigenous mobile application needed to be examined from an Indigenous point of view. The journey of reflection of the *Indigenous Friends Platform* continued in 2019 when I started thinking about the diverse aspects and dimensions that the Spirit of the mobile application had entailed throughout the five years of development. In order to conceive the mobile application as a virtual Tipi with a Spirit, the digital creation needed to integrate several crucial factors of Indigeneity into digital conception and design. Every time that I needed to share the experience of development, especially about the considerations and dimensions of the *Indigenous Friends Platform* as an Indigenous mobile application, I was required to integrate the conception of the app as a technical being, a virtual Tipi, with a Spirit and how the IFA’s community must take care of it. Several cultural principles of Indigeneity are not easy to convey in the digital environment, however, due to several colonial principles embedded in digital technologies. Moreover, I realized that digital technologies could easily involve an accelerated colonial effect as previously discussed in Chapter 4.

Through the continual process of doing through thinking and thinking through doing, I went back to my notes about this research journey, and I realized that the teachings of the Anishinaabe Medicine Wheel as a framework of balance were similar to the app’s development process. As a technical being, a virtual Tipi, the mobile application was also considering several technical aspects or dimensions to be in equilibrium. Moreover, those dimensions happened in a particular order that marked several phases in the development process where different stakeholders were integrated into the story (Table 3).

Table 3

The Stage and Phases of the Story of the Indigenous Friends Platform and their Relationship to the Anishinaabe Medicine Wheel

Stage	Phases	Dimensions	Directions	Digital principles
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The birthing ceremony and how the Spirit came to be	Communal Action	Start the digital creation in a <i>good way</i> .		
Tipi Ceremony as a software methodology	Ceremony	Spiritual	Waabinong (East – Yellow)	Software Methodology
The app and Embodiment of the Spirit	Identity	Emotional	Zhaawanong (South – Red)	Embodiment
The not-for-profit as home for the app Spirit	Community / Relationship	Physical	Epangishmok (West – Black)	Infrastructure
Sharing knowledge and data within the app	Protocols	Intellectual	Kiiwedinong (North – White)	Data
Education of others: INDIGital Program	Communal Action	Giving back to Indigenous communities		

Note. The stages of creating the platform can be chronologically followed in the different sections of Chapters 2 and 3.

I argue that those particular moments or stages in the development and implementation process were aligned with the four dimensions of the Anishinaabe Medicine Wheel. Furthermore, these four stages are delineated by two communal actions that although they are not directly part of the mobile application, they marked and provided the necessary context for Indigenous digital creation: the birthing ceremony at CASS,⁶⁴ as a way to start in a *good way*, and the INDIGital program⁶⁵ as a form of giving back to the community the learned teachings of the mobile application. Although they are not part of the mobile application itself, they provided and nurture the integration of the space as an Indigenous form of knowledge. These actions placed and hold the research under the five ethical “R”s: Relationships,

⁶⁴ The birthing ceremony set up the environment to start the digital design of the mobile application based on the need of a specific community, but moreover, the birthing ceremony marked the starting point where the teachings of the Medicine Wheel were central to the app's conception. This moment allowed me to begin the journey in a *good way*.

⁶⁵ The INDIGital program allowed the IFA to share the experiences of development to other Indigenous youth, but most importantly, it has allowed other Indigenous youth to acquire skills and training to develop digital applications.

Responsibility, Relevance, Respect, and Reciprocity mentioned in Chapter 1 because these communal actions involved starting from community needs and moreover the requirement to reciprocate the acquired knowledge to different community members in an accessible form.⁶⁶

I believe that the ethical integrity of the Anishinaabe Medicine Wheel can be translated to the digital Tipi—i.e., technical being—in the way that it provides the necessary design guiding principles that digital technologies require in order to advance the self-determination of Indigenous peoples, and most importantly, to amalgamate digital technology with Anishinaabe ethics and protocols—i.e., Elder Marshall's perspective of the Two-Eyed Seeing. The Anishinaabe Medicine Wheel, as it is understood by Elders and Knowledge Keepers, has infinite number of teachings, and therefore, I claim that it can frame the perspective of this “technical being.” In other words, when the mobile application is conceived as a virtual Tipi with a Spirit it is conceived as a technical being that has four dimensions: software, embodiment, infrastructure, and data. Similar to a human being, this technical being requires to be in balance with its dimensions in order to avoid harming others and sustain itself in the long term. Furthermore, these principles can also be conceived as the necessary elements that a technical application should consider becoming a decolonizing digital tool.

In Western academic environments, the incorporation and analysis of all the previous matters can be separated into different disciplinary streams. However, from an Indigenous point of view, it is essential that in order to aspire to create an Indigenous framework of doing/thinking digital technologies, the dimensions need to be reflected as a whole for comprehending their connections and interactions as well as finding how one another affect each other. The process of doing through thinking and thinking through doing became central in the process of encompassing these dimensions because it entailed a constant operation of coding the digital space alongside community members.

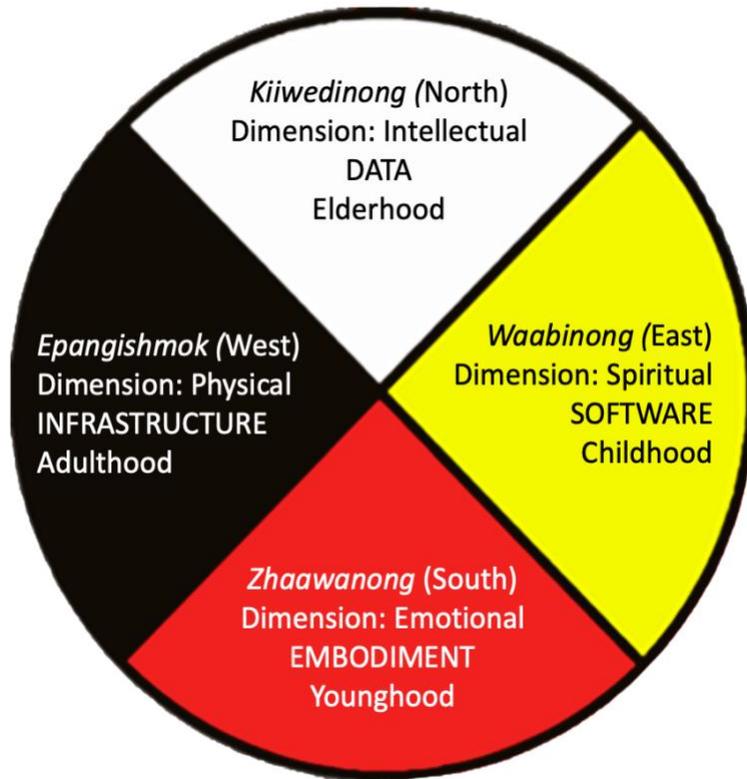
The purpose of this section of the thesis is to articulate a way of doing digital technology through the analysis of the application of the principles of the Anishinaabe Medicine Wheel and its relation to the

⁶⁶ The full exploration and analysis of those communal actions are out of the scope of this research.

story of the *Indigenous Friends Platform*. Because this digital Tipi has a Spirit, just as with any other being this Spirit needs to be nurtured by the community and in balance. The relevance of those teachings became directly connected to the mobile application when I realized the importance of these principles in the digital realm, linking the phases of development with the Medicine Wheel dimensions via doing through thinking, thinking through doing. Therefore, I claim that these phases and their principles can be articulated as the Tech Anishinaabe Medicine Wheel (Figure 18). The Tech Anishinaabe Medicine Wheel is composed of four main dimensions: Waabinong (software), Zhaawanong (Embodiment/Land), Epangishmok (Infrastructure,) and Kiiwedinong (data). Therefore, this section is organized in four chapters of the dimensions of the Tech Anishinaabe Medicine Wheel that compose the technical application.

Figure 18

The Tech Anishinaabe Medicine Wheel



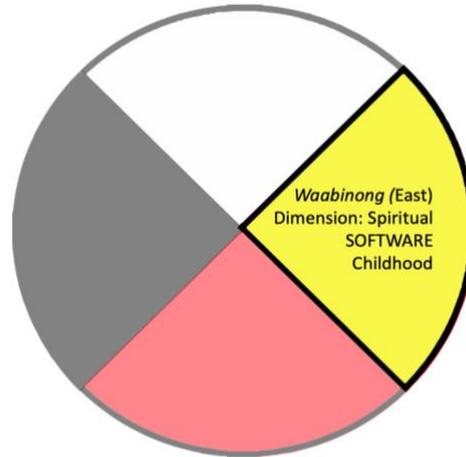
These four dimensions are the conclusion of an extended analysis of the different aspects to consider in developing the *Indigenous Friends Platform* by connecting this experience to scholars in several disciplines such as Computer Science, Media Studies, and Indigenous Studies. Moreover, the endless opportunities for presenting the progress of the results in several spaces and conferences provided me with several moments of reflection and prioritization. To start this journey, this section starts in the Waabinong (East) – “Digital Software Braid,” where I explore how Traditional Knowledge must be integrated into the software methodology as a form of ontological and axiological foundation. Then I moved to the Zhaawanong (South) – “Indigenous Embodiment in digital spaces,” where I analyze the required elements to embody Indigeneity in digital spaces through the principles of presence, caring, sharing, orality, and reclamation of land. In the third section, I shift to the Epangishmok (West) – “Decolonial Infrastructure,” where I dissect the elements of decolonizing infrastructure, and I state the opportunities and challenges of mobile infrastructures in the context of Indigenous peoples. Finally, I end on the Kiiwedionong (North) – “Indigenous Data Sovereignty,” where I describe the challenges and efforts to protect Indigenous data within digital spaces.

Chapter 6

Waabinong (East) – Digital Software Braid.

Figure 19

The Waabinong (East) - Digital Software Braid



Software design and engineering are fields of study where different actors and stakeholders have inquired and analyzed the best practices and methodologies for creating digital programs and solutions. This chapter aims to shape the importance of interweaving Traditional Knowledge and software engineering through the Cree Tipi Ceremony in the context of the *Indigenous Friends Platform* in order to provide a first design principle on a way of doing digital technology. This chapter focuses on the Waabinong, eastern direction or “childhood” to commence the decolonial conceptualization of digital technology through the Tech Anishinaabe Medicine Wheel (Figure 19). This stage is where the sun rises, the journey of life begins, and the spiritual dimension resides. On June 30, 2016, Professor David McNab’s declaration that the mobile app has a Spirit raised several inquiries about how to take care of this virtual being. This moment marked the starting point of a new articulation based on the Anishinaabe Medicine Wheel starting in the Waabinong direction—the Spiritual dimension. Is this mobile application only a piece of software and data within a piece of hardware? If this mobile application is something beyond those components, what are the dimensions of this virtual Tipi/being? What is the proper

infrastructure to take care of a tool such as the *Indigenous Friends Platform*?

In this dimension, as a first step of the journey, I focus on the initial process that allowed the conception of the Spirit of the mobile application: the *digital braid* between software engineering and Traditional Knowledge that happened through the mobile development of version 1 and the incorporation of the Tipi Cree ceremony. Although the description of the process is already written in my master's thesis (Mayoral-Baños, 2016), a process of further reflection was necessary to understand the implication of this epistemic encounter and the implications of this type of design within digital technologies and software design. Since its early conception stages, the software industry has favoured white-male individuals who excluded non-Western forms of knowledge and focused overly on monetization and profitability (Benjamin, 2019, pp. 160–173). Thereby, the software applications commonly do not reflect the needs of marginalized communities. The software programs commonly do not consider local worldviews, and communal values are not considered part of the software architecture. In the end, most computer programs are not being used by local and marginalized communities for their own growth, despite the fact that members are engaged in different ways with digital technologies. The analysis of software creation practices to decolonize digital tools, therefore, opens the space to begin deploying, re-conceiving and appropriating computing programs. Moreover, the analysis of software creation offers a first insight into how most computer programs are failing to address the cultural and social needs within Indigenous communities.

At the beginning of this section, a general overview of software engineering applications is explored to understand the perspectives and cultural biases that these practices entail in creating computer programs. Next, the findings of several authors of good-practices and imaginaries about the relationships between Indigenous Ways of Knowing/Doing and digital technologies are framed to provide some possible insights for Indigenizing software applications. As a tangible example of these practices, the proposal of the Tipi Ceremony as an Indigenous software methodology is exposed.

6.1 Software Engineering as a Western Conception

The strengths and effects of digital devices cannot be understood without looking at the management and manipulation of data via the coded programs in the hardware: the software. Moreover, any person who engages in a digital device interacts with a form of software (it involves all the instructions and data required to tell a device how to work). Therefore, the software has a direct impact on the deployment and usage of digital technologies. The difficulty for marginalized communities is that this type of knowledge is mainly produced based on Western epistemologies and methodologies that do not consider other forms or Ways of Knowing/Doing the world. Therefore, they do not address the sociocultural aspects of local and community members. When computer programs aim to be deployed into these communities, members need to learn and adapt themselves to this knowledge structure that commonly does not match communal and traditional values. Moreover, most computer programs are mainly economically and profit-focused and driven by global market requirements.

Based on these socio-political aspects, in order to aspire to decolonize software, the exploration of software development is required. This examination allows the recognition of several colonial practices attached to the process of writing digital code and thereby ended being embedded in the cultural/knowledge product (i.e., the computer program). The possibility of incorporating other forms of Knowledge and Ways of Knowing/Doing into the sociotechnical product and its creation process opens new possibilities in the conception of active decolonial / Indigenous digital spaces.

To start the analysis, the concept of software is explored. Software is “all or part of the programs, procedures, rules and associated documentation of an information processing system” (ISO/IEC/IEEE International Standard, 2017). Software is a type of written knowledge that enables an information system to work. Like any other knowledge, software needs to be produced, and in the case of the software development industry, there are several approaches and ways to develop software.

Software engineering is the “field doing research in methods and tools for developing software systems” (Bischofberger & Pomberger, 1992, p. 1). According to the ISO/IEC/IEEE Systems and

Software Engineering Vocabulary (2017), software engineering can be defined in two forms: (a) the “systematic application of scientific and technological knowledge, methods, and experience to the design, implementation, testing, and documentation of software;” and (b) “application of systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software.”

Through the Software and Systems Engineering Committee of the IEEE⁶⁷ Computer Society, software engineers, and scholars have created a standard universal document to define how software should be developed and created. This document is called the guide to the Software Engineering Body of Knowledge (SWEBOK) and frames the industry of software and design. The most recent version of SWEBOK is the 3.0, which the IEEE Computer Society Board of Governors approved in December 2013 and then published in 2014 (Bourque & Fairley, 2014, preface). This document defines how software is developed in the industry and academia worldwide, based on IEEE standards. This paper establishes the themes and topics required to develop certificates, licences, and curriculum around software engineering. This standardization process was done through approximately 30 editors and 150 reviewers from 33 countries (45% of contributors were based in the United States) (Bourque & Fairley, 2014, xxi-xxxi).

Alongside this document, the IEEE, in association with the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), created the ISO/IEC/IEEE Systems and Software Engineering Vocabulary in 2010 (1st edition) and 2017 (2nd edition) to provide general definitions of technical terms around software systems. It has been agreed to divide software development or software engineering into fifteen knowledge areas (KAs): three foundations KAs and twelve general KAs (Table 4). The general knowledge areas are the standard bodies of knowledge that are used in software development practice, while the foundation KAs are the required bodies of knowledge that were used to conceive the field of software engineering (Bourque & Fairley, 2014, pp. xxxi-xxxii).

⁶⁷ IEEE stands for the Institute of Electrical and Electronics Engineers.

Table 4*Software Knowledge Areas*

Foundation Knowledge Areas	General Knowledge Areas
1) Computing Foundations	1) Software Requirements
2) Mathematical Foundations	2) Software Design
3) Engineering Foundations	3) Software Construction
	4) Software Testing
	5) Software Maintenance
	6) Software Configuration Management
	7) Software Engineering Management
	8) Software Engineering Process
	9) Software Quality
	10) Software Engineering Professional Practice
	11) Software Engineering Economics
	12) Software Engineering Models and Methods

Note. These software knowledge areas are taken from the Software Engineering Body of Knowledge (SWEBOK) (Bourque & Fairley, 2014).

Although all the areas of software engineering have a relationship to the methodology used to design and deploy the *Indigenous Friends Platform*, from the perspective of software engineering, the only area that involves the ways software is created is Software Engineering Models and Methods. From an Indigenous perspective, however, a holistic approach needs to be considered, e.g., the software requirements cannot be disconnected from the maintenance, or from the economics, and vice-versa. The principle of relationships within Indigenous Ways of Knowing/Doing becomes relevant because of the interconnection among all the different software components. Moreover, non-Western forms of knowledge shall be considered under KAs.

According to the SWEBOK (2014), software engineering models and methods “impose structure on software engineering with the goal of making that activity systematic, repeatable, and ultimately more

success-oriented.” The usage of models provides procedures to solve and analyze technical “problems.” The methods present an approach to the requirements, design, construction, testing and verification of software (Bourque & Fairley, 2014, pp. 9–11). These days, there are several procedures, practices, and methods to create software. Although this work does not want to provide an exhaustive explanation of their scopes, it is relevant to present a chronological description of them in order to provide a general framework to incorporate decolonial / Indigenous Ways of Knowing/Doing into software design.

During the 1960s, a software crisis developed from the high expectations in computing and the scarcity of systemic software development processes. Consequently, the research area of software engineering was invented for the domain that makes inquiries in methodologies for developing software systems. A historical overview of different methods and models are listed in Appendix D.

6.2 Indigeneity and Software Engineering

In the previous section, the overall exploration of software engineering knowledge areas was explained. In the framework of decolonizing digital technologies, however, the question of how these practices can relate to Indigeneity remains unclear. Brady and Dyson (2016) claim that digital technology as a medium has both restricting and enabling implications. The domination of one factor over the other relies on several components, including the motivations of the creators, the deployment context, and the technical autonomy and capability of the people who use the technology (p. 64). In other words, digital technology can be colonial and decolonial at the same time, but the software design, the developer and the user play a crucial role in their possible emancipatory character. The importance of this analysis resides in the fact that Indigenous peoples around the world are engaged with digital technology daily, and therefore its exploration from an Indigenous lens is required to design better applications within Indigenous contexts and to aspire to decolonize digital technologies (Cajete, 2000, pp. 1–3). However, if the software is a construction that is built based on Western science, is it possible to reconcile software as a digital tool with Indigeneity? How do Indigenous peoples perceive and position themselves in relation to software, and most importantly, how do these sociotechnical apparatuses figure in local/decolonizing frameworks?

6.2.1 The Colonial Aspects of Software

Martinand asserts that digital technology is attached to the social, cultural, historical, and political environment that produced it (as cited in Dyson, 2004, p. 59), meaning that software has the potential to carry the colonial and hegemonic practices as “software” is designed with Western values. In the same regard, Unwin (2017) argues that digital technologies (ICTs) have social, cultural, economic, and political values derived from the creation process of particular individuals and companies (p. 23). However, marginalized communities are frequently not part of this creative process. Bang et al. (2013) state that these communities, especially Indigenous groups, have become only consumers of technology instead of becoming ICT makers or digital creators (p. 706). Moreover, software solutions that are developed for marginalized groups are commonly conceived in a university or corporative environment, far from the contexts of deployment, and therefore the software programs fail to deliver the anticipated outcomes (Unwin, 2017, p. 7).

Specifically, in regard to software and Indigeneity, the inquiry about Indigenous software is absent. The academic exploration of Indigeneity and digital technology has only focused on three main areas: (a) the digital divide about access and dissemination; (b) issues around data sovereignty and intellectual property; and (c) the underrepresentation in STEM careers (Bang et al., 2013, p. 706). These perspectives on intellectual property and simple discourses about access and promotion, i.e., digital divide, minimize the epistemic complexities of software and data in ways that would enable technological hegemony (Bang et al., 2013, p. 710). However, some authors have emphasized some contentious characteristics between these bodies of knowledge. According to Craig Howe (1998), cyberspace, as the place created with software, is not a place for Indigenous cultures until its universalistic and individualistic foundation is restructured to include spatial, social, spiritual, and empirical dimensions through the understandings and the needs of Indigenous communities (p. 27).

Furthermore, Salazar asserts that software is mainly written in English, and it is not adapted to the language necessities of Indigenous communities (2002, p. 75; Rodriguez-Prieto & Martinez-Cabezudo,

2016, pp. 273–277). For Iseke-Barnes and Danard (2007), software is a colonizing thought because it strives for dominance over humanity through the creation of artificial connections that isolate human beings from the universe (p. 34). In the same line, Wemigwans (2018) claims that although there are several projects about Indigenous media, she argues that commonly, they are based on Western technical software or Internet projects, and they merely insert Indigenous content into Western frameworks (Wemigwans, 2018, pp. 1–4). Reframing these different types of epistemic content can potentially have a significant influence on how the digital culture is conceived. Critical internet author Geert Lovink (2009) asserts that although there has been an enormous growth in Internet use, the Internet remains “mainly shaped by the engineering culture of IT programmers” (p. 197). Therefore, the incorporation of Indigenous creators on the Internet, both as coders and content creators, can reshape Internet cultures for Indigenous peoples.

Although some of the software KAs explored in the previous section of software methodologies, consider several aspects of the user needs, and centralized the individual over the technical dimension, these forms of creating software do not fit Indigenous worldviews. The prioritization of the individual over the community (i.e., the individual user has all the power over software design), and the profit and performance orientation, as well as the lack of local recognition (i.e., universal standardization), are some of the aspects that do not allow the connection of Indigeneity with the sociotechnical apparatus of software. The standard methodologies and practices of software creation do not consider any relevant sociopolitical and cultural aspects in their creation and design. However, as I explore in the next section, some authors propose a different approach to software creation.

6.2.2 Repatriation of Software as a Digital Braid

Despite the fact that there are no proposals for Indigenous software methodologies (or ways of doing Indigenous software), I began from the perspectives of several Indigenous scholars who have proposed several methodologies to approach science and technology from an Indigenous perspective. As Cajete (2000) claims, Indigenous Science and Technology are terms that “can include metaphysics and

philosophy; art and architecture; practical technologies and agriculture; and ritual and ceremony practiced by Indigenous peoples both past and present” (p. 2). As Snively and Williams (2016) assert, Indigenous science and technology have to do with sovereignty and social justice. This movement toward sovereignty is about acknowledging, healing, and rebuilding Indigenous Nations oppressed by colonization (p. 22). Moreover, Indigenous Peoples have engaged with several tools and technologies since time immemorial to adapt to the weather and incorporate technical developments from other particular groups (Bang et al., 2013, p. 707). Indigenous technology is “where our knowledge keeper, our Elders and our cultural producers are the architects and engineers of that construction process” (Wemigwans, 2018, p. 57). According to Suzukovich III et al. (2015), Indigenous technologies can be defined as follows:

Indigenous technologies are those technologies employed by the Native inhabitants of a country or region, which constitute an essential part of its cultural heritage. The design process is relatively simple: one must observe nature to learn from and work with its natural designs. Approaches in Indigenous technology look at more than just a single accomplishment and instead look at the whole nature, its entirety as a system, and how this system works cohesively. Practicing Indigenous technology means aiming to work within and with the ecosystem and the forces of nature that drive it, not overcoming, dominating, or replacing these. Ultimately Indigenous technologies are also those technological theories, practices, and methods based on experience and experimentation in response to local conditions. (p. 200)

In the same line, for the *Indigenous Friends Platform*'s users and creators, Indigenous technology implies cultural practices and experiences:

“Well, growing up, we did a lot of pow wows, and I slept in teepees, we smudged, and we danced. And I never grew up with the Internet, because nobody had phones or whatnot. But Indigenous technology for me was a truck with a trailer, filled with furs, and everybody gets their bundle, and we go, and we dance, and we pray. That was the technology that I thought; this is my people.” (Stefan Piercey, personal communication, May 19, 2020)

“[I]ndigenous technology is enhancing the understandings of knowledge to educate people. It has its own protocols, but it's being connective, inspirational. It can have its goods and its bads with it. It's just the way that you want to perceive it or the way that

you want to project it out there.” (McKenzie F. Toulouse, personal communication, May 13, 2020)

Postcolonial and decolonial philosophers have claimed that the study of science and technology under the colonizer's epistemic lens would not suit the Ways of Knowing/Doing of the oppressed (Ali, 2014; Ali, 2016). Therefore, Indigenous Ways of Knowing/Doing technology is a practice that has been done for millennia, and, therefore, I claim this paradigm can continue to be applied in contemporary digital technologies, but it requires the innovative and non-industrial methodologies for technological creation. In the case of the *Indigenous Friends Platform*, the form of creation and implementation of the software was through the traditional housing technology: The Cree Tipi. This form of Indigenous technology incorporates several forms of Knowing/Doing that get translated to the digital realm when the raising ceremony is followed.

In order to explore this approach, I analyze the approaches that digital creators and practitioners have used to decolonize and Indigenize digital media, as well as the tensions encountered between the Indigenous and Western epistemic systems. According to Wemigwans (2018), the revitalization of Indigenous Ways of Knowing/Doing is fundamental for Indigenous resurgence and decolonization. She claims that producing knowledge projects outside of epistemological imperialism is fundamental in order to succeed in decoloniality (p. 58). In other words, decolonizing technology cannot be conceived without using Indigenous knowledge and Ways of Knowing/Doing. An approach that doesn't incorporate these aspects would simply be considered a non-Indigenous technology within an Indigenous context. In this regard, the *Indigenous Friends Platform* informs about how Ways of Knowing/Doing are embedded into digital technology:

“I feel like one of the largest things that the app has done and is moving towards is informing the universities or institutions about our ways of knowing, and even our “traditional ways of knowing” might sound outdated. But we have always been adapting as Indigenous people for hundreds of years. And now we're moving even digitally adapting our ways of knowing into their system. And we're killing it. I feel like the trajectory and the way that I would love to see the app. Of course, with that trajectory,

with that power in the way that we're moving forward, allyship, and true allyship. True partnership.” (Stefan Piercey, personal communication, May 19, 2020)

However, Bang et al. (2013) assert that the relationships between computational thinking in Western knowledge systems and Indigenous worldviews need to be explored further in order to grasp the relationship between different forms of knowledge (p. 709). Interestingly, Berners-Lee, who is considered the father of the Internet, described web science as two dimensions: a social protocol and a technological protocol (as stated by Wemigwans, 2018, p. 5). In this regard, Landzelius (2006) states that digital technologies, such as software, can be “Indigenized” if creatively integrated into the everyday practices and beliefs of local culture, causing Indigenous peoples to appropriate digital technologies for their objectives (p. 2–5). Bang et al. (2013) recognize that tools, techniques, and technologies are part of all communities (p. 725), and, therefore, they must be able to be transformed and adapted to the local socio-cultural context. In accordance with Srinivasan, “Information in Indigenous communities is not facts to be known; information or knowledge is the experiences of communities, and thus along with knowing comes responsibilities shaped by complex systems of kinship, age, and gender, among other social dimensions” (as stated by Bang et al., 2013, p. 710). Consequently, I state that technical knowledge systems should be created based on acknowledging the social dimensions of the communities and their experiences. The incorporation of the Tipi Ceremony in the digital development of a mobile application brings the opportunity to assemble the social and spiritual dimensions of Indigenous worldviews into the technological protocol.

In relation to the connections between the medium (i.e., the technological devices and the software) and the socio-cultural dimensions of Indigenous struggles, Magallanes-Blanco and Ramos-Rodriguez (2016) analyzed Indigenous media as forms of socio-technical assemblies and political activism that requires the interweaving of several elements: “Indigenous media is a form of a challenging form of political activism. [...] It requires the consideration of a socio-technic assembly that involves and interweaves technologies, resources, social organizations, legal frameworks, as well as bureaucracies, knowledge and images” (Magallanes-Blanco & Ramos-Rodriguez, 2016, p. 93). According to Salazar,

Indigenous media, as a form of Indigenous technology, becomes a cultural construction appropriated according to the social values and relations (as stated by Bang et al., 2013, p. 709). Magallanes-Blanco and Ramos-Rodriguez, in the context of Indigenous cinema, conceived Indigenous media as a distinct form of political engagement controlled by Indigenous peoples. “[Indigenous cinema] does not simply stand for films produced by Indigenous filmmakers but refers to a distinct politically engaged mode of filmmaking that has emerged from the shared Indigenous experience of exclusion in postcolonial settler states and allows for film practices and images that are controlled by—and do justice to—Indigenous peoples and their concerns and customs.” (Magallanes-Blanco and Ramos-Rodriguez, 2016, p. 237).

I argue, therefore, that the creation of Indigenous media requires clustering the technicality of the devices and software with the complex sociopolitical frameworks of Indigenous communities. The potential of creating socio-technical objects within Indigenous media provides the opportunity of potentially doing justice for Indigenous peoples. In other words, this form of approach presents the opportunity for a technical entity such as software to become a tool for emancipation. In the specific case of the IFP, the idea that a social media platform can encompass Cree protocols, and follow Indigenous ethics, provides the opportunity for this tool to be a form of liberation and a form to claim space within digital technologies.

In the realm of Indigenous media, Wemigwans (2018) coined the term *digital bundle* as a way to describe Indigenous technology strategies where Traditional Knowledge is bundled with digital media tools. Throughout the process of production and delivery, the digital bundle acknowledges sacred teachings⁶⁸ and incorporates Elders and Knowledge Keepers while honouring traditional protocols (p. 34–46). In the same regard, Bang et al. (2013) propose that the restoration of technology to Indigenous

⁶⁸ Sacred teachings are “Traditional Knowledge passed on through ceremonial protocols. Only Elders and Traditional Teachers who have been gifted the Indigenous Knowledge and teachings in this way can share those teachings publicly and transfer them. This type of Indigenous Knowledge is often considered as belonging to the community and held in trust by Knowledge Keepers and Elders expected to abide by the cultural protocols entrusted to that knowledge. Personal knowledge is acquired through individual educational pursuits, empirical processes, or the gifts that one is born with or has received through revealed knowledge, which includes spiritual knowledge gained through dreams, visions, intuitions, and meditations” (Wemigwans, 2018, p. 3).

paradigms through an engagement process with “original technologies” has the potential of decolonizing the learning experiences of Indigenous youth to enable them to reconceptualize technology as makers rather than only consumers.⁶⁹ These forms of intervention conceive community members as architects or engineers of technology. Bang et al. (2013) call these developments processes of repatriation (p. 710–712).

Regarding Indigenous technologies, Bang et al. (2013) concluded that in order to succeed in this form of technology repatriation in online learning environments, the process should consider the following four design principles:

1. Engage original and everyday technologies: this principle disrupts the narrative that Indigenous technologies are less sophisticated than Western Technologies. It involves the usage of original technologies (e.g., weather, agricultural, fire technologies), as well as the understanding of their meaning and purposes (p. 717–718).
2. Explore the nature and uses of technologies: this principle incorporates other methods or forms to know the world. It considers the “natural senses” as the way to know the world and not necessarily “test tubes and chemicals.” It also involves centring people and relations to place (i.e., land) (p. 718–720).
3. Situate technologies in their cultural and socio-historic contexts: according to the authors, the discourse of “new technologies” can reify colonial forms of looking for “new territories.” Therefore, the technology requires to be situated in the cultural and socio-historic contexts where it is being developed (p. 720–721).
4. Engage in community-driven goals and use technology as a tool toward those goals: this principle suggests that technology must motivate community-driven goals where conditions for transformative praxis can emerge (p. 721–724). Indigenous youth need to become architects of

⁶⁹ Original technologies are “those technologies which community members saw and knew as deeply situated within Indigenous communities and tended to be placed in the contexts of origin stories and narratives of tribal communities (Bang et al., 2013, p. 710).

technologies instead of being only users (p. 706).

In order to conceive and conclude these principles, Bang et al. started from the experiential practice of two different projects: (1) Wemigwans created the multimedia design project: Four Directions Teachings, where Elders and Knowledge keepers were involved in the guidance and design of the project (Wemigwans, 2018, pp. 12–18); (2) Bang et al. developed a community-based design research project in the Chicago American Indian Community to explore the conceptualization and use of technology in the science learning environment in urban settings (Bang et al., 2013, p. 712). In the context of the IFP, I assert that these principles of repatriation were inserted continually throughout the development process in the engagement of the everyday technologies, such as the Cree Tipi, socio-cultural ethical values, and community-driven goals:

“Well, the way I want to put it is it’s a reclamation tool, [...] to reclaim themselves in a digital space where it’s not just about how Western society sees it and how it’s always been built that way in its... Even when it comes down to building those technologies from the ground up, just creating your own scripting languages or coding language in your own language or anything like that, it’s building technology from the ground up with an indigenous worldview.” (Mitchelle Gegwetch, personal communication, May 4, 2020)

I claim that the IFP as a form of repatriation engages everyday technologies (mobiles) that incorporates other methods (the Cree Tipi Ceremony) that situate technologies in the socio-cultural context (the local community at York University) and engage in community-driven goals. In other words, I assert that the Tipi Ceremony as a software methodology can be considered a digital software braid that allows the integration of ceremony and Traditional Knowledge into the digital space.

6.3 Conclusion: The Tipi Ceremony as an Indigenous Methodology for Software Design

The Tipi ceremony followed in 2015 and 2016 to conceive the *Indigenous Friends Platform* (Mayoral-Baños, 2016) is a form of Indigenous methodology for software design because, as it was explained throughout this section, this *way of doing* technology incorporated the learning and teachings of an Indigenous technology, the Cree Tipi, and it involved a process of repatriation that allowed the

conformation of a digital software braid. This moment brought the ceremonial dimension of Traditional Knowledge and marked the starting point of a new articulation based on the Anishinaabe Medicine Wheel starting in the Waabinong direction—the Spiritual dimension—because this braid signified that the *Indigenous Friends Platform* was conceived in ceremony and with a community Spirit who needs to be nurtured and acknowledged throughout their development and maintenance. The Waabinong direction of the virtual Tipi was the software creation of the digital being through a digital braid that intertwines the knowledge of Software Engineering models and the Cree Tipi Raising ceremony. In other words, the first step of decolonizing digital technology in the context of this work is to Indigenize how software programs are encoded to allow people to be communicated to, informed, or entertained through the technical being. This initial state marked the childhood of the digital application and framed the scope of the project.

As a digital tech professional, Michelle Gegwetch stated:

[T]here's the uniqueness, bridging the gaps. And I guess the whole methodology behind it, that's something I like, too, is the fact that it was not just built with the standard way of software development, which is something I'm actually very well versed in because of my background in software QA or software quality assurance. So, I know most of the inner workings of how software is built and how it goes to the process of starting is just seedling idea and becoming a full-blown project.” (Michelle Gegwetch, personal communication, May 4, 2020)

The possibilities of understanding software development as a ceremony creates a resonance within Indigenous contexts because it displaces the profit-driven purpose of the majority of software applications into a communal-driven goal to benefit community members and well-being. This paradigm shift allows us to easily incorporate the ethical principles that communities foster within their worldviews because the community's growth as a whole becomes the primary goal. Moreover, this software repatriation process engaged original and everyday Indigenous technologies, such as the Cree Tipi, in the conception of the digital world. It involved the usage and meaning of the Tipi to explore the possibilities and scopes of mobile applications. Moreover, this way of doing technology centres people and relations to place through situating mobile technology in the cultural and socio-historic context of Indigenous

peoples in Canada. This contextualization displaced the Western epistemic understandings of digital coders and injected the conception of Indigenous worldviews, which entails the possibility of reshaping digital technologies in a decolonial way.

Furthermore, the *Indigenous Friends Platform* centres the community goals as its primary focus. It creates the possibility to use Indigenous knowledge and teachings to solve the issues that digital technologies generate about centring profit over peoples. It is essential to mention that this Way of Knowing/Doing does not pretend to universalize or propose a unique form of creating software within Indigenous contexts but exposes the possibilities and capacities of using and adapting local Traditional Knowledge into digital design and development.

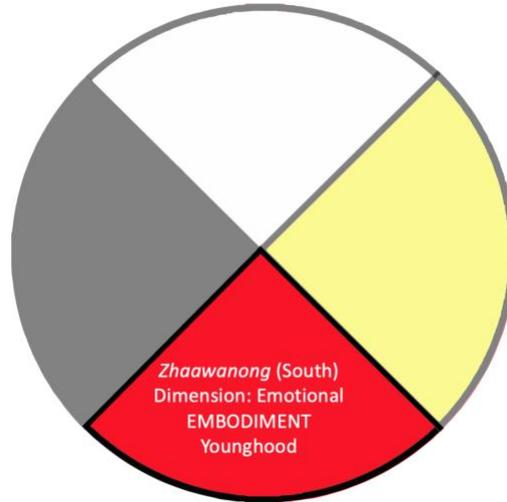
After this initial state, the Waabinong / Eastern direction, the *Indigenous Friends Platform* evolved to the Zhaawanong / Southern direction (midday or noon) by considering several aspects of Indigeneity to be translated into the digital space. The path of having Spirit now needed to grow from childhood to youthhood, thinking about how Indigeneity and land are translated within the digital era.

Chapter 7

Zhaawanong (South) – Indigenous Embodiment in digital spaces.

Figure 20

The Zhaawanong (South) – Indigenous Virtual Embodiment in Digital Spaces



The concept of embodiment entails several meanings and considerations for different stakeholders that navigate digital technologies. This section aims to shape how the digital space is conceived from an Indigenous perspective and the cultural references to embody this concept in creating digital technologies. This analysis is provided through several testimonials of users and the perspectives that were taken into consideration to design various features within the *Indigenous Friends Platform (IFP)* as well as several authors who have explored Indigenous embodiment. This section focuses on the Zhaawanong southern direction—youth—to continue the growth of the technical being (Figure 20). This stage signifies when the sun is on the top of the sky (at noon), and the trees have come awake and produce their leaves. In this stage, the life of the technical being is awake, dancing, and everything is new and growing fast. In the case of this technical being, the virtual Tipi, after the software ceremony and the Spirit came to be, there were several questions about how the users of the platform were going to bring their identity in the digital space in order to interact with each other in an ethical form as well as the necessary features to be developed within the space to respect Indigenous worldviews and values.

As has been demonstrated in this academic work, according to Oglala Sioux scholar Craig Howe (1998), cyberspace was not a place for Indigenous cultures until its universalistic and individualistic foundation was restructured to include spatial, social, spiritual, and empirical dimensions through the understandings and the needs of Indigenous communities (p. 27). Furthermore, Salazar (2002) asserted that software was mainly written in English, and it was not adapted to the language needs of Indigenous communities (p. 75). In the same line, Wemigwans (2018) claims that although there are several projects about Indigenous media, commonly they are based on Western technical software or Internet projects, and they only insert Indigenous content into Western frameworks (p. 41). Therefore, the Indigenous identities and their embodiment in cyberspace is not an implied topic that can be easily conceived. Is it possible to embody Indigeneity in the digital space?

In the first section of this chapter, I present the embodiment concept in the digital space and the tensions between Indigenous bodies and cyberspace. In the same section, I analyze the process of embodiment through an academic articulation between several authors that explore Indigenous embodiment in the digital space and the four original principles that were present in creating the *Indigenous Friends Platform*: presence, caring, sharing, and orality (Mayoral-Baños, 2018).⁷⁰ After this analysis, I explain why an additional fundamental aspect needed to be incorporated in the embodiment process. Due to the environmental impact that digital technologies have around the world reclaiming land in the digital space became the final consideration. I conclude by showing how Indigeneity can be embodied in digital technologies.

7.1 The Embodiment of Indigeneity in the Digital

Recreating digital spaces in the context of Indigeneity relies on the representation of Indigenous peoples to respect Indigenous worldviews. Manuel Castells (2004) claims that “the new power lies in the codes of information and in the images of representation around which societies organize their institutions, and

⁷⁰ It is essential to mention that this space analysis started in 2016, which ended in a book chapter published in 2018. Although the structure remained very similar, several aspects are revisited and analyzed with a deeper lens.

people build their lives and decide their behaviour. The sites of this power are people's minds" (p. 425). The question regarding digital spaces is how digital technologies can embody these dimensions in the virtual space in order to tell our stories and history. The transformation and the creation of the virtual Indigenous body compel us to think about translating several aspects of the real body into the digital space and allow us to connect with other beings that might not be in the same physical location. However, the virtual body's re-connection into the real world is also fundamental to reclaim Indigenous land and understand the implication of digital technologies in our environment and communities. This reclamation needs to happen as soon as the software is running because Indigenous knowledge and worldviews are being shared and interconnected in the digital spaces as soon as the users interact with one another. In this regard, Bonnie Rogers envisions this embodiment process as an act of rewriting history and proclamation of the space:

The thing that's so powerful is this is another opportunity [IFP] for us to reclaim a space and rewrite history digitally, [...] Because we would think "Oh, if we could go back in time, I wouldn't sign those treaties," or "I wouldn't do this." But I feel like, moving forward, this creates that opportunity as to claim that space again and look at some of the things that happened in our history and learn from them and try to move forward with this new digital space in ways that would empower us and setting those healthy boundaries for ourselves to maintain that this is our space, and that's what I see in reference to land and this app is that this creates that opportunity online because I feel like this is the way of the future is the digital world. (Bonnie Rogers, personal communication, May 25, 2020)

To understand the requirements of this process of embodiment is essential to understand how the process of Indigenous embodiment has been understood and envisioned. Performance professor Diana Taylor (2003) asserts that the process of Indigenous embodiment participates in conveying social knowledge, memory, and identity pre- and post -writing (p. 16). Moreover, she states that Indigenous bodies are sites of intersection joining the individual with the collective, the private blurs into the social, and memory and knowledge are joined (p. 80). This fundamental characteristic reveals the importance of community and cultural identity for Indigenous bodies. One individual body cannot be isolated from other

bodies, and they need to be interconnected not only to others but to their cultural identities. Taylor (2003) asserts that Indigenous bodies were excluded and marginalized through their transformation into sites of shame by European colonization, which is based on writing texts and narratives that devalued and rejected notions of embodied practices (p. 16). She highlights that Indigenous bodies were not avoided through the discourse of colonization, but they were misplaced and used through turning them into a site of shame, especially Indigenous women's bodies. In the same aspect, Cherokee Two-Spirit and Queer writer Qwo-Li Driskill (2008) reflects on the historical process of Indigenous bodies and European colonization:

Colonization is a kinesthetic reality: it is an act done by bodies and felt by other bodies. Violence is not an intellectual knowledge, but rather one that is known because of damage done to our skin, flesh, muscles, bones, and spirits. It is both our homelands and our bodies that are violated through colonization. If colonization is a kinesthetic wounding, then decolonization is a kinesthetic healing. (p. 155)

In the specific case of the IFP, the embodiment of Indigeneity and the users into the digital space happened through four different values or considerations that were connected to the cultural practices of the users in the space: presence, caring, sharing, and orality. These values allowed users' Indigenous bodies to intersect the individual with the collective, the private into the social, and reconnect memory and knowledge. More specifically, these four values or considerations brought the importance of community and cultural identity through a kinesthetic reality based on the body that opens the possibility of healing. This embodiment was constructed through: (a) the idea of "presence," by bringing their identity through different cultural constructions such as the profile and the user guidelines; (b) the action of "caring" about one another in the digital space through the peer support and the daily quotes; (c) the dynamic form of sharing knowledge as embedded actions in the design, such as FAQ, resources, and events; and (d) the possibility of orality via the sharing circles and the hyperlinks everywhere in the space.

As Taylor and Driskill claim, damage to Indigenous peoples and bodies through colonization affects collective memory, identities, and social knowledge. Therefore, any type of digital embodiment must imply the healing of Indigenous beings. According to Statistics Canada (STATCAN), in 2016, over

50% of Indigenous peoples are not in their community of origin in Canada (quoted in Mayoral-Baños 2016, p. 54). This phenomenon is a consequence of several socioeconomic constraints present daily at the community level. This rate signifies the detachment of Indigenous youth from their families, culture, social circles, and communities. Alongside the violence of separation, this factor provokes that Indigenous youth continue to experience higher rates of marginalization, mental health crisis, substance abuse, and suicide in comparison with their non-Indigenous counterparts (Snowshoe et al., 2016, p. 2).

How can Indigenous bodies be healed if they are physically far from their communities? If Indigenous peoples' embodiment within digital spaces is a possibility, then a new significant opportunity emerges for healing. Although I do not want to imply that the healing will happen uniquely through the virtual space, the digital embodiment might offer a support tool to trigger that process in real life.

The embodiment in digital spaces has been discussed predominantly in media studies, but only a reduced number of Indigenous authors have studied the relationship between Indigenous corporality and digital spaces, especially with the emergence of Indigenous media. Before mobile devices, most Indigenous scholars and activists argued that Indigenous embodiment in digital spaces was commonly not possible because Indigenous paradigms are based on the body and land. Therefore, the virtual embodiment of Indigenous bodies used to entail a loss of corporality due to the lack of orality and connections between the digital and nature. Craig Howe (1998) asserted that virtual spaces were not a place for Indigenous bodies because people usually anonymize their presence (which means that their relationships are not acknowledged and recognized), and he concluded that digital spaces do not contain spatial, social, spiritual, and experiential dimensions (p. 21–22, 27). Moreover, Diana Taylor (2003) stated that the Indigenous bodies were at risk of disappearing in digital spaces that elude embodiment because the spaces were based on a writing culture (p. 16).

As part of the embodiment analysis, critical scholar Lisa Nakamura (2010) stated that digital technologies, especially the Internet, in the 1990s, were depicted as a raceless, genderless, disembodied space (p. 337). Therefore, these spaces were politically forced to remove Indigenous peoples and cultures. Non-Indigenous Argentinian scholar Garcia-Canclini (2005) stated that Indigenous bodies and identities

are used as signs of opposition to digital technology and globalization at the beginning of the 1990s. He asserts that Indigenous cultures, and therefore Indigenous bodies, are seen as forms of historical and cultural preservation of the nostalgic past, whereas digital technologies are used as the iconic symbol of the future and progress (p. xxviii). Garcia-Canclini suggested that Indigenous cultures are a form of historical folklore that opposes digital technology and capitalism. In other words, Indigenous bodies and identities are reduced to a form of static and ahistorical cultural preservation.

However, this phenomenon rapidly shifted with the emerging of several forms of digital media in the mid-2000s. Valeria Alia (2012), an American journalist and scholar, documented several Indigenous embodiment expressions using new media in several geographies around the world by Indigenous grassroots groups and activists. Moreover, since the proliferation of mobile devices and social media in the late 2000s, there has been a significant shift in the understandings and conceptions surrounding Indigenous identities and digital spaces in ways that no longer focus on the threat of losing Indigenous corporality and connection to the land; these days digital technology has the capability to serve as an extension of the physical body. In what might seem to be a total disembodied process, “technology” is not merely an interaction with machines; instead, it can extend the interaction of people with people, and further, as I explore later in this section, interaction with land and territory.

In this regard, Australian scholar Laurel Evelyn Dyson (2016) claims that mobile technologies enhance communication among Indigenous individuals and communities and extend educational and health services through the embodiment of Indigenous peoples in digital spaces (p. 18–45). Furthermore, social media is being used within First Nations to facilitate communication between family members and friends because this type of technology enables oral communication across different locations in Turtle Island (Molyneaux et al. 2014). In this context, Kevin Kemper (2016) states that mobile technologies create shared spaces where people can easily access language and culture from everywhere. These spaces are not just written media, but they are designed with several modes of expression and representation of bodies in different media, such as pictures, sounds, and videos (p. 299–310).

The Indigenous Friends Platform through the possibilities of presence, caring, sharing, and

orality offers an opportunity of embodiment and opens up the ability of healing within the digital space. Also, the nature of the mobile phone within Indigenous communities presents the possibility to enhance the communications among individuals and communities and through different media practices, embrace cultural understandings and traditions. The embodiment of the identity of Indigenous peoples happens in the Zhaawanong (southern) direction or the emotional dimension because the cultural values are attached to a diverse number of emotions of Indigenous bodies. As Qwo-Li Driskill (2008) states, the act of colonization is an act done by bodies and felt by other bodies, and therefore, the act of decolonization would trigger emotions that would affect those Indigenous bodies through a process of healing. In other words, I argue that the successful embodiment of identity in the digital space is an act of kinesthetic healing that is felt by other bodies and therefore, it is an act of decolonization of communal bodies. Furthermore, the embodiment of Indigeneity through presence, caring, sharing, and orality is providing the opportunity to bring the consciousness of the users in the digital space, and therefore, their Spirits are only being transferred to the digital realm without the need of their physical bodies. If this transfer happens, the kinesthetic healing is possible through the interactions between the intentions of different Spirits in the virtual space.

The inclusion of virtual Indigenous bodies in digital space is a recent topic that opens new areas of exploration and creation. Doug Anderson warns that reducing Indigenous worldviews to simplistic terms through the embodiment process is problematic. In order to create synergy and enable educable environments, most Indigenous perspectives include the following: (a) a strong sense of spirituality; (b) a deeply rooted sense of place; (c) a recognition that everything is related; and (d) an emphasis on reciprocity (Anderson et al., 2017, pp. 6–7).

In the case of the IFP, Faith Desmoulin, as a digital user, affirms that for Indigenous peoples, information is oral history: “Information is something that you can see, that you can hear, right? And this goes back to the oral stories of communities because oral stories are very, very important and sometimes in academia or these settings, it’s everything about writing, about the words, about things that are maybe in the communities that doesn’t make a lot of sense” (Faith Desmoulin, personal communication, May 23,

2020). In the same line of thinking, Bonnie Rogers, who is an IFA member and former INDIGital participant from Regina, expressed the healing potential of the embodiment within IFP and the potential to reclaim this space:

It would be great to see it evolve into a social media space for Indigenous people and reclaiming that ... We talked about reclaiming spaces as Indigenous people, and this would be, moving into the future, a space for us. [...] I just think it would be so cool if it did evolve into this huge app that all Indigenous folks are on, and it's like "I'm just switching over [from Facebook/Instagram]. Screw all of those other ones. Yeah. We may be on them, but this became our main app that we're on all the time," and that'd be so fun, and to have it relatable to us and the way we talk, and our slang, and our laughing, and our humor, and our ceremonies, and how we are right now within IFA team and how we can feel so open and vulnerable to each other [...] I feel like it'd be cool if we had that space as well where we're all really so connected and we feel really safe with one another, even if ... I don't know. That's going to be hard to maintain when it's a larger group, but I do have hope that ... With where we are as Indigenous people in our healing journey and how we're moving forward, I feel like we are getting there and that we're becoming more supportive of one another than the opposite, because there is a lot of lateral violence and negativity and some healing that still needs to be done. (Bonnie Rogers, personal communication, May 25, 2020)

The successful embodiment of Indigeneity in the digital space opens Indigenous bodies to new threats and forms of violence, however, through digital harassment and discrimination, and therefore new mechanisms of safety are required to keep these spaces safer from trolls and community members who do not respect the community guidelines. Mechanisms were embedded in the IFP via the design of the "cyber clans" system, which allowed the integration of traditional protocols to handle community conflicts by providing certain community members with the responsibility to take care of the space and keep a peaceful environment within the mobile application. Although the exploration of safety and privacy is beyond the scope of this research, these considerations are also part of the embodiment and they need to be intersected with the four values of embodiment: presence, caring, sharing, and orality. These safety practices transform the IFP into a space that challenges mainstream hegemonic social media

platforms and offers an alternative to those colonial spaces. Furthermore, this form of practicing and comprehending the space invites digital designers to reimagine other forms of conceiving the concept of privacy where presence, caring, sharing, and orality are centred as the main aspects for Indigenous embodiment. This form of conceiving digital spaces rejects the Western ideas of privacy that focus on individualistic forms of protection and prioritizes this aspect over community values.

As I showed in this section, evidence suggests that presently digital spaces can ethically embody Indigenous peoples in digital spaces because mobile technologies and social media are technically capable of including important principles of Indigenous worldviews and Ways of Knowing/Doing. Through the conversations and experiences of creating the IFP, I concluded that this embodiment includes the capability to be virtually present with other members (presence), the opportunity to look after others in a safer form (caring & safety), the possibility of providing for others (sharing), and the character of these spaces being spoken or verbally communicated (orality). However, although these joined factors allowed the mobilization of Indigenous bodies within digital spaces and start healing processes, the importance of reclaiming the land and territories in the digital are still essential for directly impacting the life and the environment of Indigenous peoples.

7.2 Reclaiming Land in the Digital Space

“Our teachings are meant to help everyone, so we don’t own them the same way as we don’t own the land, right? We need the land. Land doesn’t need us. Land continues. If you and I died tomorrow, the land would still go on, right?” (Elder Blu Waters, personal communication, May 6, 2020)

“You know, this is not your land, this is community land, and this space digitally is community space.” (Stefan Piercey, personal communication, May 19, 2020)

The relationships to land/water/air/subterranean earth (land, for shorthand, in this paper) represents the fundamental ontological, epistemic, and cosmological basis of Indigenous worldviews (Cajete, 2000, pp.177–183; Nicholas, 2014, p. 215; Tuck & Yang, 2012, p. 5; Wilson & Bird, 2005, pp. 198–200). Multiple Indigenous authors from different contexts worldwide have all agreed on the

importance of land in the conception of Indigeneity (Howe, 1998, pp. 22–23; Mignolo, 2011, p. 63; Wilson, 2008, p. 87). Without land, Indigeneity cannot be comprehended.

On the other hand, digital technologies and several entities that reside within (e.g., the Internet, mobile devices, the cloud) claim that they are ethereal and consequently “landless” (Rodriguez-Prieto & Martinez-Cabezudo, 2016, p. 18; Mosco, 2017, p. 26). Moreover, in the 1990s, digital technologies were declared part of the “weightless economy” because of their insubstantial character (Hughes, 2016, p. 191). Therefore, the representation of Indigenous peoples in the digital space, which is claimed to be landless, represents a paradox for Indigeneity. In this regard, Loretta Todd argues that cyberspace might not be a place for Indigenous peoples because it is a “place to escape the earthly plane and the mess of humanity” (as cited in Gaertner, 2015, p. 59). In the same line, Indigenous scholar Craig Howe (1998) claimed that “identity and land are inseparable within tribalism, yet the locating of identity in particular geographical places is impossible in cyberspace” (p. 22). The danger of merely denying the possibility of the digital embodiment of Indigeneity, however, would mean excluding thousands of Indigenous media artists, technicians, activists, and scholars who are using cyberspace as a form of representation and political movement. Moreover, several Indigenous thinkers see that land and digital technologies are not necessarily oppositional. Jason E. Lewis (2004) started a vital analysis between cyberspace and land by analyzing the Skawennati’s CyberPowWow platform.⁷¹ He claims this project continues the expansion of Indigenous Territory beyond the reserve. In other words, the CyberPowWow is an extension of Indigenous land. He claims that this expansion is achieved within the project by reflecting on the past and looking to understand how that history shares similar dynamics with the digital worlds, and therefore, the

⁷¹ CyberPowWow is “part website and part ‘palace’—a series of interconnected, graphical chat rooms which allow visitors to interact with one another in real time. Together, the website and palace form a virtual gallery with digital (and digitized) artworks and a library of texts. All the works have been created specifically for CyberPowWow by emerging and established Aboriginal artists and writers.

From 1997 to 2004 CyberPowWow was also an event which took place every two years. The event marked new work being added to the palace, like an opening. Visitors were invited to log on from the comfort of their own computers, or, if they were feeling social (or did not have a computer of their own) they could attend via a Gathering Site. Gathering Sites were established across Turtle Island (North America) as welcoming, comfortable places where people could access computers, the Internet, friends and food” (CyberPowWow, n.d.).

exhibition helps ensure that there are no reserves confined in cyberspace. Moreover, he claims that the “natural sources” in the digital space are power, bandwidth, network, and data, always involving and expanding (Lewis, pp. 2–3, 11). Therefore, I consider that the reconciliation between these terms requires two types of co-related actions: the recognition and promotion of land in the digital space and land protection in the analog/real world.

Regarding the first aspect, the scholar David Gaertner (2015) presents compelling insights into how the land can be conceptualized in cyberspace. Through the examination of Skawennati’s CyberPowWow and Burton’s God’s Lake Narrows, he proposes that virtual spaces should include gathering sites in the analog/real world, follow Indigenous protocols and laws within the interactions of the spaces, and offer remediation to the necessities and ceremonies of the real world. The cyberspaces studied by Gaertner are not replacing analog/real spaces, but they are opening new spaces for urban Indigenous peoples. In these regards, several IFP collaborators and users shared common experiences and thoughts about how virtual spaces complement land in several ways.

In the first place, for the majority of them, in agreement with Gaertner, the land cannot be embodied in virtual spaces:

I think that relationship between the environment and digital technology can also apply to digital technology and people themselves because we’re creating these idealized notions of who we are in the digital realm while forgetting our actual realities. (Keith González-Sujo, personal communication, May 6, 2020)

There’s no relationship there. No. [...] The feeling. The feeling and just being out there. When I’m out there, when I’m out in nature, I feel like I can breathe. I feel like I’m better. I feel better if my whole self as being... I feel so much better, relaxed, and feel like I’m okay like I’m safe here. Mind you, it’s harder in big cities because they’ve made that, made it a certain way. But when I was on Manitoulin Island, Manitoulin Island is untouched for any big forest areas [...] You can just walk through it and experience it, and it’s really cool. (Faith Desmoulin, personal communication, May 23, 2020)

In this aspect, Elder Blu Waters agrees that the materiality of being in the land is not possible in the digital space:

[H]aving the digital platform is like another tool that's in our bundle, right? We still need the land. We still need to have that connection to the land. The land has things that digital can't give us. [...] we still need those connections to the land, to give us our physical part of it. Our digital kind of incorporates a little piece of all of that, right? We can physically see a land space through digital technology, but we can't touch it, but we can see it, and so our sense of visioning is taken care of through that, but as tactile people, we're not able to touch it. So, are we truly connected to it? No. We need that tactility of it to be able to touch it as well as see it as well as smell it as well as hear it to make things complete. That's that balance. (Elder Blu Waters, personal communication, May 6, 2020)

From these understandings, several scholars and the IFP users agree that the materiality of land is not possible within digital technologies. However, they all agree that relationships between land and cyberspace can be constructed and certain relationships can be established as a form of Indigenous embodiment. Moreover, from an Indigenous perspective, the land has a Spirit and therefore, I claim that there is a possibility to transfer the consciousness of that Spirit into the digital space through certain relationships and connections. The IFP collaborator, Michelle Gegwetch asserts that Mother Earth and digital technologies cannot be disconnected, and their relationship relies on the technology itself:

[E]verything that exists on this planet was made from Mother Earth, everything, down to the components that are in my laptop right now, allowing me to speak to you. That is all from materials made from Mother Earth. So, even indirectly, if we want to say Mother Earth is not involved, she is. She's providing us the materials and stuff to be able to create these technologies and create these digital spaces. [...] And that's why I mentioned even in the practical sense, even if we don't think you're taking spirituality out of it, Mother Earth is still kind of involved because I have precious metals and stuff inside of my computer. And that allows me to be able to do the things I want to do. So, even indirectly, she's still involved. (Michelle Gegwetch, personal communication, May 4, 2020)

In this perspective, Haas (2007) proposes a form of connecting historical land agreements to digital constructions, such as the hyperlink. Specifically, this author proposes that Haudenosaunee

Wampum Belts⁷² were the first type of hyperlinks in history. Wampum Belts are forms to remember land agreements and to learn more about the relationships among Nations. The conceptualization of the Internet as a complex network of hyperlinks might offer a clue how the teaching of Wampum Belts can be integrated into the Internet for land recognition. This notion would imply to incorporate Indigenous protocols when sharing Indigenous Knowledge online. In this respect, media artist Archer Pechawis claimed that within the context of the Skawennati's CyberPowWow project, a new digital treaty was signed that gives Indigenous peoples the “right to hunt, fish, dance, and make art at www.cyberpowwow.net, [.org](http://www.cyberpowwow.org) and [.com](http://www.cyberpowwow.com) for as long as the grass grows and the rivers flow” (as stated by Lewis, 2004, p. 5). In the same respect, Bonnie Rogers conceives this community connection as a form of rewriting Indigenous history:

We have our physical land, and this is our digital land, and that’s how we see that is this is our digital space that we can have sovereignty over and kind of redo history and make it a pretty cool, fun place, a very cool, fun place to be where moving forward, I see a very positive ... again, a safe space, a community that is, I guess, ours but still open and inviting to others and ... I don’t know. I just see it evolving into this space that we can have as our own again, and it’s an opportunity for us to rewrite history from now on digitally because that is the way the future feels. (Bonnie Rogers, personal communication, May 25, 2020)

The possibility of rewriting history through digital treaties signifies educating community members and allies about the history of the land and integrating this knowledge as part of the digital embodiment of Indigeneity. This form of connection between the land and the digital space opens the possibility to rethink and reimagine the digital space through Indigenous lenses and cosmologies, and therefore, it opens the possibility to use the digital space for educating and promoting nature and land:

“I think that’s really good. I guess there is some connection. You’re educating people

⁷² Haudenosaunee Wampum Belt: “Wampum is created from the shell of a clam. [...] The shell is thought of as a living record of the Haudenosaunee. The speaker puts the words of the agreement into the Wampum as the strings or belts are woven together. Each speaker thereafter uses the Wampum to remember the initial agreement and the history that has happened to date” (Onandaga Nation, n.d.)

about it.” (Faith Desmoulin, personal communication, May 23, 2020)

“Digital technologies cannot replace land. However, I see that digital technologies are a tool to promote land. A form of educating people about Mother Earth and nature.”

(McKenzie Toulouse, personal communication, May 12, 2020)

[L]and is a way of like connectiveness, right? So and digital can only give you so much of the teachings of the land. It’s up to you to actually get off to go out there and sit on the land, if you really want to connect with it, basically. That’s what we talked about yesterday. It’s about, if you can live off the land and you know how to live in a humble way, you always have a connection to that. So even though in digital doesn’t have land, but all we can do is give teachings of it, give ideas of it. Like maybe do some gardening and connect it and be in peace and silence. Basically, that’s the land. It’s quietness. It’s nature. (McKenzie Toulouse, personal communication, May 13, 2020)

In addition to the educational component, Stefan Piercey perceives that the connection between land and digital spaces resides in the role of community:

[T]he idea that the relationship is different digitally, it definitely is different, because when you move into the digital aspect of the land, it’s more community-based. To clarify that, on Tumblr, my safe space, that’s a community, you know? We come from all different parts of the world. But digitally, we’re a community. I feel like land-based territory, that’s very closed off, but then digitally, it’s very communal. You look at the big websites, like Google or Facebook, those are all powered by community members, you know? You watch Drag Race, and you’re watching halfway through; if you go on Wikipedia, you know the winner. And that’s a community that is providing information to each other from different parts of the world. So, it’s not land-based territory holders, it’s more you are now entering into a land that is community ... You know, this is not your land, this is community land, and this space digitally is community space. (Stefan Piercey, personal communication, May 19, 2020)

Under the previous circumstances, I argue that the Spirit of the land is being transferred into the digital space, and although the materiality is not possible, the actions triggered in the virtual space, such as the educational and communal actions, can have an impact in the real world. The land in the real world is necessary to keep running the digital space, but at the same time, the actions within the digital trigger actions to sustain and take care of the land and the environment, which are linked to the other aspect of

this land embodiment: the protection of land in the analog/real space.

In this respect, Cajete (2000) states: “If humans could use the land, the land would also use them to enrich it and to keep it alive. They and the place they lived were equal partners in life” (p. 204). Any Indigenous technology needs to acknowledge and address the global crisis of ecological relationships because the land and its maintenance are critical to Indigenous peoples’ physical and cultural survival (Cajete, 2000, p. 211). If land and nature continue to be separated from digital technologies’ cultural and technical dimensions as a form of purification, colonial violence would be reproduced (Mignolo, 2011, pp. 11–12, Lopez-Beltran et al., 2017, p. 761). Therefore, if Indigenous peoples seek to conceptualize land in cyberspace, these representations should incorporate political action in the real world to design more sustainable digital technologies that are not based on extractivist industries and mobilize Indigenous peoples to defend nature.

In 2016, the Indigenous social movement against the Dakota Access Pipeline at Standing Rock Sioux Reservation showed how thousands of peoples around the world virtually embodied themselves at the Reservation through checking-in at that location on Facebook in order to confuse government prosecutors. (Miller, 2016). As another example, in January and February 2020, mass demonstrations, sit-ins and blockades were organized in Canada through social media to stand in solidarity with the Wet'suwet'en peoples in northern British Columbia because Wet'suwet'en hereditary chiefs claimed the Aboriginal title over their territory against the construction of the Coastal GasLink Pipeline (Kestler-D'Amours, 2020). These online movements created the resistance collective of Water Protectors to defend any water system and organize climate justice (LeQuesne, 2018). These forms of Indigenous embodiment are expressions of the counteraction of the negative impacts to the environment that were explored in Chapter 4 because the users of social media channels protested and mobilized against the adverse environmental effects of the pipelines as well as the exploitation of natural resources in North Dakota and British Columbia. Although this type of activism was not enough to stop the pipeline projects, they tried to provide actions that favour the environment and create awareness of the consequences of the extractivist industries.

It is essential to recognize that the peoples who organized these movements embodied themselves on digital devices that relied on natural resources for their production; however, these devices were, in turn, used to draw attention to the political and environmental implications of Standing Rock and Wet'suwet'en peoples. In this regard, Wemigwans (2018) states that Indigenous knowledge in digital spaces reflects a social movement for collective action and mobilization that contributes to Indigenous self-determination (p. 207-208). As Salazar claims, digital technologies used by Indigenous peoples are a form of defiant political activism, and therefore, they require the consideration of the socio-technic assembly that interweaves technologies, natural resources, social organizations, legal frameworks with bureaucracies, knowledge and images (Salazar, 2015, p. 128). Decolonial digital technologies must have a political and social posture in order to provide them with a purpose and meaning (Wortham, 2016, p. 240). I claim that the risk of avoiding this political dimension would create a palliative for the political character of decoloniality in digital technologies. If the actions get limited to the digital space, they can deceive different stakeholders and slow down the efforts in the analogue and physical world. In other words, this factor means that the intention of creating a political change in the dynamics of colonialism cannot only be limited to the digital space, but it must be translated to the analogue world to defy the structures of power that continue to oppress Indigenous peoples and their territories.

If the embodiment of Indigeneity is possible in digital spaces, the reclamation of land becomes central in the process. Despite that the materiality of land is not possible in digital technologies, the new technical improvements are opening new spaces to educate communities worldwide about the protection and respect of Mother Earth. The inherited interconnection between the hardware components of digital technologies and the land where they are extracted paradoxically transforms these tools into potential threats for the environment but, at the same time, into extensions for land protection. Moreover, digital technologies foster the role of communities in reclaiming and setting up the rules for political action in the real world. These actions are translated into technical imaginaries of rewriting Indigenous histories and establishing new digital treaties to organize Indigenous bodies in the cyber and real space. Political activism, such as Standing Rock and the Wet'suwet'en movement, proves that the translation and

embodiment of Indigenous peoples in virtual spaces can impact the land and Mother Earth.

7.3 Conclusion: Embodied Indigeneity and Reclamation of Land

As a second phase in the research process, when the software methodology was implemented through the Tipi Cree Ceremony, the technical solution moved to Zhaawanong (South). In this dimension, Indigenous identities are transferred and embodied into the virtual world. The *Indigenous Friends Platform* experience demonstrated that this translation process is not simple and involves the consideration of several dimensions, such as presence, orality, caring, sharing, and land proclamation. These five aspects, and how they are interwoven to reclaim the digital spaces, were presented in these sections. These considerations may open possibilities of creation in other technological creation areas such as artificial intelligence (AI), machine learning and virtual reality.

The Zhaawanong direction involves the youth searching for themselves through questioning themselves: “who am I? where do I come from?” (Elder Lillian Pitawanakwat, n.d.). Similarly, during this stage, the technical being (i.e., the virtual Tipi) needs to reflect on herself about who she is and where she comes from. In other words, it is in this stage where the technical being recognized herself as part of Indigenous cultures and worldviews by incorporating essential components of corporeality and embodiment in the creation of digital spaces. I state that Indigenous digital solutions cannot be only a group of coding lines, hardware, and data but must also be a form of identity, resurgence, and reclamation. The embodiment of the community members within the platform solidly depended on the perspectives and voices of the community, and therefore, I relied on them to guide our project.

Digital spaces can support the healing and connections between Indigenous peoples because the design and implementation of mobile technologies and social media can be based on the fundamental principles of Indigenous paradigms. As I have argued throughout this analysis, the *Indigenous Friends Platform* can enable healing processes in the digital space of a virtual Tipi. This environment adopts cultural and spiritual aspects of Anishinaabe and Cree knowledges to create as supportive, respectful, and safe a dynamic as possible, which relies on the principles of presence, caring, sharing, orality, and land

proclamation. It is essential to emphasize that with the previous analysis, I am not implying or arguing that this mobile application is the only solution or form of healing for Indigenous youth, but that this mobile app is an instrument to support these processes. Moreover, as I expressed throughout this analysis, Indigenous embodiment implies collective memory. As the human body has a memory of movements and sensation, and, although in some cases it can be transferred to digital spaces, real-life experiences with community members are required alongside the virtual. In other words, the digital space was only an extension of the real space.

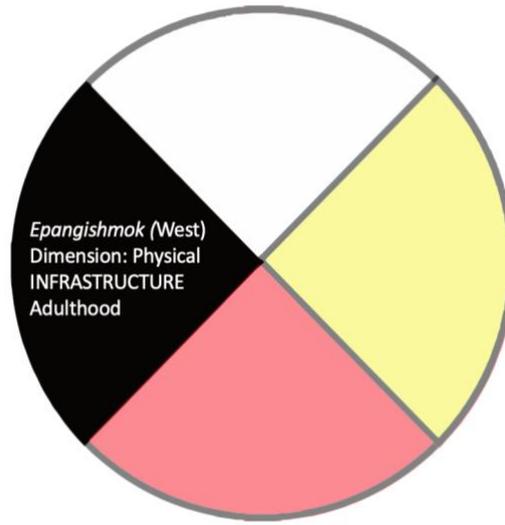
New and diverse virtual spaces, which social media and mobile technologies are opening up for Indigenous peoples, provide new areas of exploration, creation, and reflection. These areas include the possibility to listen to more Indigenous voices, which might previously have been difficult due to location and accessibility factors. The reconciliation between technology and Indigenous bodies provides alternatives to recover and embrace Traditional Knowledge in the context of a neoliberal global economy. Community-based mobile technologies are already enabling Indigenous peoples to give back to other people and Mother Earth through community building, active participation and healing, and the new app, *Indigenous Friends Platform*, would allow this process to continue.

Chapter 8

Epangishmok (West) – Decolonial Infrastructure

Figure 21

Epangishmok (West) – Decolonial Infrastructure



After the software was created through ceremony, and Indigeneity was embodied in the digital space, several inquiries around the required infrastructure to create digital solutions in the context of urban Indigenous youth were raised. This section aims to provide Indigenous infrastructure principles through the dissection of the infrastructure's concept and the linkage to the principles of *community* as a decolonial component. I justified the communal dimension through the *Indigenous Friends Platform* case and the other three case studies that relate Indigeneity with digital infrastructures. This section moves from the Zhaawanong (South)—youth—when Indigeneity was embodied, to the Epangishmok (West) – adulthood where the digital Tipi resides in the digital world (Figure 21). This stage is represented by the heart, which is the evaluator of life, where several decisions are assessed, and we make peace with our past. The Epangishmok signifies the afternoon where the being reflects and contemplates what has been done in their life journey. In other words, after the software methodology and embodiment of Indigeneity have been embraced, the evaluation of where the technical being and its Spirit resides arises as a form of

decolonial practice. In the physical dimension, the being enters a state of maturity where the reflection of the entire journey becomes vital for the sake of finding balance.

At the time of release, the mobile application was available on the two main mobile platforms: Google Play and Apple Store. I created the software alongside the participation of the community at York University and considered several cultural elements to embrace Indigeneity within the space; however, the infrastructure was not completed because the ownership and control of the community over the mobile application was not addressed. Once Professor McNab raised the idea of the app's Spirit, several key elements were naturally required to take care of the Spirit to avoid reproducing colonial practices. How was the Indigenous community at York University going to own and control the *Indigenous Friends Platform*?

In the Epangishmok (West) direction of this Medicine Wheel, I present and explain the communal principles of the infrastructure that are used to create the *Indigenous Friends Platform* as a vital component in proposing a decolonial design principle. The time of reflecting and making adjustments based on the journey are essential to continue with the balance of the technical being. To unfold this argument, I frame the concept of *infrastructure*, followed by an exploration of mobile infrastructures and their consequences to expose these technologies' advantages and colonial threats. Consequently, I present and relate three examples of mobile infrastructures owned by Indigenous communities to illustrate the communal aspect of decolonial infrastructures. Finally, I conclude with an analysis of the common characteristics of these projects and the principles to aspire to a decolonial infrastructure.

8.1 The Concept of Infrastructure

Since the creation of the microcomputer, marginalized communities have been left outside the stream of goods, services, resources, information, jobs, and data because of the insufficiency of digital infrastructure (i.e., cost of hardware, transportation, power supply, humidity factors, maintenance, software licenses) (Castells, 2010; Landzelius, 2006, p. 6). However, in the last ten years, the global

context around hardware has dramatically turned the possibilities due to the shift from personal microcomputers (fixed-line ICTs) to mobile devices (Unwin, 2017, p. 31). Research has found that the largest obstacle for digital access is the cost; however, marginalized communities continue to purchase phone time and mobile devices (Elder et al., 2013, p. x). Furthermore, mobile infrastructure's emancipatory character has created a shared imaginary that the Internet is accessible anywhere and everywhere by everyone (Powell, 2014, p. 25). At the same time as this phenomenon, several initiatives based on personal microcomputers (i.e., telecentres) were deployed by researchers, NGOs, and engineers to try to address local needs in the last three decades (Heeks, 2018). However, in most cases, that type of digital approach failed to respond to technical and socio-economic aspects at the community/local level. As a consequence, these processes commonly have not sustained themselves in the long term, and most importantly, they have not positively impacted community members and their environments (Brooks & Alam, 2017, p. 299; Heeks, 2003; Heeks, 2018, p. 103; Unwin, 2017, p. 7). In contrast, mobile infrastructures have offered new possibilities to claim the digital by/for Indigenous communities because they offer the possibility to have access to the services without significant training.

As I explained in the creation story of the *Indigenous Friends Platform* (IFP) in Chapters 2 and 3, there were several moments throughout the journey where we needed to decide where the mobile application was going to reside in the digital world and where to store the data generated by the users. What aspects need to be considered to choose the correct choices for this space? To answer this question, I found that in communication studies, digital humanities, and ICT4D, this inquiry focuses on the concept of infrastructure.

I found that infrastructure is a contested concept because it commonly refers to physical objects, but it also implies the relationships among those objects (Larkin, 2013, p. 329). Those relationships mean that the technological projects of infrastructure are objects that work at numerous levels at the same time (von Schnitzler, 2018, p. 134). Moreover, this fact means that the infrastructure is in a duality where it operates in terms of a system, and it cannot be theorized as an object alone (Larkin, 2013, p. 329). Appel et al. (2018) claim that infrastructure is “an articulation of materialities with institutional actors, legal

regimes, policies, and knowledge practices that is constantly information across space and time” (p. 12). In other words, infrastructure refers to the “amalgam of technical, administrative, and financial techniques” of a technical solution (Larkin, 2013, p. 330). In the same regard, according to Brown et al. (2016), infrastructure can be described, beyond the physical dimension, as something that “creates the conditions of possibility for certain kinds of activities” (p. 1). Any asset and institutional relationship are considered part of the infrastructure if it plays a vital role in the daily operations of an entity.

In the context of digital humanities, infrastructure comprehends digital hardware or devices (e.g. computers, laptops, mobiles, routers, access points, switches, wires, servers), the software to operate such hardware (e.g. operating systems, programs, libraries, databases engines, controllers) and organizational/institutional/political infrastructure (e.g. scholarly societies, centres, organizations, legal frameworks) (Brown et al., 2016, p. 1). Regarding mobile technologies, Wagner (2014) considers that mobile infrastructure includes network service (voice/data connectivity), hardware provision (devices and accessories) and content provision (platforms/apps) (p. 74). Therefore, in order to comprehend the infrastructure of the IFP, it is required to consider the relationships beyond the physical and informational objects (i.e., hardware and software) and include the institutional/organizational/political structures that are based on community and cultural values. The relationships among all those entities define the scope of infrastructure in the IFP. Specifically, the incorporation of the not-for-profit entity provided a practical form to connect the organizational and communal values to the technical infrastructure. It provided community members with the possibility to have self-determination over the hardware and software of the mobile application.

Under the previous considerations of infrastructure, the scope of the concept is only framed as a group of materialities (e.g. hardware, software, institutions) and their relationships. Nonetheless, the notion of infrastructure also has a direct impact on the cultural understanding of the technical being. Larkin (2013) defines infrastructure as:

Infrastructures are built networks that facilitate the flow of goods, peoples, or ideas and allow for their exchange over space. As physical forms, they shape the nature of a

network, the speed and direction of its movements, its temporalities, and its vulnerability to breakdown. They comprise the architecture for circulation, providing the undergirding of modern societies, and they generate the ambient environment of everyday life. (p. 328)

In other words, the infrastructures frame access to information, services, and goods, which generate power dynamics within the societies and moderate the cultural ideas of modernity and prosperity. Therefore, infrastructures are functional in the way they frame the circulation of goods, people, or ideas. Still, they also become cultural objects (i.e., signs and symbols) and ethical and objects of power that shape the idea of development and progress (Appel et al., 2018, p. 9; von Schnitzler, 2018, p. 134). In other words, infrastructures also become technopolitical objects that change societies and the systems of power based on the form of “progress.” Consequently, I was required to integrate cultural and communal values within the framing of the IFP infrastructure to shape the ethics and power dynamics within the technical creation.

As technopolitical objects, infrastructures are technologies that modern states have used to demonstrate “modernity” and “development,” providing cultural and ideological categories in their aesthetics, forms, and substance (Appel et al., 2018, p. 5; Larkin, 2013, p. 329). As examples of this cultural and ideological intervention, Appel et al. (2018) assert that cellular networks reshape gendered socialities in India by allowing women to leave their homes, but their movements are monitored by phone calls every few minutes. Also, FaceTime and Whatsapp change the form of connection and communication at a distance with relatives or acquaintances who migrate to other locations (p. 7). In other words, infrastructure shapes several sociocultural categories of beauty, temporality, space, safety, morality, and modernity.⁷³ Therefore, in order to challenge hegemonic cultural categories within the IFP, in the first place, I interwove Traditional Knowledge such as the Tipi Ceremony into the code, which entailed the incorporation of Indigenous ethics and worldviews into the software. As a second step, the

⁷³ These ideological and cultural structures embedded into these systems are hidden or considered invisible until infrastructure is broken because people react to the lack of services and cultural objects (Okune et al., 2018, p.1; Brown et al., 2016, p. 1).

infrastructure is owned and controlled by an Indigenous body such as the IFA. This connection aims to counteract the limited standard notions of infrastructure that do not consider cultural and identity values. The cultural understanding of beauty, temporality, space, safety, and morality is determined by the community categories imposed by the IFP's infrastructure, guided by the not-for-profit legal entity and the Tipi Cree Ceremony. Although the not-for-profit is still based on a colonial legal framework, it provides the opportunity to create and imagine new forms of interaction and decision-making in the digital space. In other words, the not-for-profit aims to embrace and interweave Indigenous worldviews within the technical creation, infrastructure, software, and data.

Simultaneously, according to von Schnitzler (2018), infrastructures are situational and cannot be guaranteed because they rely upon the specific political spaces and historical fields of intervention (p. 147). Therefore, infrastructures are framed by historical and political environments, but they also shape the societies through ideological and cultural structures. These characteristics signify that infrastructures have a double form of exercising power: (a) disparities among different groups within the societies based on historical and political factors; and (b) they have been used to insert cultural and social discourses into marginalized groups. Based on this idea of political intervention, Appel et al. (2018) assert that infrastructure experiences have long been an effective and embodied distinction between the colonizers and the colonized people. Therefore, infrastructures provide a site where colonial power and inequality are reproduced or destabilized (pp. 3, 14). Based on their analysis previously described, studies of infrastructure is “a forceful reengagement with gender, race, colonialism, postcoloniality, and class on new empirical and political terrain” (Appel et al., 2018, p. 14). In the case that this relationship is not acknowledged and challenged, the potential to reproduce colonial structures and discourses can be rapidly spread through digital technologies. The reflection on the political and colonial implications of infrastructure was a vital component that I needed to integrate into the IFP development. The assessment and improvement of the infrastructure were essential elements for redesigning the space and the requirement to push the boundaries to decolonize the colonial structures.

Based on the previous arguments, I state that infrastructure should be an essential reflection of

technology deployment in the decolonial option because it shapes the entire technopolitical object and data creation process. Moreover, it configures any technical solution under certain cultural ideologies and parameters and frames any digital project's scopes and boundaries around hardware, software, and data. In the context of this research, infrastructure refers to the hardware, software platforms, and organizational resources where digital technology resides. In other words, from an Indigenous point of view, infrastructure in this context is the built environment where the technical being would live and reside after the technological solution is conceived. The idea that infrastructure refers to articulating several materialities locates the infrastructure in the Epangishmok (West) direction of the Anishinaabe Medicine Wheel, as this direction refers to the physical dimension (that implicates the articulation of the relationships and frames how the being is formed and composed). Without that physical dimension, the technological solution would be only a piece of software and data that fails to address community needs and relationships.

8.2 Mobile Devices as Infrastructure

The first decision that needed to be made about the platform was to choose the hardware infrastructure that would be used to deliver the IFP. Although there were several options to start the implementation (e.g. desktop computers, kiosks, laptops, tablets, single-board computers, IoT devices, and mobile phones), mobile devices answered several hardware requirements that were implicitly needed in this phase of development. First, all the Indigenous students and members connected to CASS had a mobile phone, while not all of them had a laptop or desktop computer (# 17 people in total). Second, most of them connected to the Internet using a mobile device when they were not doing school-related activities: communications with family members and social media. Third, 17 out of 17 community members participating in the project at that time had an Android or iOS compatible device (Mayoral-Baños, 2016). As Keith González-Sujo, collaborator of the IFA, mentioned:

So it's a very interesting relationship in terms of the difficulties. But I think the fact that it's a mobile app, meaning in the cell phone, actually gives it a lot of flexibility because as you know, in today's world, everybody, almost everybody has a cell phone with data.

So I think that's a very positive thing as opposed to just having the app like a web-based, computer-based platform. (Keith González-Sujo, personal communication, May 6, 2020)

In the same regard, Elder Blu Waters highlights the importance of mobile technologies, based on the lack of infrastructure in the context of Indigenous youth in Canada:

So, to me, that was this concept of what was going to happen, right? Access to a platform that very few people has because we know that if you're talking unreserved people, they don't have the structures in place. They didn't have the internet accessibility. They don't have the actual tools. They don't have laptops and iPads, and there's very limited amounts of them there, right? Yes, not everybody is in poverty, but most people are living in a poverty zone to different degrees, so this was going to make that space available to people who didn't have that space and to encourage them that you can be more than the cage that you're a captive in, right? We can break down those barriers; we can break those cages that keep you confined and keep you in poverty and keep you restricted and unknowledgeable and bring to you the resources that will help you expand and be able to live outside those confounds that you're in. (Elder Blu Waters, personal communication, May 6, 2020)

The United Nations conservatively estimates that more than 370 million Indigenous people live in 90+ countries spread across six continents. They comprise 4% of humanity and speak more than 4,000 of the world's 7,000 languages (as stated by Dyson, 2016, p. 19). In almost every context, Indigenous peoples are still marginalized and struggling with the consequences of colonization. In the digital era, several forms of infrastructure can be deployed in Indigenous contexts, e.g., telecentres, fixed bandwidth lines, IoT devices, computer rooms, mainframes, among others. However, mobile technologies have excelled among these forms of digital infrastructure and are rapidly being adopted within Indigenous communities. These days, Indigenous peoples are an integral part of the mobile revolution, employing various mobile technologies (Dyson, 2016, p. 18). Indigenous peoples worldwide are willing and increasingly using mobile phones and infrastructures.⁷⁴ Hence, as it was alleged in Chapter 4, if mobile

⁷⁴ Some examples were already described in Chapter 5 under the decolonial experience. Moreover, it is essential to mention that although there is a significant amount of information regarding mobile usage around the globe, there are no statistics on Indigenous peoples and digital devices. Indeed, there is no official information available

infrastructures have a potential colonial character, why are Indigenous peoples around the world welcoming and embracing this type of digital technology?

Mobile technologies have responded to several specific requirements that Indigenous peoples need within their contexts. Beaton et al. (2014) agree that mobile technologies in the context of Indigenous peoples have helped to “overcome many challenges of remoteness and offer so many possibilities—from connecting community members out on the land with emergency services to linking, in real-time, residents from numerous communities for regional learning, to offering mobile health applications to community members in their homes-along with many others” (p. 20). According to Dyson (2016), fixed-line technologies failed to respond to the needs of Indigenous peoples due to their geographical locations, socioeconomic circumstances, and cultures. Mobile technology has been a substitute for traditional ICTs, such as laptops and desktops. For several Indigenous communities, the mobile revolution has been the social transformation from no digital access to the daily usage of mobile devices. Moreover, while in the developing countries mobile technologies provided the opportunity to Indigenous peoples to access digital technologies, in developed countries mobiles were the first personally owned ICTs. In most cases, mobile technologies have emerged for personal use (p. 18–25). Mobile technologies are communication tools “used by [Indigenous] people[s] to communicate with each other, support their land-based lifestyle and social enterprises, and share their stories and experiences with others” (Beaton et al., 2014, p. 6). The analysis of several cases of Indigenous communities worldwide offers insights about the reasoning of technological appropriation and the adoption of mobile devices. Moreover, Bang et al. (2013) consider that the increase in mobile technologies usage within Indigenous communities reflects the higher level of community-driven goals and projects (p. 708). Based on the analysis of several case studies worldwide, Fiona Brady and Laurel Evelyn Dyson concluded that mobile technologies are responding to the following needs of Indigenous peoples:

1. Socioeconomic constraints and cost of hardware: mobile technologies, in general, are low-cost

regarding Indigenous peoples and mobile phone usage, either globally or nationally (Dyson, 2016, p. 22).

and affordable at the individual level in the short term. Mobile technologies are more affordable than other digital hardware tools. In the case of thievery or damage, they are easily replaceable (Brady & Dyson, 2016, pp. 67–68). Mobile devices are cheaper than paying for a home phone or buying a desktop or laptop (Dyson, 2016, p. 23). Furthermore, Indigenous peoples are taking ownership of their devices through different cost management strategies (e.g., prepaid plans, sharing devices, using them without credit) (Dyson et al. , 2016, p. 378).

2. The preference for music and multimedia. Indigenous cultures are based on orality and storytelling; mobile devices offer to capture those cultural expressions (as stated by Brady & Dyson, 2016, pp. 67–68). The use of online content platforms provides youth the opportunity to perform their Indigenous identity in digital spaces (Rice et al., 2016, p. 4). The transformation of the mobile phones into Internet-enabled devices provided multiple functionalities to Indigenous peoples such as voice and video calls, text messaging, social networking, Internet browsing, TV and sports results, music and movies, photography, sound and video recording, contact lists and calendars, and Bluetooth file-sharing (Dyson, 2016, p. 24).
3. The portability of the devices: mobile devices promote mobility and privacy of the information. The devices are easily adaptable to different locations. The devices can be easily transported for maintenance purposes (Brady & Dyson, 2016, pp. 67–68).
4. Cultural and kinship factors. Mobile devices can be carried out to several cultural and social activities. In many cases, the only form to communicate in the Indigenous mother tongue is through mobile technologies (Brady & Dyson, 2016, pp. 67–68; Rice et al., 2016, p. 11).
5. The difficulty of fixed-line phone access: Indigenous peoples are commonly found in marginalized locations, and access to the fixed technical telecommunication infrastructures are commonly complicated and non-affordable (Brady & Dyson, 2016, pp. 67–68). Mobile infrastructure offers a feasible and affordable solution for this problem.
6. Billing structures: mobile telecommunication companies commonly offer options that are prepaid plans, and therefore, they are debt-free. People can access services at a low price without owing

money (Brady & Dyson, 2016, pp. 67–68).

7. Offline/online capabilities: in the case that there is no mobile phone service in a specific community, Indigenous peoples can use the mobile phone as a multimedia device and connect back to the mobile network when it is available (Rice et al., 2016, p. 10). This factor means that Indigenous peoples can enjoy the multimedia and apps features of their devices (e.g., take pictures, listen to music, record videos) even when they are out of the networks' ranges or without credit (Dyson, 2016, pp. 26, 378).
8. Intuitive form of usage: the direct manipulation of graphics in the display is more natural to learn in a mobile device than a keyboard or a mouse on a desktop or laptop (Dyson, 2016, p. 25). Moreover, as it was previously stated, unlike a desktop or laptop, mobile phones are regularly with their users and are in use or ready for use (Jarvenpaa & Lang, 2005 p. 7). Households with low incomes can access this technology without significant training (Brady & Dyson, 2016, pp. 67–68).

Although the previous characteristics cannot be generalized to every single Indigenous community worldwide, they show several commonalities that explain the high level of technical assimilation and acceptance of mobile technologies within Indigenous communities in the majority of contexts. This shift from fixed ICTs (i.e., desktop computers) to mobile technologies has opened up the discussion in the digital spaces, programs, and content using this type of technology. In the same line, according to Bravo (2017), mobile infrastructure within the context of Indigenous communities has:

- increased the interpersonal communications among people and families.
- improved the organization of communal life and shared work.
- enhanced the convocation to assemblies and governance accountability.
- improved security and surveillance for the protection of the land.
- helped in health emergencies.
- enhanced the prevention systems for natural disasters.

- increased commercial relationships; and
- expanded access to information (p. 122).

Although mobile technologies have not addressed all the hardware and connectivity issues of Indigenous communities, they offer a range of potentialities for groups with a high level of migration and cultural disconnection. Therefore, new paradigms of design and content creation started to be envisioned to respond to community needs. Dyson (2016) describes this phenomenon as “domestication.” This term refers to “the particular ways in which a cultural group makes a technology its own, adapting the technology to its needs and preferences but also adapting its behaviour to the technology” (p. 28). However, I argue that decolonial infrastructures must go beyond domestication because these technologies must also include new forms of designing technology under the cultural Ways of Knowing and Doing of local communities. In other words, infrastructures must be designed based on the cultural protocols of communities and not merely adapted to be used within these contexts. I state that simple domestication of the technologies without analyzing the potential threats could create dependencies in colonial infrastructures and replicate oppressive practices.

In the context of the IFP, after implicitly deciding about the hardware infrastructure during the birth ceremony by deciding the usage of mobile devices, the question of software was raised. These days there are several options for creating digital solutions (e.g., desktop applications, web service/website, mobile applications, single-board computer programs); however, all are commonly limited by the hardware requirements. I offered the idea of a website, but the Indigenous community at York University already had one website offering its services (<https://aboriginal.info.yorku.ca>). Therefore, there was a potential problem of duplicating tasks over time, plus the solution may also overlap with several other university services. During the initial sharing circles and conversations, several students expressed that they usually do not connect to the Internet outside the campus without Wi-Fi; therefore, the software application must work online and offline. Two questions were emerged: (1) How can you reach most of the youth without a high initial cost on infrastructure? (2) How can we design a technical solution that can be used online/offline?

The three people involved in the initial process, Professor Koleszar-Green, Elder Blu Waters, and I, agreed that a mobile app in the case of the urban Indigenous community, was the most appropriate solution at York University on September 29, 2015 (Mayoral-Baños, 2016, p. 156). In my encounter with several community members around creating the mobile app, most community members asserted that they and their families were using a mobile phone. Desktop applications were not considered a viable option due to the environments where these types of programs are commonly used (i.e. indoors, office or home spaces) and the lack of desktop or laptop computers owned by Indigenous youth. A web service was also discarded because of potential duplication with the institutional website and the impossibility of providing services without an internet connection. Therefore, the best viable option from the perspective of Indigenous members at York University was a mobile app available in the Apple App Store and Google Play Store.

8.2.1 Mobile Apps

As it was stated in the last section, the decision about a mobile application was made during the birthing ceremony. This decision entailed several specific considerations around the infrastructure of the digital space. However, what does a mobile application infrastructure entail and what are the implications?

Besides the physical infrastructure of mobile (hardware), mobile apps have also significantly impacted mobile Internet usage. The analysis of the mobile Internet ecosystem (i.e., mobile apps) in digital inclusion is critical because this type of software mediates access to the Internet in several diverse contexts. The apps are mediators between users and the Internet because apps manage the user experience's fluidity and content forms (Wagner, 2014, pp. 72–73). In other words, mobile apps become a cultural and sociopolitical instrument between the users and their experience with the global network.

One of the most significant innovations in mobile experience has been the practice of using mobile apps because they allowed third-party developers to produce applications for the devices (Powell, 2014, p. 34). According to Dean (2014), mobile apps are seen by the “tech-hype” trend as “the next phase

of the ICT revolution” (p. 242). In this regard, Wagner (2014) argues that the success of mobile inclusion relies on the orientation of mobile apps because they are the channel between mobile device functions and the Internet, i.e., mobile apps frame how information is accessed, and content is created (p. 81).

A mobile app is “an application; typically, a small, specialized program downloaded onto mobile devices” (mobile app, n.d.). Dean (2014) defines an app as “a small piece of software designed for a specific narrow purpose” (p. 234). A mobile app can be installed on a smartphone or a tablet, but also, there are different kinds of apps for desktops or laptops (Dean, 2014, p. 234). Mobile apps are independent, and they commonly do not require extra programs to run (the only requirement is the operating system). They always have a name and an icon. They do not necessarily require an internet connection to function. However, when they detect an available internet connection, mobile apps frequently consume significant amounts of Internet data (Summerfield, n.d.).

Although mobile apps have existed since 1993 with the first smartphone by IBM: Simon (Curtis, 2014), it wasn’t until the iPhone in 2007 when the mobile market rocketed, because Apple opened the opportunity to individual developers to create their programs through a software development kit (Dean, 2014, p. 233). This factor allowed developers to design their software and provided a way to sell the software on the same platform. In other words, Apple consolidated separated actions, i.e., coding and selling, into one place: The Apple App Store (Dean, 2014, p. 234). The prestige, profitability, and accessibility of the app stores made app developers focus on “neutral” cultural products (Wagner, 2014, p. 81).

Consequently, the current mobile application market has an effective duopoly via two mobile application platforms: Google Play in Android and the Apple App Store in iOS (Appfigures & VentureBeat, 2019; ITU, 2018a, p. 75; Powell, 2014, p. 35). Based on the current presence of operating systems in the mobile market,⁷⁵ Google Play in Android and Apple App Store in iOS have 98.4% of the

⁷⁵ In the case of mobile operating systems, there has been a significant change in the last seven years. In January 2012, the global market share of mobile operating systems was Google Android (23.21%), Apple iOS (24.04%), Nokia Symbian (31.89%), BlackBerryOS (6.94%). By August 2019, the market dramatically changed to a

mobile apps market (StatCounter, 2019a). In the second quarter of 2019, the number of apps in each store was: (a) Google Play – 2.46 million apps; (b) Apple App Store – 1.96 million apps; (c) Windows Store – 669 thousand apps; and (d) Amazon Appstore – 479 thousand apps (Appfigures & VentureBeat, 2019).⁷⁶

All these enterprises control the approval of applications that can run in their operating systems. The platforms also restrict visitors to their application stores based on the geographical location of users. Powell (2014) asserts that the power of the platforms is a significant case in the telecommunications industry because privacy and security issues have historically been addressed by regulation and not by corporate policy (p. 35). According to Wagner (2014), the platform providers are “in a position of power, having control over the underlying software and the diffusion of mobile contents” (p. 72).

In particular, Apple is extremely rigorous in its approval process, commonly refusing apps that Apple claims violate its community norms (Powell, 2014, p. 35). Moreover, any Apple iOS/iPadOS device must use the Apple App store in order to access any mobile app (Apple, n.d.).⁷⁷

Powell (2014) asserts that even though the iPhone is an excellent consumer product and the Apple mass-market eventually permitted the development of collaborative-based applications, the development of applications in this platform is incredibly confined (p. 39). In Android, the idea of using open-source practices to create mobile apps has been carried forward. Android developed an “open-source stack for mobile phones that was partly structured around open-source libraries, and the open-source derived [Software Development Kits] SDKs” (Powell, 2014, p. 39). The success of Android is that they worked with existing manufacturers of smartphones through a trade organization (i.e., Open Handset Alliance) instead of using a unique hardware project as in the Apple devices (p. 39). However, regardless of the openness/closedness of the framework, Powell asserts that a functioning device is often more

monopoly: Google Android (76.23%), Apple iOS (22.17%), KaiOS (0.59%), while Nokia Symbian and BlackBerryOS were discontinued (StatCounter, 2019a).

⁷⁶ The Windows Store is for apps based on their desktop/laptop operating system Windows 10. Amazon App Store is for mobile apps based on Google Android devices.

⁷⁷ In order to access mobile applications that are outside of the official store, special root permissions are required to be granted to the phone. The iOS/iPadOS device requires to go through a process of jailbreaking (i.e., replacement of pieces of software or firmware in the OS) to achieve these permission grants (Powell, 2014, p. 41).

important than an open contribution framework (p. 41).

As a consequence of the previous considerations, the number of downloaded apps has significantly increased in the last five years. In 2017, 178.1 billion apps were downloaded worldwide from the app stores, while in 2018 is estimated that the number raised to 205.4 billion downloads. It is expected that for 2022, the number of downloaded apps will increase to 258.2 billion (App Annie, 2018). Ironically, from the total mobile apps in the app stores, 25% of them have been used only once by 2019 (Business 2 community, 2019). According to Wagner (2014), as the number of apps increases, the relevance of contents and interfaces becomes an essential factor in digital usage (p. 73). The most critical attributes that users require for building trust in a mobile application in 2017 were around privacy, that users can: (a) request that all information is deleted; (b) withdraw permission to use their data; and (c) approve what information is collected and what is done with it (Marketing Charts, 2017).

In Canada, 1.003 billion mobile apps were downloaded in 2018. In the same year, the average number of apps installed per smartphone was 95 while used apps per month/smartphone were 36 (WeAreSocial, HootSuite & DataReportal, 2019b). In January 2019, the penetration of active mobile social media (i.e. the percentage of the population that log in to social media services at least once per month) in Canada was 59%. This fact means that almost 60% of the population are users of social media platforms through a mobile app (WeAreSocial, Hootsuite & DataReportal, 2019a). In Canada, by August 2019, the most popular mobile social websites were Facebook, with 57.56% of the visits, Pinterest with 32.77%, and Twitter with 6.06% (StatCounter, 2019d).

8.3 Mobile Infrastructures in Practice

Why are we depending on these corps like SaskTel and AT&T, all these types of businesses, to provide our Wi-Fi if we could actually be doing that ourselves? and seeing those types of things, and if we're shown how, and I know I'm not saying it has to be easy, but clear, not so confusing, and that's also in our language. (Bonnie Rogers, personal communication, May 25, 2020)

In the last section, the usage of mobile infrastructures (hardware and software platforms) by

Indigenous peoples was analyzed. However, the conversation of decolonial infrastructure requires going beyond simple access and usage of digital technologies. The recurrent hegemonic discourse of the “digital divide” has placed the academic and political conversations of digital technologies as a simple division about access/no-access without considering control and possession of such digital technology. Moreover, the mere integration of Indigenous peoples in existing hegemonic systems controlled by states and corporations is not adequate due to the high risk of reproducing colonial practices (McMahon, 2014, pp. 2003–2004). The conversations about the digital divide have commonly happened outside of Indigenous communities and without considering Indigenous voices. However, the importance of the mobile phenomenon in Indigenous contexts and the Internet has pushed several grassroots organizations and groups to challenge this notion of digital technologies.

In the case of the IFP, the relationship between the not-for-profit with the software and hardware is that this organizational structure provides an extra layer to the infrastructure that allows the usage of colonial tools in forms that can benefit the Indigenous-specific community’s well-being. In other words, the process of incorporating a not-for-profit meant that a community was inserted into the infrastructure, allowing the community to hold the rights and decide about the destination of the technology.

In this regard, the Indigenous thinkers Jaime Martínez Luna (Zapotec) and Floriberto Díaz Gómez (Mixe) define community as a territorial space of the communal property, a shared history of the oral character, a common language, a form of own organization and a communal system of justice procurement. All these concepts are called “communality” as a form of being, living and feeling, considering the earth as a Mother, practicing consensus in assemblies as a maximum form of government to make decisions, developing collective work as an act of solidarity and reciprocity; and the feast, rituals, land and ceremonies as expressions of the common goods (as stated by Bravo, 2017, p. 117). The common good is “one whose access must be allowed to anyone who meets certain requirements” (Huerta et al., 2017, p. 125). The importance of these goods is their relationships with the community.⁷⁸ For the

⁷⁸ Communality is a concept that, although started in the context of Indigenous peoples, goes beyond Indigeneity.

decolonial author George Sefa Dei, “community is shared space, thought and body. It is a collective more powerful than a sea of individuals. The power of community (however defined) prevails over the fragmentation of individuals, each locked in her/his own subjectivity and discursive agency” (Dei, 2012, p. 108). For Dei (2012), to adopt community as a framework generates a radical decolonial consciousness of knowledge production.

After the communal experience of the IFP, and through the continual process of doing through thinking, thinking through doing, I explored other positive and negative alternatives that Indigenous and non-Indigenous communities were using in the context of alternative infrastructures. Are other experiences similar to the *Indigenous Friends Platform*? What are the common challenges that these organizations are facing regarding ownership and self-determination? Are there commonalities in the forms of implementation?

The next section explores three different mobile experiences in the context of Indigenous peoples in order to analyze their commonalities and threads. In the first example, the INE mobile app was used in the context of Indigenous peoples in Mexico without involving the communities, which involved a colonial experience in relation to mobile infrastructures because the members of the communities were not consulted in the design and implementation. Subsequently, two experiences of mobile infrastructures

Therefore, when these forms of “communality” were translated into digital spaces, they found similarities with some other communities that are also fighting against hegemony. KO-KNET mobile and Community Mobile Telephony are a breach between the hacker movement of open software and the Indigenous communities (Bravo, 2017, p. 115; Huerta et al., 2017, p. 122). In accordance with Huerta et al. (2017), the concept of “communality” is compatible with the principle of work as pleasure and knowledge as a common good that is present in the hacker communities (p. 124). The hacker and open-source community have used this concept as a form of collaboration and participation to share common knowledge and resources. According to Huerta et al. (2017), the hacker and developer communities are governed by postulates compatible with Indigenous forms of governance concerning resource management (p. 124). In other words, the hacker and Indigenous communities built a breach between them based on the common goods (Bravo, 2017, p. 123–124). The value of communal knowledge of these hacker communities is so important that the tech industry has exploited the open-source communities taking advantage of the collective action (Padilla, 2017, p. 10). However, it is important to highlight that the hacker community is concerned about knowledge as a common while Indigenous communities see culture, ceremonies, and land as the common. Also, the hacker commonly looks for the common from the individual while communities start from the communal (Bravo, 2017, p. 123-124).

owned and controlled by Indigenous communities are explored to analyze the decolonial principles that have guided these groups. The first decolonial experience is the initiative of *Community Mobile Telephony* in the state of Oaxaca, Mexico. The second experience is the Keewaytinook Okimakanak's Kuhkenah Network mobile (KO-KNET mobile) in Northern Ontario, Canada. In these two experiences, communities have control and possession of the infrastructure.

8.3.1 The INE Mobile App (Mexico)

In the context of the national election in Mexico, the former political Indigenous presidential pre-candidate, María de Jesús Patricio Martínez (“Marichuy”), publicly denounced how mobile technologies were being used against her Indigenous candidacy in 2017. The National Electoral Institute of Mexico (INE) designed a mobile application for independent pre-candidates to collect and validate signatures of supporters across the country. The mobile app required volunteers to take pictures of national identity cards and current photos of the supporter signatories and then collect their signatures through the touchscreen of the mobile devices. Then, the volunteers needed to input the personal information (i.e., name and id number) of the signatory to finally submit the information to the INE system for validation and verification via the Internet. The validation and verification process needed from 3 to 24 hours of processing for a batch of voters. Each independent candidate required 866,593 thousand valid signatures to be considered an official independent candidate at the national election. On October 18, 2017, Marichuy reported publicly that this mobile application was not made “for the poor of this country; but for the rich, demanding technologies for the collection of signatures that in many of our communities we do not even know” (Mandujano, 2017). She also stated that the mobile app required high-end devices because “the INE made a list of brands and models of phones that should have at least an Android 5.0 operating system onwards and a few hours after starting to download the applications on the devices we found that this list is not true; we find brands that are not included in the list and those that are included, it turns out that not all of them work. The download is tedious and can last for hours” (Mandujano, 2017). During a press release, she mentioned two significant design problems: (1) Lighting: “for the picture to be

accepted, it must be taken at noon, as the morning and afternoon light is insufficient unless there is a special lamp that illuminates enough. This factor means if we reduce the days to hours, we have a third of the 120 days provided by law”; and (2) Internet connection: “Many signatures that we collected could not even be uploaded in many hours because the places we were going through Altamirano, Ocosingo and Palenque, where there is usually a good internet signal, not even the telephone signal was working” (Mandujano, 2017).

She concluded her speech by saying that this tool was “classist, racist and excluding” (Mandujano, 2017). On November 7, 2017, members of Marichuy’s volunteer team reported that 45% of the collected signatures were not able to be uploaded to the INE system for verification/validation. Moreover, the mobile app was causing privacy infringements because the personal data of the signatories remained in the devices even after it was verified and validated by INE. Furthermore, several Indigenous municipalities and towns in rural Mexico do not have a mobile broadband internet connection (Gil-Olmos, 2017). By the deadline, on February 19, 2018, Marichuy had officially only collected 248,115 signatures, and therefore, she was not considered a candidate for the presidency (Alduenda, 2018).

The significance of this example is that although the hardware and software were useful and present in many cases (i.e., 248,115 signatures were collected across the country), I argue that the communal and organizational dimension of the mobile infrastructure was excluded and denied. Indigenous communities, Marichuy, and her team were not considered in the design and implementation of the mobile application. The ownership and control of data by the communities were not examined or visualized in the digital design. Although the ownership of hardware was an issue at the beginning of the campaign, the main problem at the end was the lack of understanding of the context of Indigenous communities in rural Mexico (e.g., insufficiency of broadband internet connection, the low-cost devices). The software (i.e., mobile app), which aimed to support the democratic process of the national election in Mexico, became a tool to continue replicating the hegemonic colonial processes. The lack of involvement of Indigenous communities in the infrastructure design transformed digital technologies into a repressive and misogynist tool of exclusion that marginalized and excluded Indigenous peoples. Mobile

infrastructures are not decolonial only by themselves, but I state that they require a profound reappropriation process by community members where communal ownership and control are located in the centre of the design.

8.3.2 Community Mobile Telephony (Oaxaca, Mexico)

Community Mobile Telephony in Mexico is a “hybrid network made up of an infrastructure (software and hardware) and an internet service that allow a community to become a communication service provider” (Bravo, 2017, p. 120). The Community Mobile Telephony is an alternative way to connect by supporting communities to build and maintain self-governed and owned communication infrastructures (Huerta et al., 2017, p. 119). The model of Community Mobile Telephony is a local network that is operated and managed by community members and supported by a cooperative/not-for-profit organization to which all participant communities belong. The hardware consists of “a GSM signal transceiver and a controller or computer, operating with open-source software, connected to the network of a local internet provider and to which a Voice over IP (VOIP) service is contracted” (Bravo, 2017, pp. 120–121). Long-distance and off-net calls are made via the Internet (Huerta et al., 2017, p. 121).

The cooperative that supports this initiative is called *Telecomunicaciones Indígenas Comunitarias* A.C. and is structured by an assembly of communities (Bravo, 2017, p. 120). By July 2019, 19 Indigenous communities (18 in Oaxaca and 1 in Guerrero) are part of the cooperative (Telecomunicaciones Indígena Comunitarias [TIC], n.d.). The service fee is only 2 USD per month with unlimited internal calls and SMS within the localities connected to the network (off-net calls are extra) (Bravo, 2017, p. 121).

The Community Mobile Telephony has four essential elements: (a) the organizational base, which is the social support; (b) the technological base, which is the hardware and software affordable in terms of price; (c) the economic base, which is an unbundled business plan (i.e., the unlimited local calls and SMS); and (d) the techno-economic base which is the material and human resources. The cooperative trains, educates, and hires local technical technicians to maintain the infrastructure (Huerta et al., 2017, p.

121).

This autonomous and communal cellular phone network started in community radio, *Palabra Radio*, in Oaxaca in 2009 (Bravo, 2017, pp. 115, 119). The central importance of the Community Mobile Telephony is the establishment of a mobile infrastructure that belongs to the users and promotes self-determination (Huerta et al., 2017, p. 147). The cooperative continues to expand the infrastructure to more localities, creating a regional network of community-based infrastructure (TIC, n.d.). In this example, the communities that are part of the project are the owners who decide on the infrastructure. Mobile infrastructures are transformed into decolonial tools where community members administrate and decide about the objectives of digital technology.

8.3.3 Keewaytinook Okimakanak's Kuhkenah Network (Northern Ontario, Canada)

Keewaytinook Okimakanak's Kuhkenah Network or KO-KNET (*Keewaytinook Okimakanak* means "Northern Chiefs" and *Kuhkenah* "everybody, everywhere" in Oji-Cree) is an Indigenous-owned and operated ICT service supplier that provides capacity-building assistance to First Nations, such as cellular services, broadband connectivity, and online applications. These services are provided to 28 First Nations in the district of Sioux Lookout across northwestern Ontario and other remote regions in Canada (Middleton & Crow, 2008, pp. 430–431). The online applications combine video, voice, and data services that require broadband and high-speed connectivity. KO-KNET was founded in 1995 by the KO Chief Council with the mandate to work "with First Nations to enable them to control the ownership of their terrestrial or satellite broadband network" (KNET, n.d.; KNET, 2003).

KO-KNET works in partnership with Indigenous peoples, the public, and the private sector to develop their network. The broadband network supports band office programs, health, and education based in Sioux Lookout, Ontario. KO-KNET works with local technicians and suppliers to decrease the requirements for managed service contracts and reduce the time for local repairs and maintenance (KNET, 2003; Middleton & Crow, 2008, pp. 430–431). The First Nations employ local technicians who receive training to support the KO-KNET team (Beaton et al., 2014, p. 6). This educational component is

a vital aspect of the sustainability of the infrastructure in the long term. By 2014, KO-KNET is already present in more than 80 First Nations across Ontario to deliver their local internet connections (Beaton et al., 2014, p. 6). Currently, KO-KNET continues to assist with the administration, bandwidth management, and operations of the ICT infrastructure in the communities through the revenues of the users and the anchor tenants such as health and education services (McMahon, 2014, p. 2012).

Although KO-KNET does not strictly focus on mobile infrastructures, this digital provider has an entire branch that only focuses on mobile: KO-KNET mobile. KO-KNET mobile offers 3G broadband connection, voice, and SMS capabilities to at least 15 remote communities in Northern Ontario. KO-KNET has agreements with other service providers such as TBAYTEL (Northern Ontario) and Rogers (Canada) to continue giving service to their customers when they are outside of their communities (Garrick, 2013). The infrastructure pricing is shared among all network users, reducing the bandwidth cost and supporting the local community economy (KNET, 2003). A significant aspect of the foundation of KO-KNET was that despite their diverse local contexts, the Chiefs of KO agreed to provide equitable connections to all communities, regardless of the size, location, or infrastructure (McMahon, 2014, p. 2011).

As it was stated earlier, there are no official statistics regarding the use of ICTs and Indigenous peoples; however, in the case of Northern Ontario, a small survey was conducted among 209 Indigenous adults of five communities in early 2014 by KO-KNET mobile with significant results (Beaton et al., 2014, p. 5).⁷⁹ Of all the users, 79% of them were using the KO-KNET Mobile daily. 68% believe that the mobile infrastructure is essential for safety and security when they are out on the land. 92% of the surveyed residents use a computer daily (i.e., laptop, desktop, or tablet). Several users used their mobile phones to go online daily (44%) through a Wi-Fi connection. Also, 39% had a smartphone (Beaton et al., 2014, p. 17).

⁷⁹ The five communities are Deer Lake First Nation, Fort Severn, Keewaywin, Poplar Hill and North Spirit Lake, with 1450 eligible adults (which means that the response rate was 14% from the adult population) (Beaton, Seibel & Thomas, 2014, p. 5).

In this example, the KO-KNET infrastructure proves that the community's role in designing and implementing digital technologies is fundamental. The solutions based on the ownership of infrastructure that belongs to community members opens the possibility of using originally designed colonial and capital tools to be used in decolonial contexts in order to progress the sovereignty and well-being of Indigenous communities.

8.3.4 Decolonial Mobile Infrastructures: The Communal Component

Because again, going back to what I was saying earlier is Indigenous people are all about community, and I think that still translates to what indigenous digital technology looks like. It's community. It's communal. Everybody is a part of it and contributes their ideas and thoughts into how something should be built or how something should go. (Mitchelle Gegwetch, personal communication, May 4, 2020)

Malvido (2018) claims that radio, telephony, and community wireless Internet and Intranet networks acquired and operated by the communities respond to the right of communication and information and the right of self-determination (p. 2). According to Dyson (2016), community-owned networks “enhance Indigenous control and decision-making to maximize social benefit, an instance of ‘self-determination applied to telecommunications’” (p. 26). In other words, without the fact that the infrastructure is owned and controlled by the community (i.e., the communal factor), the hardware and software infrastructures would become an open door for colonization in any of its forms (e.g., rewesternization and dewesternization). Moreover, policymaker and academic Francesca Bria (2015) asserts that “alternative forms of public and common ownership for platforms will help to create a more democratic economy, transcending the logic of market-based, rent-seeking, privatized network systems” (p. 4).

In the examples provided, mobile technologies were initially a viable option for creating an infrastructure that could reach Indigenous peoples due to the high penetration level in most contexts. However, as shown with the INE mobile app, the lack of self-determination and imposition of technology from groups outside of the communities can create a hostile environment. As the Indigenous leader

Marichuy expressed at the end of the process, mobile infrastructures can become a form of “classist, racist and excluding” technology for Indigenous peoples. The fact that this type of technology was generated and designed outside of these communities provides significant challenges to communities to accomplish the self-determination of their digital tools and data.

In the case of KO-KNET mobile and Community Mobile Telephony, they present a challenge in urban environments. Both projects are implemented in remote areas distant from urban centres, where a significant number of Indigenous communities are located. In the cities, the ownership of hardware infrastructures is more challenging due to the various low-cost options that are already implemented in these massive scale markets. In the same way, the diversity of Indigenous cultures that live in those contexts presents difficulties at the governance and decision-making level for the different groups living in the city. How can an Indigenous infrastructure be imagined in these circumstances? In the case of KO-KNET several partnerships were created with larger corporations to provide service in the cities (e.g., Tbaytel & Rogers).

The *Indigenous Friends Platform* project tries to answer those challenges by reimagining and reframing the concept of infrastructure based on software platforms via the community-based not-for-profit. Due to these significant constraints, the *Indigenous Friends Platform* does not own hardware that provides services (e.g., servers, antennas, networking devices), enabling the possibilities of investing more resources in software creation and educational tools for community members. Moreover, this solution uses the same devices that community members already have in order to deliver its services and features. Therefore, the Epangishmok (West) direction of this Tech Medicine Wheel focuses on the communal characteristic of Indigenous digital technology in order to aspire to become a decolonial tool.

In Community Mobile Telephony (Mexico), the *Indigenous Friends Platform* (Canada), and KO-KNET mobile (Canada), Indigenous communities are not only using mobile infrastructures, but they have control and ownership of them. Commonly, projects around mobile technologies and Indigenous peoples have only focused on the hardware and software without looking to the organizational dimension of these tools and without considering social and relational aspects of the technology (e.g., the INE mobile app).

These three projects are forms of reappropriation that are happening at the hardware or software levels but considering “community” as an organizational/institutional dimension of the infrastructure. Mobile infrastructures do not imply a decolonial character per se, but because of their characteristics in the context of Indigenous communities, they allow Indigenous peoples to move forward to have self-determination of their digital infrastructure and include community principles in the management of hardware and software. This control over digital technology signifies a step forward towards sovereignty over their information and data.

As a conclusion of this analysis, before Indigenous peoples can claim this type of technology, I argue that mobile spaces need to be constructed through an infrastructure that could accommodate the various needs and understandings of significant diverse communities. Therefore, decolonizing digital technology requires embracing the analysis of the implications of infrastructure to aspire to assemble decolonizing digital spaces. In the case that the infrastructure is not appropriate in the context of Indigenous peoples, the process of software creation, embodiment, and data can trigger forms of colonial imposition and misappropriation because an external entity might control the hardware and software which contain all the data and ideas shared in the virtual space (e.g., INE Mobile App). In this regard, Dyson (2004) warns that the only way that digital infrastructures could have colonization power is if the digital technologies are institutionalized to that end (p. 69), which potentially means that in order to decolonize the technologies, they need to be organized in that decolonial sense as well. Commonly, the advocates of Information and Communication Technologies for Development (ICT4D) follow the colonial pattern, assuming that people will benefit from new forms of technical infrastructure (hardware/software) instead of focusing on what diverse communities are demanding (Okune et al., 2018, p. 8). Moreover, I state that the mainstream discourse embraced by ICT4D commonly focuses exclusively on the access level without considering the control and ownership layers.

8.4 Conclusion: Community as Decolonial Technical Infrastructure

In this chapter, I present the current context of mobile technologies and how this form of

technology is responding to the communal needs of local Indigenous groups to demonstrate that mobile technologies can be considered a decolonial infrastructure due to the fact that this technology responds better to local needs and adapts to Indigenous worldviews. The communal aspect considers the transfer of legal ownership and control to local communities and transfers the required skills to maintain such infrastructure with the local resources around them (i.e., control over them). The three decolonial projects presented in this chapter include a significant educational component to provide community members with the skills and experiences to sustain the infrastructure in the medium and long term. Moreover, the community-based initiatives consider the values and principles present in the offline communities and apply them in the digital. In the specific case of this research, I argue that the communal factor within the *Indigenous Friends Platform* is a vital component to aspire to decolonize infrastructures and provide community members with the possibility of controlling digital technologies in their communities. However, it is essential to clarify that this journey has not finished, and the IFA needs to continue developing more skills in order to acquire and control decentralized physical and software infrastructures.

The digital Epangishmok (West) dimension signifies the afternoon, where the technical being reflects what has been done with their usage and implementation. In other words, after the software and the embodiment of Indigeneity were embraced, the evaluation of where the Spirit of the mobile app resides was raised as a form of decolonial practice in the infrastructure. An infrastructure based on “community” is essential to counterbalance the colonizing effects of digital hegemonic power. When the community becomes an integral part of the infrastructure's organizational dimension, a decolonial infrastructure is being implemented. These forms of reappropriation provide some ways in which digital technology can be deployed as a possible support for the processes of decoloniality. The exploration of these forms of technological reappropriation proves that because they enable incorporating community into the technical infrastructure, they allow the reclamation of these machines as forms of potential decolonizing tools. In other words, although mobile devices or mobile apps provide several answers to the insufficiency of infrastructure for the majority of communities, the principles of communality and self-determination need to be included as a crucial part of the design and implementation of a potential

decolonial and Indigenous infrastructure.

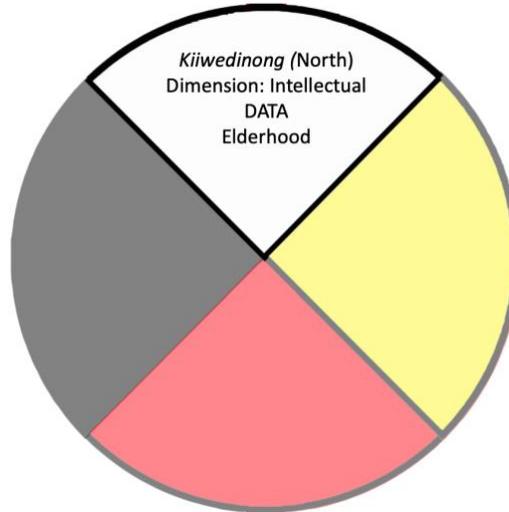
An important aspect to highlight is that just because the hardware and software contain Indigenous data does not mean that the infrastructure is decolonial. The data is contained in the hardware and software, but the Indigenous data would have the risk of being appropriated by outsiders. As mentioned earlier in the chapter, infrastructures would continue replicating colonial power forms and creating discrepancies between the colonizer and the colonized without the communal component. In other words, the inclusion of the community into the infrastructure is not yet enough to create a decolonizing digital solution. Several capitalist and colonial principles of mobile apps are still present within the information and data stored. How do the colonial values of mobile apps and markets potentially get detached from the data and information? The decolonial perspective must be included in how data and information are stored. In this physical dimension, the being enters a state of maturity where the reflection of the entire journey becomes vital to find balance and to move forward to the sovereignty of the information. The next dimension of this methodology in the Tech Anishinaabe Medicine Wheel is the Kiiwedonong (North), which answers several data sovereignty inquiries.

Chapter 9

Kiiwedinong (North) – Indigenous Data Sovereignty

Figure 22

Kiiwedinong (North) – Indigenous Data Sovereignty



Following the software methodology, the embodiment of Indigeneity and decolonial infrastructures, several inquiries around Indigenous data emerged as the result of the information produced and stored in cyberspace. Therefore, there is a need to explore the implications of information in the context of Indigenous peoples. As the fourth stage in the Tech Anishinaabe Medicine Wheel, the technical being moves to the Kiiwedinong (North), where the intellectual thoughts and knowledge reside (Figure 22). The Kiiwedinong represents the winter months, and it is a time to slow down, rest, contemplate the life journey and reflect on being a child, a youth, and an adult. During this state, Elders, pipe carriers, and lodge keepers share stories and experiences (InvertMedia Inc., 2012a).

Similarly, in this stage, the purpose of the mobile application is reflected and re-evaluated to respect and protect Traditional Knowledge in the form of Indigenous data/knowledge. Moreover, this concept of Indigenous data sovereignty unfolds an extensive analysis between intellectual property, ethical principles, and forms of governance.

From all the different dimensions of the Tech Anishinaabe Medicine Wheel, the Kiiwedining is the one that entails more theoretical challenges residing in the complexity of the topic and ambiguity due to the diversity of different legal and ethical approaches on data governance. While several authors focus on the ethical considerations of the information itself, there is another vast group of intellectuals whose main interest exclusively relies on the legal frameworks and specific tools to protect Indigenous data/knowledge. This issue makes Indigenous data governance a complex topic that transgresses several ethical, moral, and legal systems that sometimes contradict each other. Although the full problematization and historical analysis of Indigenous data governance are out of the scope of this research, this section aims to provide an overall understanding of the critical issues around this topic and how some efforts worldwide have been created to provide initial tools and principles to navigate the ethical and legal dilemmas on Indigenous data/knowledge. Moreover, in order to incorporate data solutions and principles into the development of the *Indigenous Friends Platform*, a theoretical understanding of the different intersections of data governance and Indigenous ethics was necessary.

This chapter begins framing the tensions between the notions of data and Indigenous knowledge in order to provide a definition of Indigenous data sovereignty. After this initial discussion, the contradictions of the public domain and the “commons” in the context of Indigenous data are unfolded. Next, an analysis of the different types of inconsistencies between the intellectual property regime and Traditional Knowledge are explained through three different types of legal gaps. Consequently, the practice of Indigenous data sovereignty is framed based on the ethical solutions that several communities have developed around data governance and how these solutions are linked to the *Indigenous Friends Platform*.

9.1 Indigenous Data and Its Sovereignty

Indigenous peoples throughout the history of colonization have been dispossessed from all types of data and knowledge due to the fascination of Europeans with transforming communities and their members into research objects (Christen, 2012, p. 2876; First Nations Information Governance Centre

[FNIGC], 2016, pp. 142–143; Rodriguez-Lonebear, 2016, pp. 255, 256; Smith, 1999; Smith, 2016, pp. 120–121; Wilson, 2008, p. 15). The tensions between Indigenous knowledge and data can be genealogically traced back to the creation of the intellectual property regime in the 19th century during the Paris Convention (1883) because the legal framework for accumulating and storing data was created in this event (World Intellectual Property Organization [WIPO], n.d.). Within this initial framework of dispossession, there is a need to differentiate the notion of Indigenous data and Indigenous knowledge.

The word “data” comes from the Latin datum, meaning “something given” (Rodriguez-Lonebear, 2016, p. 255). Data is commonly defined as “unprocessed information” (Heeks, 2018, p. 5). However, traditional practices and knowledge are information that has been “processed” generation over generation. Moreover, from an Indigenous point of view, “‘Information’ in Indigenous communities is not facts to be known; information or knowledge is the experiences of communities, and thus along with knowing comes responsibilities shaped by complex systems of kinship, age, and gender, among other social dimensions” (as stated by Bang et al., 2013, p. 710). Sharma (2014) defines Indigenous knowledge (IDK) as: “the information base for a society, which facilitates communication and decision-making. Indigenous information systems are dynamic and are continually influenced by internal creativity and experimentation as well as by contact with external systems” (p. 128). In the same line, the International Institute of Rural Reconstruction defines IDK as the “knowledge that people in a given community have developed over time and continue to develop. It is based on experience, often tested over centuries of use, adapted to local culture and environment, and dynamic and changing” (as cited in Sillitoe et al., 2005, p. 3). Finally, Lodhi and Mikulecky describe IDK as “complete body of knowledge, know-how and practices maintained and developed by peoples through generations” (as cited in Awori, 2015, p. 17).

The purpose of distinguishing data from the concepts of information and knowledge resides in its practical/legal and political implications. When data is processed to make it useful to its recipients, it becomes information. When this information is assimilated into a coherent framework of understanding within the human mind, it becomes knowledge (Heeks, 2018, p. 6). Therefore, the objective of using the Western category of “data” is to encompass all the possible forms of epistemic content in a legal form;

however, it is vital to note that several Indigenous academics have extensively developed this concept as Indigenous knowledge.

Furthermore, the simplistic notion of data as “something given” hides its political implications over Indigenous knowledge. Schnarch (2004) asserts that data is not just gathered from nature but created by those with the resources and opportunities to do it (p. 92). In the context of Indigenous communities, this factor means that data under Indigenous contexts and experiences frequently means “something taken” instead of “something given” (Rodriguez-Lonebear, 2016, p. 255). Due to this epistemic oppression and violence as a form of past and ongoing colonialism, the concept of Indigenous data is currently tied to the idea of sovereignty (Snipp, 2016, p. 51). Data sovereignty means “managing information in a way that is consistent with the laws, practices and customs of the nation-state in which it is located” (Snipp, 2016, p. 39). Therefore, Indigenous data sovereignty is “[I]ndigenous peoples’ right to maintain, control, protect and develop their cultural heritage, Traditional Knowledge and traditional cultural expressions, as well as their right to maintain, control, protect and develop their intellectual property over these” (Kukutai & Taylor, 2016, xxii). It is important to expose that even though the idea of data sovereignty might be seen as a consequence of the digital age, this idea is rooted in the historical claims of Indigenous self-determination as sovereign entities predating European colonization (Kukutai & Taylor, 2016, p. 14; Smith, 1999, p. 7; Wilson & Bird, 2005, pp. 1–4). Although the linguistic implication of data and knowledge is beyond this research, the trinomial concept of Indigenous information/data/knowledge (IDK) recognizes this epistemic transformation, and therefore it is used throughout the analysis of this research.

Under the context of the US Indigenous Data Sovereignty Network, Rainie et al. (2019) defined IDK as data, information and knowledge, in any format, that impact Indigenous peoples, nation, and communities at the collective and individual levels: (a) Data about Indigenous resources and environments (e.g. land, water, geology, titles, air, soil, sacred sites, territories, plants, animals, among others); (b) Data about Indigenous peoples as individuals (e.g. administrative, legal, health, social commercial, corporate, services, among others); and (c) Data about Indigenous peoples as collectives—

Nations and peoples (e.g. traditional and cultural information, archives, oral histories, literature, ancestral and clan knowledge, stories, belonging, among others). From this perspective and framework, the US Indigenous Data Sovereignty Network (n.d.) defines Indigenous data sovereignty as: “the right of a nation to govern the collection, ownership, and application of its own data. It derives from tribes’ inherent right to govern their peoples, lands, and resources.” From this perspective digital data and information is positioned under an Indigenous rights framework.

The main problem in the digital context is that this IDK, either stolen or not, is currently mainly transmitted through information technologies, most commonly, via social media and online institutional databases. Therefore, information becomes shareable around the world, not local anymore, and unprotected from cultural misappropriation. During the development of the *Indigenous Friends Platform*, there were two IDK components necessary to consider in their development and implementation. First, the Traditional Knowledge of raising the Cree Tipi to develop the mobile application software, and second, the data the users were going to share in the space. As it was questioned throughout the intersections with several York University stakeholders, understanding these components was fundamental to aspire for a certain level of IDK protection. Although these two types of components are intertwined and interconnected in Indigenous Ways of Knowing, their separation and transformation were necessary in order to provide appropriate legal protection instruments in digital spaces.

From this departure, one of the most significant assumptions from neoliberal agendas and European left thinkers has been the assumption that Indigenous knowledge belongs to the public domain or “the commons.” Although the two political movements have fundamental differences, their views present fundamental divergences with Indigenous worldviews. The significance of exploring this scenario offers an essential description of the values and beliefs that Indigenous Data Sovereignty entails.

9.2 Public Domain and the Commons

For centuries, IDK has continually been incorporated in several data repositories (e.g., museums, books, articles, databases, newspapers) without the consent of Indigenous communities by researchers,

scientists, gallerists, archivists, museologists, and librarians due to the fascination of the West to transform communities and their members into research objects (Christen, 2012; First Nations Information Governance Centre[FNIGC], 2016; Rodriguez-Lonebear, 2016; Smith, 1999; Smith, 2016; Wilson, 2008).

The constant extractivism of knowledge from communities has generated continual epistemic violence against Indigenous knowledge(s) worldwide. Moreover, the new technologies and ways to process and generate data based on the Internet such as the social media, Internet of Things (IoT), cloud computing, and big data are accelerating this phenomenon into a massive and global scale because the information can be shared elsewhere, and hence this type of knowledge becomes unprotected from cultural misappropriation. Therefore, there is a need for an urgent transdisciplinary discussion about the possible solutions for Indigenous traditions and knowledge within digital spaces.

One of the most significant assumptions from the fascination towards Indigenous peoples as research objects in the contemporary world is that IDK should belong to the public domain. This notion has been boosted by the open data movement to make IDK available for “open and free” research and exploration (Research Data Alliance International Indigenous Data Sovereignty Interest Group [RDA IIDS Group], 2019). The public domain is “generally said to consist of intangible materials that are not subject to exclusive IP rights and which are, therefore, freely available to be used or exploited by any person” (WIPO, 2010b, p. 1). Neoliberal approaches conceive the public domain as the absence of intellectual property rights and as a form of freedom, i.e., every piece of knowledge that is not under intellectual property law (Bowrey & Anderson, 2009, p. 494; Christen, 2012, p. 2876; WIPO, 2010b, p. 5). In contrast, the Western left, which is the political ideology behind the open data movement, has fostered the idea of “the commons” as a form to reorientate previous concepts of communism and socialism (Mignolo, 2011, p. 39) through fostering legal licenses based on copyright. Although the two political movements, neoliberal and Western left, have fundamental differences, their views concerning IDK and its ownership regularly present significant similarities because they exclude IDK from protection, and, clearly, they have been used to justify its misappropriation. For the neoliberal agendas,

IDK does not have a commercial value, it does not fit easily in the concept of private property and seems to overpass the time scope of protection, and therefore, IDK should belong to the public domain. In the case of Western left thinkers, IDK should be open for everyone because all types of knowledge are equal regardless of their identity (i.e., erasure of the difference), and therefore, IDK should belong to the commons. Both cases do not recognize the historical power imbalance and misappropriation within Indigenous communities for centuries. In this regard, the IFP users agree on this perspective:

[O]bviously, there is the need to be restrictions and stuff like that where when it comes to certain information, certain things like that, the procedure needs to be followed and etcetera, etcetera. Because there's the information freedom, but there's also some things that shouldn't be shared, that in regards to Indigenous people, some things that they don't want to share if they don't want to make certain things public, they shouldn't be obligated that they have to do that. And maybe not even for Indigenous people, but for other cultures as well, if they have things that are sacred to them and they don't feel are public, then that should be up to them. That shouldn't be anybody else's choice. It should be up to them to be able to say that and be able to share what they feel comfortable sharing. (Mitchelle Gegwetch, personal communication, May 4, 2020)

Not everything needs to be broadcasted [...] what stays secret because not everything's meant to be shared with the world. (McKenzie Toulouse, personal communication, May 12, 2020)

The discourses around the public domain match the same form of oppression as the doctrine of discovery, which prevailed that Indigenous peoples were “uncivilized [and] primitive,” and they could not hold property the same way that European hold property. Similarly, the idea that IDK belongs to the commons or the public domain is an analogy to the doctrine of *terra nullius* fostered by European settlers when they arrived in the Americas (Rodriguez-Prieto & Martinez-Cabezudo, 2016, pp. 273–277).⁸⁰ In other words, IDK is apparently ready to be exploited because it does not belong to “anyone” or require a knowledge “savior” (e.g., researcher, gallerist, librarians, archivist, among others) to hold it as it was the

⁸⁰ A Latin expression meaning “nobody’s land.” It was a principle used in the colonization processes to justify claims that territory can be acquired by the only fact of the occupation of it (Watson, 2014).

case with Indigenous lands. While data extractivism/colonialism is framed in the current context of data extraction by social media and internet companies globally, Indigenous data sovereignty is formulated from the historical and colonial local struggles of Indigenous peoples over their data.

In the contemporary context, Indigenous voices were not heard in the creation of the legal concept of the public domain or the concept of the commons' licensing, and therefore, Indigenous political aspirations were not included within the ethical and legal frameworks (Anderson, 2010, p. 25; Bowrey & Anderson, 2009, pp. 481–482; Christen, 2012, p. 2880; Frankel & Drahos, 2012, p. 9; Wong & Fernandini, 2011, p. 207). Furthermore, Indigenous peoples and “the public” should not be assumed to share a common interest, and therefore, the public domain cannot be the de facto option regarding Indigenous data (Bowrey & Anderson, 2009, p. 480; Nicholas, 2014, p. 214). This entity also reinforces the invisibility of past and ongoing Indigenous practices in communities around knowledge management (Anderson, 2010, p. 26). The public domain has historically “violated [I]ndigenous peoples' rights by defining their collective works as ‘folklore’ and excluding their protection” (Christen, 2012, p. 2880). Paradoxically to all this reasoning, most Indigenous knowledge/data currently resides in the public domain (Anderson, 2012, p. 72; Brown, 2005, p. 45; Nicholas, 2014, p. 223; Wong & Fernandini, 2011, p. 185).

In the case of the *Indigenous Friends Platform* and the first design principle of IDK (i.e., the digital software braid), there was tension from external academic progressive members to immediately share the source code of the mobile application on the Internet as part of the open-source movement. However, the tensions among the Cree Tipi ceremony and “the commons” were raised as a form of misappropriation and misuse. Therefore, since the beginning of the development, I decided not to share the source code of the application to respect the knowledge shared with me by different Elders and knowledge keepers. Part of the decision and objective to create the INDIGital program in 2019 was to share the *Indigenous Friends Platform's* experience and knowledge.

In the case of the second component of IDK in the IFP (i.e., the data of the users), community members expressed throughout the design and implementation process their concern regarding the

privacy and usage of their data even before the Cambridge Analytica scandal in 2018. Furthermore, during the advisory sessions of different York University stakeholders, there were several requirements to protect the data of the users from misappropriation. Therefore, an integral and central decision in the implementation of the *Indigenous Friends Platform's* sustainability plan was not to use the data of the users to generate marketing strategies or commodify users' data. As it was explained above, the decision was central to avoid the terra nullius data policy that is implemented in other social media platforms.

In the face of ongoing misappropriation and theft of IDK under the public domain and albeit the limitations of Indigenous knowledge under the Intellectual Property Law, most authors and scholars agree that IDK also needs to be protected in the global context from becoming part of the public domain. Furthermore, the only way to do it is to follow the Intellectual Property Rights (IPR) legislation as the only form of current legal protection. Under a framework of Indigenous Data sovereignty, this aspiration to legally protect IDK should also consider ethical principles of data governance to avoid discourses that foster IDK as part of the commons as de facto. Therefore, in order to protect the knowledge within the IFP, it was necessary to explore the legal and ethical challenges to achieve Indigenous data sovereignty.

9.3 The Tensions between Indigenous Knowledge and Intellectual Property Rights

In the era of information technology, the production and sharing of knowledge have significantly increased in several groups and social sectors. The digital age provides Indigenous peoples and communities with a unique opportunity to share their wisdom and traditions outside of their communities and across borders. However, traditional historical repositories (e.g., galleries, libraries, archives, museums—better known as GLAM), and, more recently, social media as digital repositories, have created several challenges for protecting IDK. Joanne Waitoa acknowledges that it can be challenging to navigate the online world concerning Indigenous values because of how the IDK is digitally transmitted (as stated by Wemigwans, 2018, pp. 62–63). Joanne agrees that the problem is “how do we protect and transmit our ceremonies and knowledge in ways that maintain their integrity, for the many young Indigenous People coming up who may not have direct access in their environment to those who hold that knowledge and

conduct those ceremonies?” (as stated by Wemigwans, 2018, pp. 221–222). This problem has been present with GLAM repositories for a long time, derived from their fascination with Indigenous peoples as research objects; however, the sharing of information in social media has accelerated and intensified inquiries about the protection of IDK as digital assets.

In the international context, liberal thinkers created intellectual property rights (IPR) in the nineteenth century to protect informational goods’ ownership and profitability. Due to the quick adoption of the Internet in the early 1990s, the Intellectual Property Law was expanded and established at a global scale through the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) in 1993. This international law significantly transformed how data is protected, and commodified knowledge to boost the information economy. The independent legislation for copyright, database protection, plant variety protection, geographical indications, patents, designs, trademarks, trade secrets, and confidential information together constitute intellectual property laws (Anderson & Christen, 2013, p. 107; Frankel & Drahos, 2012, p. 1).

As a first step to protecting IDK, the scope and boundaries of “Indigenous knowledge” were contested within the framework of Intellectual Property. For Indigenous peoples, knowledge can include several aspects that Western epistemic conceptualizations might exclude (e.g., ceremonial and sacred practices, spiritual teachings, the connection of humans with the environment, creation stories). Therefore, at the international level, the terms Traditional Knowledge (TK) and Traditional Cultural Expressions (TCE) were coined by the World Intellectual Property Organization (WIPO) to understand and categorize the types of protections that IDK has under the IPR.

According to the WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC), Traditional Knowledge (TK) refers to:

[K]nowledge that is created, maintained, controlled, protected and developed by indigenous [peoples], local communities, [and nations] and that is directly linked with the social identity and/or cultural heritage of indigenous [peoples] and local communities; that is transmitted from generation to generation, whether consecutively or not; which subsists in codified, oral, or other forms; and which may be dynamic and evolving, and

may take the form of know-how, skills, innovations, practices, teachings or learnings. (WIPO, 2017b, p. 7)

Traditional Knowledge (TK) innovations can be found in, but are not limited to, methods of governance, traditional architecture, methods of hairstyling and body decoration, food preservation, processing and conservation, traditional medicine and techniques, traditional modes of environmental and biodiversity conservation and sustainability, cloth weaving and cloth dyeing techniques, farming and agricultural knowledge, among others (WIPO, 2010a). Commonly, TK innovations benefit from patent, trademark, and geographical indication protection, or they might be protected as a trade secret or confidential information. (WIPO, 2010a; WIPO, 2017b)

IGC refers to Traditional cultural expression (TCE) as:

[A]ny form of [artistic and literary], [other creative, and spiritual,] [creative and literary or artistic] expression, tangible or intangible, or a combination thereof, such as actions, materials, music and sound, verbal and written [and their adaptations], regardless of the form in which it is embodied, expressed or illustrated [which may subsist in written/codified, oral or other forms], that are [created]/[generated], expressed and maintained, in a collective context, by indigenous [peoples] and local communities; that are the unique product of and/or directly linked with and the cultural [and]/[or] social identity and cultural heritage of indigenous [peoples] and local communities; and that are transmitted from generation to generation, whether consecutively or not. Traditional cultural expressions may be dynamic and evolving. (WIPO, 2017c, p. 5)

In this case, TCEs can be communicated, including, but not limited to dance, plays, ceremonies, rituals, peregrinations, games, traditional sports, puppet performances, material expressions of art, handicrafts, ceremonial masks or dress, handmade carpets, songs, rhythms, stories, epics, legends, popular stories, poetry, riddles, words, signs, names, symbols, among others (WIPO, 2017c, p. 5). TCEs might benefit from the copyright and related rights, as well as trademark law, whether there is a commercial gain implied. (WIPO, 2017c, p. 13)

Although these two concepts form part of a single integrated heritage for most Indigenous communities worldwide and in many national jurisdictions are contentious, they still raise particular legal and policy inquiries within the IPR that must be explored separately. In the case of the analysis of digital

spaces, the focus mainly relies on TCE because the content creations over the Internet and social media, and most contents within the GLAM institutions, fall under this category. Moreover, in the case of digital content, the materiality of the expressions and representations (e.g., songs, pictures, images, sounds, melodies, written text, and videos, among others) allocate all these materials under the umbrella of TCE.

In the case of TK, albeit they can be recorded as TCE, their materiality designates them under another IP category scope. In other words, although TK can be expressed or represented in the digital space (e.g., a video of a sacred ceremony), the protection of the TK itself (e.g. the sacred ceremony) beyond the medium of the expression (e.g. the recorded images, videos and sounds of that ceremony) goes outside the digital realm. Therefore, the focus of this section is to exclusively unfold the context of TCE, although several of the analyses may be applicable also for TK. In the case of the *Indigenous Friends Platform*, the nature of the software and digital spaces locate most of the content and IDKs within the platform under the category of TCEs.

Regarding the issues of TCE, there is extensive literature worldwide that focuses on several challenges that this legal framework has at the global and national levels in order to provide a form of protection for IDK (Anderson, 2010; Bowrey & Anderson, 2009; Christen, 2012; Frankel & Drahos, 2012; Janke & Iacovino, 2012; Jaszi, 2017; Nicholas & Bannister, 2004; Wong & Fernandini, 2011). Although the extensive discussion about the legal limitations of TCE is out of the scope of this research, I want to provide a general explanation of these legal challenges in order to present the legal complexities that digital technologies are adding in the context of Indigenous data sovereignty worldwide.

To frame this general comprehension of the legal limitations of TCE, I use the analysis of Peter Jaszi, Law Professor from the American University Washington College of Law, which in 2017 and 2018 offered an extensive analysis of the different types of limitations under Intellectual Property for the protection of IDK. Although the full exploration of these gaps is outside of this research scope, they provide an understanding of the challenges protecting IDK in online environments. Jaszi (2017) classified these gaps into three main categories: (a) structural gaps, referring to the epistemic and ontological differences and challenges between the framework of Intellectual Property and IDK; (b) functional gaps,

relating the low correspondence between the purpose of IPR and the goals of Indigenous communities concerning their IDK; and (c) doctrinal gaps, referencing the legal deficiencies and limitations of specific IPR instruments and IDKs.

9.3.1 Structural Gaps: The Systemic Problem

One fundamental premise in the analysis of IDK in the digital world is that in order to be transferred/translated into a virtual realm, Indigenous knowledge is transformed into data (i.e., the knowledge is transformed into a sequence of 0's and 1's). When this data is processed (this transformation can be written or recorded), it becomes an informational good (i.e. Indigenous data). As an informational “good,” IDK acquires the digital attribute of “property” and “ownership.” In other words, the idea of commodifying IDK into a good to be sold, owned, or controlled by a private entity becomes problematic for several Indigenous worldviews that do not see IDK as a digital asset. At this level, there are still structural or systemic gaps that emerge due to the historical, ideological, and economic conflicts among Indigenous peoples versus national governments, enterprises, and non-Indigenous individuals. Presently, there are still no customary international instruments or alternatives for the protection of Indigenous knowledge outside of the Intellectual Property Law (Jaszi, 2017; Frankel & Drahos, 2012, pp. 3–6; Wong & Fernandini, 2011, p. 201).

In order to protect IDK under the IPR, Indigenous epistemologies are transformed and modified through categorization to associate them with specific Western legal frameworks (Anderson, 2012, p. 67; Frankel & Drahos, 2012, p. 2; Riley, 2005, p. 87; Tunney, 1998, p. 2). The enforcement of Indigenous knowledge to accommodate Western legal structures constitutes a form of neo-colonialism. In other words, these forms of protection impose several colonial values into the knowledge and imply oppressive structures of domination over data owned by Indigenous peoples, which by definition, is tied and attached to Mother Earth and territories (Kundnani, 1999). This recognition becomes significant due to the several distinctions, divisions, and categorizations of IDK made throughout the application of Intellectual Property Law. Due to the reasons above, Indigenous peoples commonly find justifications for not

pursuing protection on cultural rights for IDK (Brown, 2005, p. 45). The recognition of these epistemic oppressions situates the Intellectual Property structures as colonizing tools that use the terms and language of the oppressors; nonetheless, all the authors agree that some of them under particular circumstances might offer some alternatives for Indigenous identities to protect their knowledge (Anderson, 2012; Brown, 2005; Cottier and Panizzon, 2005; Kundnani, 1999). Moreover, Cottier and Panizzon (2005) assert that Indigenous peoples should not neglect the IPR in order to become part of the global economy (p. 567). The colonial aspects and forms of oppression under the intellectual property structure are the structural gaps in protecting Indigenous knowledge. However, it is essential to clarify that the Indigenous data that is not protected under the legal framework of Intellectual Property becomes part of the public domain and can be used by any entity worldwide.

As it was explained at the beginning of this chapter, the separation of the two types of IDKs within the *Indigenous Friends Platform*, the data of the users and the software methodology, implied the first level of transformation of Indigenous knowledge within this research. Moreover, throughout the protection and transformation of the legal intellectual property instruments, the IDK continued to be adapted and changed within a colonial framework. However, this transformation was required to provide some level of protection to the IDKs that were included in the platform. The structural gaps require an entire redefinition of the legal framework within Indigenous Nations and communities beyond the scope of this research.

9.3.2 Functional Gaps: The Legal Debacle

The contentious categorization of IDK to suit several intellectual property instruments has frequently failed on fulfilling functional gaps under the law. These gaps refer specifically to things that intellectual property law does not accomplish and arguably should do under the terms of intellectual property. These gaps are:

1. Attribution. This refers to the aspiration of persons and groups associated with IDK (including states in which they are found) to legally guarantee that when knowledge is disseminated, their

sources are adequately and appropriately acknowledged (Anderson, 2010, p. 30; Bowrey & Anderson, 2009, p. 488; Frankel & Drahos, 2012, p. 143; Jaszi, 2017, p. 5; Wong & Fernandini, 2011, p.187). Although there recently created “works” to recognize this concern, there are no legal actions to guarantee attribution in all the different varieties of TK and TCEs.

2. Control. This means that Indigenous peoples can decide how IDK is employed (i.e., control, possession) in order to avoid offending or malicious uses for peoples and groups who function as their custodians (Bowrey & Anderson, 2009, p. 481; Frankel & Drahos, 2012, p.143; Jaszi, 2017, p. 5; Wong & Fernandini, 2011, p. 179). This conversation derived from GLAM in the context that although some of them recognize the importance of Indigenous data and might attribute the work to the respective communities, they do not provide control of the material or content to Indigenous peoples under the exception of fair-use.⁸¹ Furthermore, the control of the data is not reachable (a) if Indigenous peoples have no legal rights because a third party owns the material; or (b) if the material is already in the public domain (Anderson & Christen, 2013, p. 110).
3. Remuneration. This refers to legally avoiding the economic exploitation of Indigenous knowledge, and especially when the profiting is far from their places of origin (Jaszi, 2017, p. 5; Kedron, 2016, pp. 102–106; Wong & Fernandini, 2011, pp. 189–193). The protection system does not easily allow small Indigenous communities to claim property rights on materials, especially if those rights imply a form of profit, in any other national jurisdiction different from where they are located without a high disbursement of capital and human resources.

These functional gaps signify that despite the regulations and particularities under Intellectual Property law, the purpose of legal frameworks is not fully met in the context of Indigenous peoples.

These functional gaps are directly connected to the ethical principles that several Indigenous communities have pushed forward at several national, regional, and international instances.

⁸¹ Fair-use is a doctrine that “allows users to make copies of, quote from, and refer to copyrighted works for the following purposes : in connection with criticism or comment on the work; in the course of news reporting; for teaching or classroom use; or as part of scholarship or research.” (Vaidhyathan, 2001, p. 27)

In the context of the *Indigenous Friends Platform*, the objective of protection focused on the first two components: attribution and control. In the case of the attribution, there was the challenge to attribute the collective authorship of the software methodology and recognize the source of the user content in the case that a person shares a form of IDK. This issue was addressed through the copyright of the source code and the TK Labels included in the platform. In the case of the control gap, this matter became complex due to the legal entity of the “Indigenous community” at York University. From a legal point of view, the “community” cannot be translated to a legal entity, and therefore, the control over the platform and its data became a complex issue to be discussed with the Indigenous community at York University. This obstacle was addressed through the incorporation of the not-for-profit.

9.3.3 Doctrinal Gaps: Intellectual Property Regime and Indigenous Knowledge

In the realm of TCE and digital spaces, several intellectual instruments offer a certain level of protection for Indigenous knowledge; however, all of them present several doctrinal or technical legal deficiencies. These gaps are common to several intellectual property instruments, as explained later in this section. It is essential to mention that these gaps are transferred to digital spaces because all the instruments are applicable within the Internet and digital spaces.

Among all the intellectual property laws and instruments, copyright law offers an initial starting point for protecting TCE within the IP framework. Copyright is “a ‘bundle’ of rights that includes the exclusive right to make copies, authorize others to make copies, create derivative works such as translations and displays in other media, sell the work, perform the work publicly, and petition a court for relief in case others infringe on any of these rights. Control of these rights can be transferred—or ‘licensed’—via a contract with another party” (Vaidhyathan, 2001, pp. 20–21). In Canada, copyright is acquired automatically when an original work is generated; the creator is not required to register or mark the work with the copyright symbol in order to be protected. Copyright offers the possibility to protect the traditional cultural expressions of Indigenous peoples to a certain extent.

Copyright is the most commonly critiqued area of intellectual property concerning TCEs because

it is encoded “into older analog material, into the behaviours of archives, libraries and museums, into the capacity to deliver material digitally, and into the rhetoric of open access” (Anderson & Christen, 2013, p. 107). Anderson and Christen (2013) state that copyright “protects too much for too long, it privileges certain interests over others, it creates frameworks of the property upon a material that perhaps should not be considered as property, it curtails creativity rather than promoting it, it is too culturally specific to be of any use of certain [Indigenous] communities” (p. 108). Several authors caution about its limitations due to: terms of protection, authorship, originality, fair-use and fixity (Bowrey & Anderson, 2009, pp. 488–489; Christen, 2012, p. 2887; Frankel & Drahos, 2012, p. 7, 143; Janke & Iacovino, 2012, pp. 156–157; Nicholas & Bannister, 2004, p. 329, Wong & Fernandini, 2011, pp.184–187). The overall doctrinal challenges of copyright laws and TCE's are expanded on below.

The Term of Protection. The international copyright law limits the protection of the work to at least 50 years after the author has been dead (economic right). After this period, the work becomes part of the public domain. For most TCEs, this term has expired because the knowledge has passed generation after generation (Jaszi, 2017, p. 6; Spangler, 2010, p. 711). In the case of other instruments, such as trademark and industrial designs, they need to be periodically renewed in order to continue being valid (commonly 7 to 10 years).

Authorship. Copyright and several IP tools were developed around the notion of “authorship” to claim originality. An object protected by copyright should originate with a specific human being or a group of them. In the case of the majority of TCEs, there is no identifiable author. Most of the TCEs have been produced collectively rather than collaboratively, which means that not everyone in the collective participated in the creation (Jaszi, 2017, p. 7; Spangler, 2010, p. 711; Wong & Fernandini, 2011, pp.184–185), which means that the creators might be unknown and/or unlocatable (WIPO, 2018, p. 9). Therefore, there is a gap in the recognition of communal rights over any intellectual property instrument, especially copyright (WIPO, 2018, p. 10). Also, in most communities located in developing countries, the collective cannot be easily defined under the national jurisdictions.

Originality (or Novelty). The work has to be novel or unusual. However, in the majority of the

TCEs and TKs, it is not possible to prove novelty because TCEs and TKs have been passed down from generation to generation (Jaszi, 2017, p. 7; Spangler, 2010, p. 711; Wong & Fernandini, 2011, pp.187–188). This type of knowledge production and communication does not suit the parameters of novelty in the IPR.

Fixity. The work under copyright law has to be “fixed” in some material form; however, several TCEs are oral expressions that change quickly over time and by the person who is sharing it. Moreover, even when the work is “fixed,” it needs to be stable, which is not the case because the oral expressions are shared via the use of mouth (Jaszi, 2017, p. 7; Spangler, 2010, p. 711; WIPO, 2018, p. 9). The problem of fixation was expressed by some IFP users when sharing knowledge within the platform because knowledge changes over time, and there are different points of views within Indigenous traditions:

[H]ow does Anishinaabe from Cree differ? How do they play together, right? Because conflict can happen as well. I’m sitting here telling you, no, that’s not how it goes; this is the teaching of this particular topic. But maybe I’m not realizing, other people we know might have different understandings. For example, there are different nations, and they have various teachings, right? Maybe if you’re just learning your Indigenous culture, you probably don’t know that each community has different teachings. Perhaps you think Indigenous is just one umbrella and not different perspectives (Lisa Maracle, personal communication, May 12, 2020).

The Exception and Limitation. The limited term of protection of copyright materials allows TCEs to be reproduced in other media without the permission of the communities; e.g., a work of artistic craftsmanship can be reproduced in photographs, drawings and in other “artistic” ways without any permission from the author community. Also, with the fair-use exception, public GLAM institutions are allowed to make reproductions of works and keep them available for the public (i.e., to be part of the public domain) (WIPO, 2018, p. 9).

Derivate Works, Adaptations and Defensive Protection. Indigenous peoples and communities are concerned with non-Indigenous companies and individuals that imitate or even copying their TCEs as a “source of inspiration,” and acquire IP protection over the derivative work, design, mark or other

production (WIPO, 2018, p. 10). In other words, in artistic expressions, “style” is not protected under copyright nor industrial design laws (Jaszi, 2017, p. 7; Spangler, 2010, p. 711; WIPO, 2018, p. 10). In this context, communities may seek a form of defensive protection to deny or at least restrict authors’ ability from the relevant community to enjoy copyright of creations derived from TCE (WIPO, 2018, pp. 19–20).

Rights in Recordings and Documentation. TCEs that were once only transmitted by oral tradition may be indirectly protected through their fixation in a sound recording. The problem resides in the fact that the sound producers hold the rights to the recordings, and they enjoy the exclusive rights of reproduction, distribution, rental, availability, and possibly remuneration (WIPO, 2018, p. 15). This producer is often an ethnomusicologist, folklorist, or another collector who is not part of the communities and commonly part of GLAM (WIPO, 2018, p. 20). Therefore, Indigenous communities commonly do not have control over the oral traditions.

Moral Rights. Moral Rights encompass several rights of creators of copyright works that are not related to remuneration, such as the author’s right to receive attributions of his/her/their work, as well as the integrity of the work, in terms of preventing distortion and/or destruction of his/her/their work (Janke & Iacovino, 2012, p. 156; Spangler, 2010, pp. 717–719; Wong & Fernandini, 2011, p. 187). Their perpetuity, inalienability (i.e., the right to take it away from the possessor), and their individual/collective character vary significantly in national jurisdictions (Anderson, 2010, pp. 20–21; Spangler, 2010, pp. 717–719, 727). The main issues of moral rights are the same as copyright regarding authorship and fixity (Anderson, 2010, p. 21; Spangler, 2010, p. 725). The *Indigenous Friends Platform* has the moral rights to the software methodology of the Cree Tipi ceremony that was granted through the writing piece of the master’s thesis; however, due to the fixity limitation of the Tipi ceremonies, those moral rights are limited.

These doctrinal gaps are still a challenge within the *Indigenous Friends Platform* because of the legal limitation of copyright. These limitations restrict the solutions under the platform because the IFP relies on the Canadian context of copyright. However, the future possibility of incorporating other intellectual property instruments can open up possibilities to further protect the IDK within the platform,

especially the knowledge regarding the digital software braid and Cree Tipi Ceremony. Furthermore, the recording of TCEs and TKs may result in the protection of the knowledge instead of the TCEs and TKs themselves. In other words, the partial protection will come from the picture, audio, or video recording of the Traditional Knowledge rather than the expression itself (Wong & Fernandini, 2011, p. 188).

Therefore, further analysis of the doctrinal gaps between IP and TCE in digital spaces requires exploring other instruments under Intellectual Property Law beyond copyright. This understanding demonstrates the scopes and boundaries of current legal digital instruments used in virtual environments.

Although the previous aspects primarily focus on the doctrinal limitations of copyright and TCEs, there are other IP instruments that might be used to partially add protection to TCEs within digital spaces.

Limitations in Trademarks, Collective Marks, and Certification Marks. A trademark is primarily a sign indicating a trade origin of good and services, and one or more individuals, one or more business organizations, or any other legal entity can own it (Cottier & Panizzon, 2005, pp. 578–580; Wong & Fernandini, 2011, p. 189;). They also serve to associate the reputation of a particular entity with the good or service to which the service is attached (Wong & Fernandini, 2011, p. 189). It is in this form that trademark is useful for Indigenous peoples because cultural elements can be trademarked; however, this fact is problematic because of the commodification process that is implied in it (Anderson, 2010, pp. 18–20; Brown & Nicholas, 2012, p. 312; Frankel & Drahos, 2012, p. 7; FNIGC, 2016, p. 149).

Furthermore, Anderson finds three main problems with this form of protection related to the usage of these instruments as labels of authenticity: (a) the gap of constructing what is Indigenous authenticity; (b) the pan-Indigenous label, which does not leave space for individual, family, clan or community diversity; and (c) a practical problem of the national entities to certify, distribute, and regulate such labels (as cited by Wong & Fernandini, 2011, p. 191). In the case of the *Indigenous Friends Platform*, there was a trial to trademark “Indigenous Friends” in Fall 2019 with the primary purpose of protecting the software methodology to create the platform; however, it was unsuccessful due to the “clearly descriptiveness” of the trademark, which means that the name describes the service related to “users making Indigenous Friends through the app.” Under Section 12(1)(b) of the Trademarks Act in Canada, “clearly descriptive”

trademarks are not registrable. Moreover, the trademark lacked inherent distinctiveness for the trademark authority (i.e. the name was considered too generic to consider a trademark). This example of the IFP embodies the three problems that Anderson pointed out in her analysis.

A variation of the trademarks is the collective marks, which are given to an association of traders, producers, manufacturers, or service providers to show that members belong to the association and their product or services. In this sense, the labels can be “communal” (Wong & Fernandini, 2011, p. 191; Cottier & Panizzon, 2005, p. 580). This tool inherits the same problems as trademarks regarding commodification and authenticity. The collective mark cannot be explored for the *Indigenous Friends Platform* until more communities around Canada and worldwide start using this specific software methodology to develop software applications.

On the other hand, certification marks assure that the goods or services have been examined and tested by the registered proprietor of the mark as to characteristics such as origin, material, mode of manufacturing, quality or precision (Wong & Fernandini, 2011, p. 192; FNIGC, 2016, p. 152). The potential of these forms of protection for Indigenous peoples is that this type of tool can transmit information on natural and human conditions that accompany the protection of the protected goods (e.g., traditional, or artisanal elements of a craft). This type of protection inherits the same problem as the moral rights due to the fixity limitation on the intellectual property around the Tipi ceremonies, as well as the complexity around authorship (i.e., which entity or legal body has the right over specific Tipi ceremonies).

As previously mentioned, the main problem regarding trademarks, collective, and certification marks is the commodified nature of the protection (i.e., the knowledge required to be transformed into good or service). In this line, intellectual property expert Rosemary Coombe asserts that signs of social and cultural difference are converted when used as trademarks. They are removed from the cultural commons and returned to the public sphere as “jealously guarded” signs of commercial distinction (as cited in Kedron, 2016, p. 135). Also, in this type of IP protection, the holder must apply for it at least every 7 to 10 years which makes it difficult for several artists.

Limitations in Confidential Information. Confidential information is also referred to as the law of trade secrets or undisclosed information in several jurisdictions worldwide. Trade secret protection “allows a holder of confidential information to prevent that information from being disclosed to, acquired by, or used by others without the holder's consent in a manner contrary to honest commercial practices” (WIPO, 2017a, p. 60). Sacred and secret knowledge can benefit from this instrument. However, the trade secrets have three requirements that commodify the knowledge: (1) the information must be kept secret only to those who need to know it for its normal exploitation; (2) reasonable procedures need to be in place to preserve the confidentiality; (3) the information must have a commercial value. This option was discarded because there is no intention of generating “commercial value” from the digital software braid based on the Cree Tipi ceremony, plus the information was already disclosed through the master’s thesis.

Limitations on Sui generis / Customary Law. There are some legislative initiatives at the national and regional levels to give superior protection to Indigenous knowledge based on intellectual property instruments. Some examples are the Pacific Model Law, the Philippines Act to Recognize, Protect and Promote the Rights of Indigenous Cultural Communities /Indigenous Peoples and the [African] Bangui Agreement. The Intergovernmental Committee on Genetic Resources, Traditional Knowledge and Folklore (IGC) of the World Intellectual Property Organization (WIPO) has worked to reach a harmonized international framework for Indigenous knowledge protection of provisions and terminologies. However, consent has not been reached, and the largest problem resides with the adoption of those laws at the national and regional level (Anderson, 2010, pp. 33–35; Anderson, 2012, p. 66; Brown, 2005, p. 50; Coombe, 2009, pp. 249–254; Cottier & Panizzon, 2005, pp. 583–593; Frankel & Drahos, 2012, pp. 103–105; Riley, 2005, pp. 118–119; WIPO, 2017c; Wong & Fernandini, 2011, p. 204). In Canada, although there are several customary laws related to the Aboriginal Status under Section 35 of the Constitution Act of 1982, there is no customary law related to the protection of Indigenous knowledge. However, as explained in the last section, Jaszi (2017) claims that this type of approach to protecting Indigenous data/knowledge mainly resides at the technical/doctrinal level of intellectual property instruments (as well as in WIPO, 2018). Indigenous data/knowledge is required to be

commodified in order to apply these forms of protection. In other words, the issue resides in the inadequacy of the legal regimes to address the conceptualizations of Indigenous ways of knowing (Jaszi, 2017, p. 5). Despite these factors, there are several civil society initiatives regarding Indigenous data governance, such as the First Nations Information Governance Centre (FNIGC) and the Inuit Tapiriit Kanatami National Inuit Data Management Committee (NIDMC) that work around Indigenous data governance.

As I explained throughout the analysis, in the *Indigenous Friends Platform* case, the doctrinal gaps were out of the scope due to the Canadian legal framework where the digital solution was developed. In the case of the functional gaps, they were partially addressed through the usage of TK Labels and the incorporation of the not-for-profit entity. Finally, in the case of the doctrinal gaps, the IFP uses copyright, but its protection is limited due to Traditional Knowledge's legal framework within intellectual property. In the case of trademark protection, the mark's registration got rejected for several factors that exemplify the limitation of the IP system on Traditional Knowledge. Finally, the customary law is a route that should continue being explored in the Canadian context and requires a broader range of actors and stakeholders. Therefore, there are still several intellectual property challenges to be addressed within this framework.

In conclusion, several IP legal instruments are being adapted to provide legal protection to IDK; however, as it was explained throughout this section, these legal instruments are not enough to offer a holistic approach to IDK due to the epistemic principles that were used for their conception. Therefore, several authors have explored other types of solutions based on Indigenous ethics and worldviews.

9.4 Navigating the Ethical and Legal Dilemmas of Indigenous Data Governance

The limitations of legal instruments demonstrate that these tools have several common challenges. Although particular expressions of IDK are protected under certain jurisdictions, they also manifest that there are still central problems in order to guarantee sovereignty to Indigenous communities over their data. Regarding these gaps, lawyers, policymakers, Indigenous activists, and academics have

explored possible solutions and alternatives. Moreover, digital spaces have accelerated the process and introduced the possibility of violations of Indigenous peoples' rights from any geographical location worldwide. Therefore, in the context of the information era, several collectives, academics, and activists have imagined new forms of collaboration beyond the intellectual property instruments, intersecting legal frameworks, Indigenous ethical principles, and Indigenous sovereignty/governance.

9.4.1 Licensing: Local Contexts and the Kaitiakitanga License

In 2013, Professor Jane Anderson and Kimberly Christen from the University of New York decided to create the Local Contexts project. The Local Contexts project “is an initiative to support Native, First Nations, Aboriginal, and Indigenous communities in the management of their intellectual property and cultural heritage specifically within the digital environment” (Local Contexts, n.d.). This project consists of Traditional Knowledge (TK) Labels Licenses and Notice, also based on copyright and private law. The TK Licenses, Notice, and Labels are inspired by the Creative Commons movement in order to protect the knowledge of different communities across the globe.

Creative Commons (CC) started in 2001 as a reaction to the IP legislation's proprietary character. CC is “a licensing framework that seeks to provide an alternative to the copyright regime, and the implied ‘all rights reserved’ model that copyright upholds” (Anderson, 2010, p. 26). Creative commons accommodates local jurisdiction under local copyright law and support different needs in the form of licensing (Anderson, 2010, p. 27). Creative Commons uses labelling or badging to convey the licensing terms (Wong & Fernandini, 2011, p. 210). The CC was created to continue expanding the creative works that are available for others to share within a legal framework. The original purpose of the Creative Commons was to create a movement to counteract the IP restrictive laws of the 1990s, and its impact has expanded since its creation. Due to this political stance, several academics started inquiring if this set of tools can be applied within a framework of Traditional Knowledge and Indigenous data. Their successful implementation across jurisdictions is a strength that several experts have seen as a possibility for the protection of Traditional Knowledge (Anderson, 2010, p. 26). Creative Commons benefits from copyright

law as well as private law in the form of the licences.

The TK Licenses Notice and Labels “offer a set of new options for addressing issues of ownership, access and control of traditional cultural expression documented and recorded by non-indigenous peoples and researchers that now reside in numerous cultural institutions worldwide” (Anderson & Christen, 2013, p. 112). These legal instruments protect IDK, specifically in digital spaces. When the knowledge is shared, the licensor grants specific Indigenous data permissions, but the control and distribution are restricted by cultural protocols established within the license. In the words of Kimberly Christen (2015), TK Licenses are “a set of additional agreements that Indigenous copyright owners can use to convey culturally-specific concerns about the material that they already legally own and control” (p. 10).

TK Licenses are not useful when the materials are part of the public domain, or the contents are already protected by copyright (Anderson & Christen, 2013, p. 113). The TK Licenses are an extension of existing contract law and are legally defensible in multiple jurisdictions (Christen, 2015, p. 10). They incorporate essential community-based rules and regulations with the provisions set within the license for use and circulation (Anderson, 2012, p. 71). These specifications can change depending on the necessity of the community (e.g., attribution, education [formerly outreach], commercial, non-commercial) (Christen, 2015, p. 12).

In the case of content materials in the public domain or materials already owned by a third party (i.e., protected through copyright), the TK Labels are instruments to teach peoples how to use these expressions in digital spaces. TK Labels provide “a set of cultural parameters and ask people to think about their actions carefully and thoroughly, including the various stakeholders that fall outside the legal domain” (Christen, 2015, p. 12). TK Labels consist of appealing digital images and attached explanatory texts that provide useful information about Traditional Knowledge (Figure 23). As Anderson explains (2012), TK Labels are not legal agreements, but education and social mediations (p. 73). TK Labels “help users make responsible choices about how or if to use these materials at all” (Christen, 2015, p. 13). These instruments give back the power to the user about how to use that knowledge. In other words, they

seek to “provide a set of guidelines for responsible digital remixing by giving users more (rather than less or restricted) information about materials they found online” (Christen, 2015, p. 13).

Figure 23

TK Labels in the Local Contexts Project



Note. This is based on the TK Labels in the Local Contexts project. (September 2020). “Traditional Knowledge (TK) Labels” Local Contexts. localcontexts.org

As a variation for the TK labels, the TK notice was created. The TK notice is “intended to be a collective notice and an initiative to elevate recognition of the cultural significance, importance and often placed-based nature of TK” (Local Contexts, n.d.). The TK notice is only identifying the nature of the material. The TK Notice “can be applied as a general stand-alone notice, or it can indicate that TK Labels are in development, and their implementation is being negotiated.” (Local Contexts, n.d.). These TK Notice, Licenses and TK Labels have been successfully implemented in the Mukurtu Project, Canning Stock Route Project, Plateau Peoples’ Web Portal, Ziibiwing Center for Anishinabe Culture & Lifeways, and by the Karuk Tribe, among others (Local Contexts, n.d.).

In the case of the *Indigenous Friends Platform*, the Local Contexts project offers protection for the data-generated content by the user. However, it is essential to clarify that not all instruments are applicable. First, the TK Licenses could not be included because there is no certainty that users own the content they are sharing, and therefore, neither they nor the IFA can issue a license over their content. Second, in the TK Labels case, they might be suitable for the data shared within the app because the ownership of the content is not necessary; however, the multiple and the diverse number of labels makes them complicated and not accessible for the final users. TK Labels were made in the context of GLAM, and therefore, the specifications of each of them require a previous understanding of knowledge production and render them unsuitable for user-generated platforms. However, the TK Notice offered a simple but effective form to provide attribution to the user content generated by the *Indigenous Friends Platform*. Every time a user publishes in a shared space (e.g., Chats, Forums, Events), they have the opportunity to attach the TK Notice and acknowledge the author of the IDK. The TK Notice allows the users to interact with the data to attribute the IDK and be aware of the sensitiveness of the knowledge shared. In the new version of the app, the TK notice will continue to be shared in public spaces (Shared Teachings, Sharing Circles, Chats, among other features).

On the other hand, in new contemporary approaches of coding and digital technologies, the protection of Traditional Knowledge is also being transferred to the realm of open-source software (OSS) as a form of copyright.⁸² Similarly to Creative Commons, these approaches are not suitable for cultural and Traditional Knowledge, especially if this type of knowledge is tied to code lines. Therefore, in 2018, the Māori people in Aotearoa/New Zealand created the Kaitiakitanga License. “Kaitiakitanga” is a Māori word that has a meaning in English similar to protector or guardian. This license’s primary purpose is to provide ownership and control of the code to the Māori people who generate any type of code with Traditional Knowledge and want to share the code with other community members for collaboration

⁸² OSS is a type of computer software in which source code is released under a license in which the copyright holder grants users the rights to study, change, and distribute the software to anyone and for any purpose (Open Source Initiative [OSI], n.d.)

(TeHiKuMedia, 2018). This license acknowledges the copyright of the material in the code and wants to provide a framework for the IDK that is embedded in a particular software section's content. As it happens in the Western forms of knowledge, this license protects the programming language, but not the content created through it. In the case of the content, the TK Licences, Notice, and Labels would be more appropriate. Furthermore, it is essential to mention that this license is only applicable to Māori peoples and needs to be adapted for each Indigenous context.

In the case of the *Indigenous Friends Platform* and the digital software braid of the Cree Tipi ceremony as it was explained in the previous sections, it presents several challenges for its protection due to the fixity and authorship of the ceremony; however, one crucial future exploration is the protection of the source code with the equivalent of a Kaitiakitanga License in the context of Indigenous Nations in North America. In Canada, code is protected as a literary work under the Copyright Act of Canada. Although the application code can be protected under copyright, software development methodology based on the Cree Tipi is not suitable for this type of protection because of the diversity of communities. The methodology might be patentable, and then it can be licensed in order to be used by other communities; however, this falls under the category of Traditional Knowledge (TK) and not Traditional Cultural Expressions (TCE). In other words, if the methodology is patentable, an equivalent license to the Kaitiakitanga license could give rights to other communities to benefit from this type of development.

In summary, when Indigenous communities or peoples own the copyright, and these instruments are correctly implemented, IP protection's functional gaps are addressed. The potential of the full implementation of these tools to protect Traditional Knowledge within digital repositories, such as digital galleries, libraries, archives, and museums, as well as social media networks, can create safer spaces for Indigenous knowledge and cultures. Local Contexts and the Kaitiakitanga License both present a significant flaw, however. Both mechanisms are created on top of the copyright framework, and they inherit the doctrinal gaps of the Intellectual Property Regime. The works that are protected under these instruments recognize just "original" work (i.e., originality) with a single entity as an author (i.e., authorship). Moreover, the content must be in a tangible and fixed form (i.e., fixity), and the term of

protection will rely on the local copyright law (e.g., in the case of Canada, copyright protects the work up to 50 years of the death of the author). These doctrinal problems can derive from several legal problems, especially when international actors are present in digital spaces while creating and sharing in several jurisdictions. Similarly, these flaws force Indigenous creators to transform their work into something that fits these law forms. Therefore, other approaches were created by Indigenous leaders and creators at the national and international levels.

9.4.2 The OCAP Principles

In the Canadian context, to address data governance issues, there have been some reactions from the grassroots and academic communities. In the mid-1990s, the principles of Ownership, Control, Access, Possession (acronym OCAP) of data and information were developed to protect Indigenous Knowledge in the context of the First Nations Regional Health Survey (First Nations Information Governance Centre [FNIGC], n.d., p. 2). These principles “are a set of standards that establish how First Nations data should be collected, protected, used, or shared. They are the de facto standard for how to conduct research with First Nation” (FNIGC, 2016). These days, OCAP (R) is an acronym and certification trademark owned by the First Nations Information Governance Centre (FNIGC, 2016).

OCAP is described as “self-determination applied to collective data, information and knowledge. It is a response to being 'researched to death' and offers a way forward for First Nations research and information management” (FNIGC, 2016, p. 148). Although these principles benefit from IPR, its conception was based on Indigenous Ways of Knowing. OCAP commonly is described as “political response to colonialism and the role of knowledge production in reproducing colonial relations” (FNIGC, 2016, p. 148). The principles of OCAP are followed because communities can have the complete stewardship of the materials (i.e., ownership, control, access & possession of data). OCAP principles are rooted in self-determination, nationhood, self-governance, and nation-rebuilding (First Nations Centre [FNC], 2007, p. 2). Currently, the FNIGC offers an online certificate program of the OCAP principles in order to understand the framing and the considerations of these principles over data. I personally took the

online program in 2019.

The four OCAP ethical principles are:

1. **Ownership:** This states that a community or group owns information collectively (FNC, 2007, p. 4). According to the FNIGC, “the notion of ownership refers to the relationship of a First Nations community to its cultural knowledge/data/information. The principle states that a community or group owns information collectively in the same way that individuals own their personal information. Ownership is distinct from stewardship. The stewardship or custodianship of data or information by an institution that is accountable to the group is a mechanism through which ownership may be maintained” (FNIGC, 2016, p. 149).
2. **Control:** Indigenous peoples, their communities, and representative bodies have power over how information about them is collected, used, and disclosed (FNC, 2007, pp. 4–5). According to FNIGC, control is “the aspirations and inherent rights of First Nations to maintain and regain control of all aspects of their lives and institutions extend to information and data” (FNIGC, 2016, p. 149).
3. **Access:** Indigenous peoples must have access to data about themselves and their communities, regardless of where it is held (FNC, 2007, p. 5). Furthermore, this principle refers “to the right of First Nations communities and organizations to manage and make decisions regarding who can access their collective information” (FNIGC, 2016, pp. 149–150).
4. **Possession:** This reflects the state of stewardship of data and puts it within an Indigenous jurisdiction (FNC, 2007, p. 5). According to FNIGC, “ownership” identifies the relationship between peoples and their data, while possession means the state of stewardship of data. Possession is the mechanism to assert and protect ownership and control over data. Indigenous communities generally exercise low control over data that is in possession of others, particularly the Canadian government bodies (FNIGC, 2016, p. 150).

The successful implementation of these principles requires communities’ full participation around data production, storage, and distribution. These principles must be included in several informational

policies and procedures of informational systems. The OCAP principles are an integral part of all the data cycle and involve stakeholders' participation through the line of data transfer. These ethical and practical principles seek to surpass the legal limitations of Intellectual Property and provide a holistic framework for data management.

In the context of this research, to address the difficulties of Indigenous data sovereignty within the *Indigenous Friends Platform*, I formally started including the OCAP principles during the summer of 2017. The exploration of these principles started when I had several conversations and meetings with lawyers and paralegals through the Intellectual Property Clinic at Osgoode Law School and York University Innovation. As I mentioned in the story of the app in Chapter 2, there were several inquiries regarding the app's intellectual property, the code, and the storage of the data. As I thoroughly explained in that section, one of the first challenges to address was to decide the primary legal holder of the *Indigenous Friends Platform*. Therefore, the decision to incorporate the not-for-profit entity provided an answer to the collective benefit and the assurance that the platform would continue under the control of Indigenous peoples, i.e., the board of the organization. Although these approaches infer the commodification of the knowledge to be protected, they also provide ownership, control, access, and possession of information to Indigenous bodies that are more similar to Indigenous forms of governance. In this regard, Elder Blu Waters acknowledges the ownership and control over the data within the IFP:

[Data] is owned by IFA, and yes, other people can invest in it, but there are restrictions on it. Right? So, the information is not being sold to third parties, which are then saying, "If anybody looks up tripods, send my information. Here's the money. I'm going to pay you, and you're going to be able now to promote my ad." So, that's the difference. So, they're not as safe. (Elder Blu Waters, personal communication, May 6, 2020)

One of the challenges of this approach is that the OCAP principles are only applicable in the Canadian context and exclusively in First Nations because Métis and Inuit communities present significant differences in the ways they are politically structured and the ideological concepts of ownership and control. Despite these limitations in the Canadian context, the OCAP principles have served as a reference for several other solutions worldwide and helped define the global initiative on

Indigenous data.

9.4.3 The CARE Principles and Indigenous Data Sovereignty

What does that look like for us, and how do we maintain it, and how do we maintain that sovereignty that this is ours and still maintain our values and respect and love for others, even non-indigenous folks, but still maintaining that this is still our space, this is our home, and you're a visitor? (Bonnie Rogers, personal communication, May 25, 2020)

Based on the successful implementation of the OCAP principles, the contemporary concept of Indigenous data sovereignty and its principles were framed in the context of creating a common agenda for Indigenous data governance (Kukutai & Taylor, 2016, p. 15). In 2017, the founders of existing national networks: Te Mana Raraunga Māori Data Sovereignty Network (Aotearoa), the United States Indigenous Data Sovereignty Network (USIDSN), and the Maiamnayri Wingara Aboriginal and Torres Strait Islander Data Sovereignty Collective in Australia, as well as representatives from the First Nations Information Governance Centre (FNIGC) in Canada, created the International Indigenous Data Sovereignty Interest Group at the Research Data Alliance [RDA IIDS Group] (Issues on Indigenous Data Sovereignty, 2019). This diverse group aims to provide Indigenous Data governance principles, including privacy, ethics, research data, big data, and open data worldwide.

On November 8, 2018, the CARE principles were first drafted by RDA IIDS Group at the International Data Week co-hosted event “Indigenous Data Sovereignty Principles for the Governance of Indigenous Data Workshop” in Gaborone, Botswana. In September 2019, the RDA IIDS Group published the CARE principles (Table 5). As with the OCAP principles in the Canadian context, these principles are trying to address several issues around managing data within Indigenous communities beyond the legal framework of Intellectual property at the global scale. The CARE principles have initially been a reaction to the “FAIR guiding principles for scientific data management and stewardship”; however, these days, they offer a completely independent framework for Indigenous data (RDA IIDS Group, 2019).

In March 2016, “FAIR Guiding Principles for scientific data management and stewardship” was published in the Nature research journal *Scientific Data*. The 53 authors of these principles intended to

provide a framework to improve the findability, accessibility, interoperability, and reuse of digital data. The primary purpose was to foster the open data and open science movement across entities through computational systems' capacity to manage data with no or minimal human intervention, i.e., the use of metadata. However, the FAIR principles focused on data sharing among entities without recognizing the historical conditions and power imbalances in several contexts worldwide. To address that issue, the CARE principles aimed to provide a framework to assert greater control over the governance of Indigenous data for the collective benefit of Indigenous communities.

The CARE principles compile and gather several values and ethical principles that community members pursue about data governance regardless of where the IDK is stored. Moreover, these principles subscribe to the concept of Indigenous data sovereignty that is defined and subscribed by the members of the network as follows: “the right of a nation to govern the collection, ownership, and application of its own data. It derives from tribes’ inherent right to govern their peoples, lands, and resources” (US Indigenous Data Sovereignty, n.d.).

Table 5

Definition and Characteristics of the CARE Principles

CARE Principles	Definition	Characteristics
[C]ollective Benefit	The data environment shall be designed to derive a communal benefit.	<ol style="list-style-type: none"> 1. For inclusive development and innovation: Governments and all types of institutions must actively support establishing foundations for Indigenous innovation, value generation and promotion of local self-determination. 2. For improved governance and citizen engagement: Data can enhance the planning, implementation, and evaluation processes that support Indigenous communities’ policy needs. 3. For equitable outcomes: Any value created from Indigenous data should equitably benefit

Indigenous communities.		
[A]uthority to Control	The Indigenous peoples' authority to control Indigenous data shall be recognized. Indigenous peoples shall determine how they are represented and identified within data.	<ol style="list-style-type: none"> 1. Recognizing rights and interests: Indigenous peoples have rights and interests in Indigenous knowledge and Indigenous data. Indigenous peoples have collective and individual rights to free, prior, and informed consent in collecting data. 2. Data for governance: Indigenous peoples have the right to data relevant to their worldviews and empower effective self-governance. 3. Governance of data: Indigenous peoples have the right to develop cultural governance protocols for Indigenous data.
[R]esponsibility	Those who work with Indigenous data shall share how they support Indigenous self-determination and collective benefit.	<ol style="list-style-type: none"> 1. For positive relationships: Indigenous data requires building relationships on respect, reciprocity, trust, and mutual understanding. 2. For expanding capability and capacity: Indigenous data shall enhance data literacy within Indigenous communities and support the workforce's development. 3. For Indigenous languages and worldviews: Generated data must be grounded in Indigenous worldviews, languages and lived experiences of Indigenous peoples.
[E]thics	Indigenous rights and well-being should be the primary concern at all stages of the data life cycle.	<ol style="list-style-type: none"> 1. To minimize harm and maximize benefit: Ethical data shall not stigmatize or portray Indigenous peoples in terms of deficit. Assessing ethical benefits and harms should be done from the perspectives of Indigenous peoples and communities. 2. For justice: Data ethical processes address imbalances in the power of Indigenous rights and human rights. These ethical processes must include

the representation of Indigenous communities.

3. For future use: Data governance shall consider future use and harm based on ethical frameworks grounded in Indigenous worldviews.

Note. This table is based on the definitions and characteristics of CARE principles in the Research Data Alliance International Indigenous Data Sovereignty Interest Group [RDA IIDS Group]. (September 2019). “CARE Principles for Indigenous Data Governance.” The Global Indigenous Data Alliance. GIDA-global.org

In the context of the *Indigenous Friends Platform*, the incorporation of OCAP principles through creating the not-for-profit and the integration of the TK Notice unwittingly involved the consideration of CARE Principles. These forms of data management are essential ethical values implemented throughout the policies and guidelines of the platform and organization. First, the collective benefit was established by incorporating the not-for-profit, allowing Indigenous members to be in charge and be part of the technological solutions. Second, the members have the authority to control the data created, and the app provided the opportunity to have self-determination about data management and infrastructure. Third, responsibility was represented in the taking care of the Spirit of the application and her maintenance; IFA increased her capacity through the INDIGital program. Finally, the IFA has a permanent commitment to respecting and being guided by Indigenous ethics, values, and worldviews. In the context of the IFP, McKenzie Toulouse asserts that:

Those are the main things that come with it, right? So it's like what's being shared, you respect it. What's being shared with you, person to person is sacred. It's personal. And it's something that you do is you respect it, you honour it. Do you know what I mean? You're trustworthy of it, your bravery. All the seven of [the Seven Sacred Teachings] all combined into one is like, that's how you honour in a digital world. (McKenzie Toulouse, personal communication, May 13, 2020)

Alina Rizvi, the Tech Lead of IFP, asserts that this is a central element of how data is processed within the IFP:

It's different. It's not as focused on pushing random things at you or even collecting your

data. It wants you to be there for yourself. I don't want you to be there for the sake of its own improvement. It's not collecting your data, so it's not getting any money from you. It doesn't want to listen to you and give you personalized ads. It's more like a friend, and I think it's way better for your mental health than other places. (Alina Rizvi, personal communication, May 4, 2020)

The CARE principles are ethical principles that aim to guide the management of IDK; however, they present one significant challenge. The CARE principles are only ethical principles and are not legally binding in any national jurisdiction. These principles were thought to be framed outside of intellectual property rights scope, and, therefore, their legal scope is limited. It is up to the data collector or agency (e.g., gallery, library, archive, museum, research institute, ethnologist) to decide whether or not to pursue these principles. Despite this limitation, these principles deliver a clear message to the open movement about the differences between their ideological agenda and Indigenous communities. Moreover, they offer an alternative to the legal challenges of the legal framework of Intellectual Property.

9.5 Conclusion: The Approach of the Three Solutions

In this chapter, a comprehensive exploration of Indigenous data governance's ethical and legal principles was explored. This analysis was necessary to unfold and explain current digital approaches' limitations and start imagining new digital solutions for the challenges around data sovereignty and Indigenous self-determination. However, up-to-date, Indigenous data/knowledge is still under-protected and under the threat of being misrepresented or misappropriated in the majority of contexts worldwide, as it was demonstrated throughout the analysis. Implementing the *Indigenous Friends Platform* principles implied several months of reflecting and learning of the potential challenges about data governance in the digital realm. As it was explained throughout the section, the aspiration of incorporating the principles of Indigenous data sovereignty within the IFP was achieved through the interweaving of several solutions as a form of data governance: the TK Notice, the OCAP Principles and CARE principles. In this stage, the purpose of the *Indigenous Friends Platform* was reflected on and re-evaluated to respect and protect Traditional Knowledge in the form of Indigenous data/knowledge.

This intervention signified the reflection on several elements that were decided in previous steps and the reflection on the journey of the community members throughout the process of creation. The technical dimension of Kiiwedining (North) involves the contemplation of the journey and reflects about early stages. Considering the software methodology, the data generated within the space required the usage of a decolonial framework of Indigenous data sovereignty that could provide users certainty that their data and knowledge were going to be held by Indigenous entities. The long tradition of intellectual property law around TK and TCEs demonstrates that these instruments continue to be significantly incompatible with several needs and particularities of local communities. Although there are several advancements around them, they continue to present significant challenges, especially in the context of small communities worldwide.

The understanding of the binomial term of Indigenous data/knowledge (IDK) revealed several essential aspects of how knowledge is conceived and managed within communities. At the same time, it presented new challenges on how the current framework for data management can support Indigenous communities' self-determination. The current data policies for IDK must advocate avoiding the public domain or "the commons," because that signifies reinforcing the ongoing colonization process of extractivism among communities. Therefore, new transnational Indigenous efforts, such as the RDA IIDS Group, provide innovative forms to approach data management in the context of the information era and Indigenous peoples.

The journey of reflection around data governance exhibited the importance of analyzing and considering Indigenous data sovereignty in any information solution with/for Indigenous Nations and communities. This process involves extensive analysis of the intellectual property and the ethical forms of data governance. It is imperative to create digital solutions within Indigenous contexts to generate a recurrent cycle of reflection and consideration of the type of measurements taken to provide data self-determination to the groups and peoples involved. The constant reflection over Kiiwedining (North) will allow the IFA to explore the advancements in the legal terms of intellectual property rights and provide new forms of transnational protection of Indigenous data/knowledge within digital spaces. The mere

implementation of information solutions without an ethical and legal reflection would signify the reinforcement of historical colonialism through the generation of data colonialism. In this aspect, the understanding of the mobile application as a virtual being with a Spirit involves the integration of those ethical values from the perspective of the software, embodiment, infrastructure, and data.

Part 5: The Transdisciplinary Balance between Academia and Practice

In this final part, I present the transdisciplinary character of the Tech Anishinaabe Medicine Wheel through the linkage of the narratives of storytelling, academia, and digital practice. This association is achieved through the analysis of the proposed design principles alongside other academic authors. The distinction of the different academic intersections of decoloniality and digital technologies is proposed through two different concepts: digital decoloniality and decolonial computing. For this purpose, I introduce this section with a rationale on how the Tech Anishinaabe Medicine Wheel interweaves with the principles of decoloniality, and then I present the overall conclusion of this research.

Chapter 10

Balance of the Tech Anishinaabe Medicine Wheel

Throughout five years of development and research, the *Indigenous Friends Platform* proposed several transformations in *doing* and *thinking* the relationships between Indigeneity and digital technologies through the balance of four design principles: (1) Waabinong – Digital Software Braid; (2) Zhaawanong – Embodiment of Indigeneity; (3) Epangishmok – Decolonial Infrastructure; and (4) Kiiwedining – Indigenous Data Sovereignty. This chapter aims to state the answer to the main research question of this dissertation: *what design principles of decoloniality can be used in the context of digital technologies and Indigenous peoples in Tkaronto, Canada?* by explaining the balance of the Tech Anishinaabe Medicine Wheel, reflecting on the research journey, showing what knowledge I have contributed to academia, and making some recommendations for future work on this topic. To structure this chapter, I first start (section 10.1) by linking the design principles of the Tech Anishinaabe Medicine Wheel with the concept of decoloniality through the distinction of two conceptual terms: decolonial computing and digital decoloniality. Next (section 10.2), I conclude this dissertation through (a) reflecting on the research journey, (b) articulating various tensions of using GAFAM tools, (c) disclosing the current challenges of the *Indigenous Friends Platform*, and finally, (d) providing some insights into future research about this topic and how allies can support decolonial digital spaces for Indigenous peoples.

As an essential element of Indigenous worldviews and research, Shawn Wilson (2008) concluded in his work that Indigenous research has an impact on the researcher as well: “if research doesn’t change you as a person, then you haven’t done it right” (p. 135). As I explained in the introduction of the dissertation, framing this research as a journey entails that the processes involved in this knowledge creation were a particular and unique trajectory. This route had a personal impact on my being. This journey made me discover that I can embrace my different identities and areas of knowledge as a whole construct, bringing significant insights to civil society and academia. This transdisciplinarity character of my life story makes it unique and makes me responsible for continuing to support the connections

between Indigeneity and digital technologies. Moreover, this research journey made me reflect on my life journey and comprehend the reasoning of each of the phases of my life, from studying computer science to the creation of the not-for-profits in Canada and Mexico.

10.1 Decolonial Computing and Digital Decoloniality

One of the goals of this research was to continue the theoretical conversations of digital technologies and Indigeneity by providing several practical insights into how to implement this type of technology at the community level. More specifically, this exploration adds to the theoretical reflections of several authors with respect to decolonial computing and the relations between decoloniality and Indigenous peoples, such as Rafael Rodriguez-Prieto, Fernando Martinez-Cabezudo, Mustafa Ali, Anita Say Chan and Alexandra Deem. As I mentioned in Chapter 5, few authors incorporate practical methods in their analysis and commonly do not include the different technical specifications that digital solutions imply in the current context of social media, cloud computing, and rewesternization.

In order to link the four design principles with the previous theoretical discussions of digital technologies and decoloniality, there is a teaching from the Anishinaabe Medicine Wheel that is applicable in the relationships among different directions that can lead to the articulation between theory and praxis. In the Anishinaabe tradition, there are strong connections between the opposite directions of the Medicine Wheel. Zhaawanong (youth) and Kiiwedion (elderhood) are related because the youth and elders take care of each other, as well as Waabinong (childhood) and Epangishmok (adulthood) are related due to the relationship between parents and their children as they nurture each other. In other words, the opposites attract each other based on their needs and most importantly they complement each other (Elder Blu Waters, personal communication, October 26, 2014). Similarly, in the Tech Anishinaabe Medicine Wheel, the Embodiment of Indigeneity—Zhaawanong—is directly related to Indigenous Data Sovereignty—Kiiwedionong— as they complement each other. In the first place, the embodiment of Indigenous bodies in the digital world requires data protection to avoid harassment, discrimination, and cultural appropriation from people who are not members of the communities or people who should not

have access or control over the information. At the same time, Indigenous data/knowledge requires a successful embodying of Indigeneity to respectfully follow the protocols of what information and data can be posted within the digital spaces and with whom the data is shared. In other words, without the ownership and control of the data, Indigenous bodies in the digital world might be in danger to continue experiencing the violence of colonization. In the same way, without the successful embodiment of Indigeneity and land in the digital space, data can continue to replicate data extractivism and contribute to natural resources extraction in the analogue world.

On the other side of the spectrum, the Digital Software Braid—Waabinong— and the Decolonial Infrastructure—E pangishmok— are strongly interconnected. The digital infrastructure contains the software braid, but at the same time, the protocols of the software methodology transform how the infrastructure is constructed and conceived. In short, the infrastructure directly impacts the software and how the digital solution is structured because the software has a direct connection to how the hardware will respond to community needs. Moreover, how the software is imagined and conceived directly impacts and frames the required infrastructure and information architecture that this construct demands at the community level. In other words, the software changes the hardware requirements and frames the relationship between the local community and the digital solution. Based on these relationships and interconnections, I propose that these four design principles should be classified with respect to their implementation and usage into the two main concepts I presented in Chapter 5: digital decoloniality and decolonial computing.

10.1.1 Digital Decoloniality

The concept of digital coloniality was coined by Alexandra Deem (2019) as form of connecting the digital protest and environmental movements. The interpretation of this concept focuses on the outcome of digital technologies and how Indigenous peoples use digital technologies for environmental action; this concept signifies that digital technology can be used in a decolonial form, but it might not necessarily be decolonially designed. In this category, the opposite principles of Zhaawanong—

Embodiment of Indigeneity—and Kiiwedining—Indigenous Data Sovereignty—are the main emphasis. Under this concept, the focus is on the result and usage of technology—i.e., the embodiment of Indigeneity and the data sovereignty—because the infrastructure and software might be already designed through hegemonic colonial tools. I argue that the concept of digital decoloniality only implies the relationship between Indigenous peoples and digital technologies in the form of expressions that are transferable to the analogue world through Indigenous embodiment, land proclamations, and protection of Indigenous data/knowledge. Indigenous peoples might use external infrastructures—i.e., GAFAM—because of the limited access to digital skills and technology at the local level, but this factor does not remove the importance of their decolonial action in the analogue world. In the end, these actions are being transferred to the analogue world and become part of the self-determination of Indigenous peoples. In digital decoloniality, the actions are performed on the front line, and the digital component is commonly blurred by the actions of the people generating the content and taking social and political action in the non-digital spaces. Digital decoloniality has been embraced by thousands of Indigenous artists, activists, and academics worldwide through many calls for diverse forms of action in mainstream social media (e.g., Facebook, WhatsApp, Instagram, TikTok, among others). I assert that without this political and social organization of Indigenous communities in digital spaces, several significant changes would not be possible at the national or regional level due to the lack of non-digital communication among different Indigenous groups and collectives. In other words, under digital decoloniality, digital spaces are embracing and allowing new forms of decolonial actions in the analogue / non-digital world while not necessarily using decolonial technical tools.

10.1.2 Decolonial Computing

The concept of decolonial computing was coined by Mustafa Ali (2014) and emphasizes how the digital tool is created and designed. The interpretation of this concept focuses on how Indigenous peoples control and own the digital solution. Under this classification, the opposite design principles of Waabinong—Digital Software Braid—and Epangishmok—Decolonial Infrastructure—are the main

objectives. This concept focuses on how digital technology can be decolonially developed and designed but acknowledges that the application may or may not be used for emancipation and self-determination outside of the digital world. In other words, the technological tools—i.e., software and infrastructure — are decolonially designed, but they may not necessarily create political and social action or intervention in the real/analogous world. I assert that decolonial computing involves designing and developing digital software braids and communal infrastructures that challenge the hegemonic forms of creating and managing digital solutions. Decolonial computing frames a new way of doing computing, and in the context of Indigenous peoples is present when Indigenous worldviews are inserted into the computing process and digital design throughout the creation practice. Moreover, decolonial computing involves the positionality of the people designing and implementing digital technology and redefining the meanings of digital and data in their communal and local contexts. This aspect includes the re-conception of digital/virtual/web objects (e.g., hypertext, websites, mobile application, coding) and transforming them into local cultural materialities (e.g., the Tipi, ceremonies, the Wampum belt). Decolonial computing implies a complete departure from the digital scaffolds and displacement of the standard forms of creating digital technology.

Decolonial computing and digital decoloniality are interconnected concepts, and both of them want to recognize the decolonial actions that Indigenous peoples are doing within digital technologies. Although there are relevant epistemological relationships, the danger of avoiding this distinction is that there is a vast number of digital solutions that do not reflect or consider these holistic aspects and are simply considered “decolonial.” To a certain extent, they continue to replicate forms of digital coloniality due to the lack of understanding of the differences. Thereby, these theoretical concepts can complement each other in the reflection of the challenges that the current digital landscapes present in the context of digital technologies and Indigeneity. Both conceptualizations can be used as a form of analytical and practical tool in the implementation of digital solutions in the context of Indigenous communities and support local decision-makers in the assessment of service providers and deployment of digital solutions. Moreover, these concepts in turn inform the implementation of the *Indigenous Friends Platform* through

the continuation of *doing through thinking, thinking through doing* to embrace the dialogue between Indigeneity and colonial digital environments.

10.2 Conclusion of the Research Journey

Figure 24

The Research Journey of the Indigenous Friends Platform



Note. This vision was created by Anishinaabe Onyota'aka artist Tsista Kennedy when I shared with him the conclusion of my research. Copyright 2021 by the Indigenous Friends Association.

The journey to frame four design principles within digital spaces through the development of the *Indigenous Friends Platform* in Tkaronto, Canada, expanded the understanding and learning of decolonial options in the context of Indigenous peoples and digital technologies. The quest to find new ways to understand digital technology departing from other epistemic lenses demanded to displace and unsettle several digital design structures and, most importantly, to conceive Indigenous digital principles. The epistemic encounters between Indigenous Traditional Knowledge(s) and digital spaces within this doctoral research situate several academic discourses about digital technologies, infrastructure, digital embodiment, data, and software engineering into the context of Indigeneity as a form of Indigenous and

decolonial resistance. This proposition started in my master's thesis in which I conceived a digital space as a technical being—a virtual Tipi—with a Spirit. Subsequently, in this doctoral dissertation, I explore the design principles necessary to keep this technical being in balance through the teachings of the Anishinaabe Medicine Wheel. As a result, four practical principles were conceived throughout the implementation of the *Indigenous Friends Platform* and the creation of the Indigenous Friends Association: (1) Waabinong – Digital Software Braid; (2) Zhaawanong – Embodiment of Indigeneity; (3) Epangishmok – Decolonial Infrastructure; and (4) Kiiwedining – Indigenous Data Sovereignty. These four design principles constitute the Tech Anishinaabe Medicine Wheel, which became relevant in the proposition of new forms of designing and developing digital spaces through the interweaving of digital conceptions with Traditional Knowledge.

Each of these dimensions of the wheel in the *Indigenous Friends Platform* conceived design principles of decoloniality that I argue must be considered and locally adapted in the context of Indigenous peoples and digital creation. The principle of self-determination about our lives, communities, lands, resources, and institutions requires, more than ever, to be translated to digital spaces. The provocation resided in the contrasting tensions that this form of technology—i.e., mobile technologies—implies in the digital space by continually changing and fostering data extractivism, but, at the same time, allowing several Indigenous groups to engage in the digital world.

The objective of this thesis was to formulate design principles of decoloniality within digital technologies through the story of the development of the *Indigenous Friends Platform* (IFP) in the context of Indigenous urban youth at York University in Toronto, Canada. To accomplish this objective, the reflection on the dimensions of the Anishinaabe Medicine Wheel provided the guidance on this journey as a form of reviewing and concluding a way of doing digital technology by/for/with Indigenous peoples.

I began in Part 1 (Chapter 1), where I introduced myself and the attributes of academic research through Indigenous worldviews to start unfolding the analysis of the balance of this *Way of Doing/Knowing* for Indigeneity and digital technologies. I presented a decolonial way of doing/knowing

this research through the proposal of a methodology and theoretical framework based on the principle of *doing through thinking, thinking through doing* that embraces this research’s transdisciplinary character and invites to unsettle standards in Western academia. In Part 2 (Chapters 2 and 3), I shared the story of the *Indigenous Friends Platform* to disclose the relationships and be accountable for the knowledge and teachings shared throughout the thesis journey. After this storytelling, in Part 3 (Chapters 4 and 5), I presented a general framework to understand the conceptualizations and exploration of coloniality and decoloniality within digital technologies. This section demonstrated that several digital technologies are not only colonial in their practices but also are colonially created and designed. Furthermore, several decolonial practices are distinguished as reactive forms to coloniality within digital technologies that differ from decolonial approaches; however, it was shown that there is an absence of decolonial ways of doing—i.e., methodologies for deployment—for digital technologies. Finally, in Part 4 (Chapters 6 to 9), I proposed the Tech Anishinaabe Medicine Wheel, a digital creation journey guided by the Anishinaabe worldview.

In the first place, in the eastern direction of *Waabinong*, the incorporation of Traditional Knowledge within the software design methodology as a digital software braid is an invitation to interfere with the hegemonic forms of coding and conceiving digital solutions. Moreover, it obliges designers and developers to follow Indigenous ethical practices and teachings because Indigenous ways of doing became central to digital creation and not something to be “included” within the digital spaces as purely cultural content. The displacement of the global software standards and the conception of a local form of Indigenous software creation through the Cree Tipi ceremony forces the integration of Indigenous ways of doing as a digital method of interaction among users and a way of including these teachings within the terms of service.

Then moving to the south, in the *Zhaawanong*, the conception of Indigeneity in the digital space was analyzed and explored. The different cultural and political aspects to consider when Indigenous peoples use and navigate digital spaces became relevant as a form of embodying Indigeneity: presence, orality, sharing, and caring. These four aspects bring communal values into the digital space and became

relevant in the conception of safe(r) spaces for youth. These values of embodiment are a form of political action through the integration of critical aspects of Indigeneity but acknowledge that land cannot be conceived without an integral and practical relation to the analog and physical world. Moreover, it was clear the relevance of reclaiming digital technologies as land in order to translate the digital movements into actions in the analog world to protect the environment and the territories.

Next, moving to the west, in the *Epangishmok*, I explored the principles to unsettle technical infrastructures as a form of decolonial action. Most of the projects related to Indigeneity and digital technology are solely focused on the discourse of *access* to digital technology without considering the communal ownership and control of infrastructure. Technological infrastructure within Indigenous contexts should be conceived under communal values where the communities have the right to decide over the technology (i.e., hardware, software, and data) and get the benefits of it. The continual usage of externalized and centralized infrastructures replicates colonial practices of extractivism where Indigenous communities rely on outsiders to use digital platforms, and pieces of information are extracted continuously from them. Therefore, the proposal to include “community” as part of digital infrastructure within Indigenous digital projects wants to challenge the colonial idea of resource extraction.

Finally, shifting to the north in the *Kiiwedinong*, all the journeys combine into the principle of Indigenous data sovereignty that is conceived as the right of each community to govern the collection, ownership, and application of their data. In this section, an exploration of the current challenges to protect Indigenous data is explored through the navigation of the legal challenges under Intellectual Property Rights and the ethical propositions of OCAP and CARE principles in the Canadian and global perspectives. Under the *Kiiwedinong* of the Tech Anishinaabe Medicine Wheel, the control and ownership of information by Indigenous peoples generate tensions concerning the open-source, open-data and open-science movements because they embrace the facilitation of sharing knowledge without acknowledging the historical contexts and the colonial power dynamics of Indigenous communities worldwide. I contend that a real form of sovereignty over data may occur in the deployment of digital technologies until the other principles—i.e., software, embodiment and infrastructure—are also

considered and addressed in digital design.

Under the Anishinaabe worldview, in order for the being to be healthy and in peace, the four dimensions of the Medicine Wheel—Waabinong (East), Zhaawanong (South), Epangishmok (West), and Kiiwedionong (North)—need to be in balance. Similarly, in the Tech Anishinaabe Medicine Wheel, the different aspects of digital creation, i.e., software, embodiment/land, infrastructure, data, require balancing and harmony with one another. In the balance of the four dimensions, technical beings are sufficiently at peace and healthy to survive digital colonial ecosystems and potentially create safe(r) digital spaces for Indigenous youth. Throughout this academic work, seeking this balance through the process of *doing through thinking, thinking through doing* allowed me to connect different areas of knowledge and envision new forms of conceiving the digital world.

Based on this principle, I argue here that once the four design principles of the Tech Anishinaabe Medicine Wheel—Waabinong: Digital Software Braid, Zhaawanong: Embodiment of Indigeneity, Epangishmok: Decolonial Infrastructure and Kiiwedionong: Indigenous Data Sovereignty—are equally incorporated, reflected, and in balance in the design and deployment of digital solutions, then a sustainable process of decoloniality for Indigenous Peoples will happen within digital spaces. Through this exploration of the four dimensions and the journey of *doing through thinking and thinking through doing*, I invite software designers, technologist enthusiasts, media studies intellectuals and, more importantly, Indigenous activists to reflect on the considerations that digital technologies imply for Indigenous peoples. Moreover, this proposal provides principles and guidelines for designing digital technologies, but, fundamentally, each community must incorporate its own local knowledge and worldview into the digital design. This proposed *Way of Doing/Knowing* does not establish a universalistic approach to digital tech regarding Indigenous peoples but provides some reflection considerations for digital design.

Furthermore, based on this dissertation research I claim that only when the Tech Anishinaabe Medicine Wheel's dimensions are in balance, which means equilibrium between decolonial computing and digital coloniality, can we answer the recurrent calls to use technologies outside GAFAM and finally

align Indigenous peoples' self-determination. The call for several activists and intellectuals to engage outside of the GAFAM should be proposed with a clear path on how alternative and open-movement technologies can financially and educationally be used by marginalized communities that have historically been excluded from knowledge and technical production. I propose that in the current circumstances of digital technologies, Indigenous peoples should take advantage of the resources provided by GAFAM to develop technical skills and have access to several sources of knowledge. After those technical skills and knowledge have been gained, then Indigenous peoples can create a clear vision of how marginalized communities can displace themselves from the use of GAFAM through revisiting the principles of the Tech Anishinaabe Medicine Wheel, in order to own infrastructures outside of the colonial boundaries, and most importantly, to educate and invite other community members to embrace and use these alternative solutions. All these decolonial efforts created outside of the colonial boundaries would be meaningful if these resources were accessible in all forms by community members outside of the tech industry, academia, and specific civil society organizations. In other words, I argue it is essential in the context of Indigenous communities to understand that starting from the colonial tools of GAFAM may be necessary to learn about the digital world to transform the colonial digital spaces into potential decolonial tools.

Similarly, the analyses in this research provide distinctive ways of reflecting and navigating the complex contexts of Indigenous peoples. In these scenarios, the usages of digital technologies are diverse, and their relationships are complicated. As I mentioned in Chapter 4 and Chapter 5, some groups use the current GAFAM solutions to express themselves and organize analogue decolonial actions to defend their territories. In contrast, other groups have had the resources to develop and deploy their own technological solutions through their digital infrastructure. I argue that in both cases, however, a certain degree of decoloniality is occurring based on the level that these actions are transposed into the analogue/non-digital world. In other words, if the use of digital technologies and Indigenous peoples is only confined to the virtual worlds without having an impact on communities or land in the real world, then digital technologies are just a palliative approach to real-world problems, and the process of decoloniality is not

happening for Indigenous peoples (e.g., One Laptop Per Child, Internet.org by Facebook). In contrast, even when certain Indigenous groups and activists still use GAFAM tools, these responses can be considered decolonial actions due to the linkage with the analogue action and the protection of the land, such as the Water Protectors of the Dakota Access Pipeline and Wet'suwet'en resistance to the Coastal GasLink Pipeline .

In the context of this research, the development and implementation of the *Indigenous Friends Platform* were central practical considerations to provide alternative forms of knowledge production and to practice and frame the concepts of digital coloniality and decolonial computing. There are still practical challenges to address within this space, however. First, it is fundamentally important to increase the platform's usage with more users, and the organization requires outreach to include more communities in the space. During these years of exploration and development, it was a real challenge to engage with other institutions and communities to continue increasing the usage of the space. Moreover, it is critical to continue developing the app's sustainability plan in the long term to continue developing the space. By March 2021, the new version of the app (version 3) will be released, creating new expectations, challenges, and forms of interactions among users and digital creators. From the perspective of decolonial computing, the development journey for this potential type of tool is still a work-in-progress that implies the deconstruction of several types of neoliberal technologies and colonial structures such as mobile app markets—e.g., Google Play and Apple Store. In other words, the challenge still resides in how to conceptualize and construct the elements of the platform outside of these boundaries without excluding people because the app would not be available outside of those spaces. Nonetheless, based on the principles of digital decoloniality, ethical considerations could potentially guide the design and implementation of new processes that might be limited in the digital arena, but they would be transferable into real actions in the analogue world. From a methodological point of view, the deficiencies of this type of transdisciplinary research were based on the extensive scope that this type of inquiry entails. In the first place, the diverse range of Indigenous identities sharing the space brought several worldviews that, in most cases, coincide in the final results, but they had significant differences in the protocols and forms of

thinking. Therefore, there was a need to reconcile several points of view in different moments throughout the research. Second, the limited notion of institutional ethic protocols did not allow the adaptation of the methodology of doing through thinking, thinking through doing to the changing notion of the IFA communities (e.g., in 2019, IFA started to implement projects in Saskatchewan, and the ethic protocols did not allow this type of adaptations). Third, the continuous epistemic tension between the trends in the mobile world versus decolonial ways of doing did not further explore specific features due to the continuous need to update the digital features.

After all the stages in the Anishinaabe Medicine Wheel are completed, the cycle restarts again in order to continue seeking balance and harmony. The revision of the four dimensions is a repetitive cycle that requires several journeys around the wheel throughout the life of the technical being, which means that this journey does not end in this research. Several aspects of Indigenous peoples and digital technologies need to continue being explored and researched from this departure point. First, as Indigenous peoples, I argue that we need to remove ourselves from paternalistic discourses of the digital divide where outsiders only provide “access” to digital technologies without self-determination—i.e., control, ownership, and possession—over digital tools. In other words, Indigenous peoples require a digital agenda that includes community members’ involvement throughout the development and implementation processes of digital technologies. Second, Indigenous peoples worldwide must start collaborating to imagine and envision digital technologies that are not based on extractivist industries and consider solutions that are respectful with the environment. Related to this aspect, from the perspective of technical standards, it is fundamental to continue exploring new forms of including Traditional Knowledge and Indigenous worldviews within digital technologies’ design and implementation, not only in software but in hardware as well. This aspect of the design is fundamental to guarantee the ethical considerations that Indigenous peoples seek through self-determination, and most importantly, to connect digital technologies to the land and the environment. Third, these reflections are vital to continue imagining new forms of legal protection for Indigenous data because this type of knowledge continues to be persistently disrupted by outsiders to the communities, particularly since social media platforms have accelerated the process of data extraction. These explorations might trigger new areas

of digital security and privacy under the lens of Indigenous peoples. In connection to this last point, Indigenous communities need to continue redefining and conceiving the notions of "community" in the digital because these spaces are requiring a definition or approximation to nationhood and territory in digital spaces and primarily when people identify as part of the same group, however, they are physically, socially or culturally distant from one another. Finally, but not least, Indigenous peoples must continue to invest in creating new pedagogical tools to educate new generations about the potential and threats of digital technologies.

Regarding Indigenous allies, this dissertation provides insights on the principles that need to be consolidated around digital solutions and Indigenous peoples. First and foremost, the Traditional Knowledge and its derivatives, such as the Anishinaabek Medicine Wheel and the Cree Tipi Ceremony, cannot be simply copied or adapted without following the local protocols and without having the trusted relationships at the community level. In the case that there is interest to use or continue developing the conclusions of this academic work, the epistemic terms of digital decoloniality and decolonial computing are offered as a departing point. These terms involve several aspects such as decolonial infrastructure, Indigenous embodiment of land, Indigenous data sovereignty, and Indigenous software design. Second, Indigenous peoples need to control and own digital solutions and the data produced through them. Moreover, in order to generate an effective and practical decolonial proposition, Indigenous peoples need to be included as users of the digital design, but also different Indigenous worldviews need to be integrated within the digital solution to address the colonial scenarios of digital spaces. Fourth, allies should support Indigenous pedagogies to develop tech skills in order for youth to get more interested in not only accessing digital tools but also designing and developing them. Finally, I claim that research regarding digital technologies and Indigenous peoples must integrate and have an application in the real world to be considered "decolonial." Therefore, Indigenous peoples must be part of the entire research process of digital deployment (*doing*) and academic production (*thinking*).

The decolonial and Indigenous vision in digital design and creation is vital to disrupt positions of power and to dismantle the forms of accelerated extractivism in today's world. The Indigenous worldviews

within digital technologies offer new forms of solving the problems triggered by colonial digital processes. The purpose of integrating Traditional Knowledge as part of the design and digital processes displaces the academic and practical forms of conceiving digital applications and disrupts the positivist logic of Western science and technology. Most importantly, this proposition brings community members, such as Knowledge Keepers and Elders, to conversations and discussions about digital colonialism as crucial contributors to creating and envisioning new solutions. This is why this work is a new call for collective and communal action that considers and integrates Indigenous worldviews into digital technologies and the conception of innovative Indigenous mobile approaches.

References

- Abrahamsson, P., Salo, O. & Ronkainen, J. (2002). *Agile software development methods: Review and analysis*. Espoo: VTT Publications 478. Retrieved December 6, 2019 from <http://www.inf.vtt.fi/pdf/publications/2002/P478.pdf>.
- Absolon, K. E. (2011). *Kaandossiwin: How we come to know*. Halifax, NS: Fernwood Books Ltd.
- Access Now (n.d.) *Access now. About us?* Retrieved September 1, 2019, from <https://www.accessnow.org/about-us/>
- Alberta Education (2005). *Our words, our ways: Teaching First Nations, Métis and Inuit learners*. <https://education.alberta.ca/media/3615876/our-words-our-ways.pdf>
- Alcantara, C., & Dick, C. (2017). Decolonization in a digital age: Cryptocurrencies and Indigenous self-determination in Canada. *Canadian Journal of Law & Society/La Revue Canadienne Droit et Société*, 32(1), 19–35.
- Alduenda, I. (2018, February 22). La ilusión de las candidaturas independientes. Retrieved December 6, 2019, from <https://www.animalpolitico.com/inteligencia-publica/ilusion-candidaturas-independientes/>
- Alexander, C. J., Adamson, A., Daborn, G., Houston, J., & Tootoo, V. (2009). Inuit cyberspace: The struggle for access for inuit qaujimaqatungit. *Journal of Canadian Studies/Revue d'Études Canadiennes*, 43(2), 220–249.
- Ali, A. H. (2011). The power of social media in developing nations: New tools for closing the global digital divide and beyond. *Harv. Hum. Rts. J.*, 24, 185.
- Ali, M. (2014). Towards a decolonial computing (pp. 28–35). Presented at the CEPE 2013: Computer Ethics: Philosophical Enquiry, Lisbon, Portugal: International Society of Ethics and Information Technology. Retrieved from <http://oro.open.ac.uk/41372/>
- Ali, M. (2016). A brief introduction to decolonial computing. *XRDS*, 22(4), 16–21. <https://doi.org/10.1145/2930886>
- Alia, V. (2012). *The new media nation: Indigenous peoples and global communication* (Vol. 2). New York: Berghahn Books.
- Anderson, D., Chiarotto, L., & Comay, J. (2017). *Natural curiosity 2nd Edition: A resource for educators: The importance of Indigenous perspectives in children's environmental inquiry*. Toronto: Laboratory School of the Dr. Eric Jackman Institute of Child Study
- Anderson, J. (2010). Indigenous knowledge/traditional knowledge and intellectual property. (Issues paper for the Center for the Public Domain, Duke University). Retrieved July 17, 2017, from <https://law.duke.edu/cspd/itkpaper3/>

- Anderson, J. (2012). Options for the future protection of GRTKTCEs: The Traditional Knowledge licenses and labels initiative. *The WIPO Journal: Analysis of Intellectual Property Issues*, 4(1), 66–75.
- Anderson, J., & Christen, K. (2013). “Chuck a copyright on it”: Dilemmas of digital return and the possibilities for Traditional Knowledge licenses and labels. *Museum Anthropology Review*, 7(1–2), 105–126.
- Anderson, K. E. (2020). Getting acquainted with social networks and apps: It is time to talk about TikTok. *Library Hi Tech News*.
- Andrejevic, M. (2016). The pacification of interactivity. In D. Barney, G. Coleman, C. Ross, J. Sterne, & T. Tembeck (Eds.), *The participatory condition in the digital age* (pp.187–206). Minneapolis: Univ Of Minnesota Press.
- App Annie. (May 2, 2018). Number of mobile app downloads worldwide in 2017, 2018 and 2022 (in billions) [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/271644/worldwide-free-and-paid-mobile-app-store-downloads/>
- Appel, H., Anand, N. & Gupta, A. (2018). Introduction: Temporality, politics, and the promise of infrastructure. In N. Anand, A. Gupta & H. Appel (Eds.), *The Promise of Infrastructure* (pp. 1–38). New York: Duke University Press. <https://doi.org/10.1515/9781478002031-002>
- Appfigures & VentureBeat. (August 6, 2019). Number of apps available in leading app stores as of 2nd quarter 2019 [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statistacom.ezproxy.library.yorku.ca/statistics/276623/number-of-apps-available-in-leading-app-stores/>
- Apple (n.d.) *Download apps and games on your iPhone or iPad*. Retrieved September 1, 2020 from <https://support.apple.com/en-ca/HT204266#buy>
- Archibald, J. A. (2008). *Indigenous storywork: Educating the heart, mind, body, and spirit*. Vancouver: UBC Press.
- Arita, H. T. (2011). El regreso del caballo: lo macro y lo micro en la evolución. *Ciencias*, 97(097). <http://revistas.unam.mx/index.php/cns/article/view/18024>
- Avgerou, C. (2017, May). Theoretical framing of ICT4D research. In J. Choudrie, M. S. Islam, F. Wahid, J. M. Bass, & J. E. Priyatma (Eds.), *Information and communication technologies for development* (Vol. 504, pp. 10–23). Cham: Springer International Publishing. Retrieved from <http://link.springer.com/10.1007/978-3-319-59111-7>
- Ávila-Pinto, R. (2018). Digital sovereignty or digital colonialism? *Sur – International Journal on Human Rights*, 15(27), 15–27.

- Awori, K. (2015). What Indigenous Knowledge is not: An introductory note. In N. Bidwell & H. Winschiers-Theophilus (Eds.), *At the intersection of Indigenous and Traditional Knowledge and technology design* (pp. 15–19). Santa Rosa: Informing Science Press.
- Balaji, S., & Murugaiyan, M. S. (2012). Waterfall vs. V-Model vs. Agile: A comparative study on SDLC. *International Journal of Information Technology and Business Management*, 2(1), 26–30.
- Bang, M., Marin, A., Faber, L., & Suzukovich III, E. S. (2013). Repatriating indigenous technologies in an urban Indian community. *Urban Education*, 48(5), 705–733.
- Bartlett, C., Marshall, M., & Marshall, A. (2012). Two-eyed seeing and other lessons learned within a co-learning journey of bringing together indigenous and mainstream knowledges and ways of knowing. *Journal of Environmental Studies and Sciences*, 2(4), 331–340.
- Bartlett, R., & Milligan, C. (2015). *What is diary method?* London: Bloomsbury Academic.
- Bauerlein, M. (2011). *The digital divide: Arguments for and against Facebook, Google, texting, and the age of social networking*. New York: Penguin.
- Beaton, B., Burnard, T., Linden, A. & O'Donnell, S. (2015). Keewaytinook Mobile: An Indigenous community-owned mobile phone service in northern Canada. In L. Dyson, S. Grant, & M. Hendriks (Eds.), *Indigenous people and mobile technologies* (p. 149–171). New York & Abingdon: Routledge. <https://doi.org/10.4324/9781315759364>
- Beaton, B., Seibel, F. & Thomas, L. (2014). *Valuing the social economy and information and communication technologies (ICT) in small remote First Nations*. Association of Social Economy and Non-Profit Research, Brock University, St. Catharines, Ontario, May.
- Benjamin, R. (2019). *Race after technology: Abolitionist tools for the new Jim Code*. Cambridge, UK/ Medford, MA: Polity.
- Bhambra, G. K. (2014). Postcolonial and decolonial dialogues. *Postcolonial Studies*, 17(2), 115–121.
- Bhattacharya, J. (2010). Technology standards: A route to digital colonization. *IETE Journal of Education*, 51(1), 9–21. <https://doi.org/10.1080/09747338.2010.10876064>
- Bischofberger, W. R., & Pomberger, G. (1992). *Prototyping-oriented software development: Concepts and tools*. Berlin, Heidelberg: Springer.
- Bourque, P. & Fairley, R. E. (Eds.). (2014) *Guide to the software engineering body of knowledge, Version 3.0*, IEEE Computer Society, <https://www.swebok.org>
- Bowrey, K. & Anderson, J. (2009). The politics of global information sharing: Whose cultural agendas are being advanced? *Social and Legal Studies*, 18(4), 479–500.
- boyd, d. & Crawford, K. (2011). *Six provocations for big data* (No. ID 1926431). Rochester, NY: Social Science Research Network. Retrieved from <https://papers.ssrn.com/abstract=1926431>
- Brady, F. & Dyson, L. E. (2016). Why mobile? Indigenous people and mobile technologies at the edge. In

- L. Dyson, S. Grant, & M. Hendriks (Eds.), *Indigenous people and mobile technologies* (p. 45–72). New York: Routledge.
- Brady, F., Dyson, L. E., & Asela, T. (2008). Indigenous adoption of mobile phones and oral culture. In F. Sudweeks, H. Hrachovec, & C. Ess (Eds.), *Proceedings of the sixth international conference on cultural attitudes towards technology and communication, 2008* (pp. 384–398). Murdoch University, Australia.
- Bravo, L. (2017) Una semilla brota cuando se siembra en tierra fértil. In Spideralex (Eds.) *Soberanía Tecnológica 2* (pp. 113–128). Descontrol: Barcelona. Retrieved from <https://sobtec.gitbooks.io/sobtec2/content/es/>
- Bria, F. (2015). Public policies for digital sovereignty. In T. Scholz and N. Schneider (Eds.). *Ours to hack and to own* (pp. 218–222). New York: OR Books.
- Brooks, L., & Alam, M. S. (2017). Affordance and Habitus: Understanding Land Records E-services in Bangladesh. In J. Choudrie, M. S. Islam, F. Wahid, J. M. Bass, & J. E. Priyatma (Eds.), *Information and Communication Technologies for Development* (pp. 295–306). Springer International Publishing. https://doi.org/10.1007/978-3-319-59111-7_25
- Brown, M. (2003). *Who owns native culture?* Cambridge: Harvard University Press.
- Brown, M. (2005) Heritage trouble: Recent work on the protection of intangible cultural property. *International Journal of Cultural Property*, 12, 40–61.
- Brown, S., Clement, T., Mandell, L., Verhoeven, D. & Wernimont, J. (2016). Creating feminist infrastructure in the digital humanities. In *Digital humanities 2016: Conference abstracts* (pp. 47–50). Jagiellonian University & Pedagogical University, Kraków.
- Brown, S., & Hussain, F. (2017, May). Information ecology as a framework for south-south cooperation: Case studies of Rwanda and Bangladesh ICT-Based health applications. In J. Choudrie, M. S. Islam, F. Wahid, J. M. Bass, & J. E. Priyatma (Eds.), *Information and Communication Technologies for Development* (Vol. 504, pp. 803–808). Cham: Springer International Publishing. Retrieved from <http://link.springer.com/10.1007/978-3-319-59111-7>
- Burnham, C. (2018). *Does the internet have an unconscious?: Slavoj Žižek and digital culture*. New York: Bloomsbury.
- Burum, I. (2016). Mojo in remote Indigenous communities. In L. Dyson, S. Grant, & M. Hendriks (Eds.), *Indigenous people and mobile technologies* (pp. 172–200). New York & Abingdon: Routledge. <https://doi.org/10.4324/9781315759364>
- Business 2 Community. (May 5, 2019). Percentage of mobile apps that have been used only once from 2010 to 2019 [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/271628/percentage-of-apps-used-once-in-the-us/>

- Cadwalladr, C., & Graham-Harrison, E. (2018). The Cambridge Analytica files. *The Guardian*, 21, 6–7.
- Cajete, G. (2000). *Native science: Natural laws of interdependence*. Santa Fe, NM: Clear Light Publishers.
- Canada Media Fund. (January 14, 2019). Average weekly time spent online in Canada from 2015 to 2018 (in hours) [Graph]. In Statista. Retrieved September 15, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/473730/canada-weekly-time-spent-online/>
- Canadian Wireless Telecommunication Association [CWAT] (2020). Facts & Figures. Retrieved September 1, 2020 from <https://www.cwta.ca/facts-figures/>
- Castells, M. (2004). *The network society: A cross-cultural perspective*. Cheltenham, UK: Edward Elgar.
- Castells, M. (2010). *The rise of the network society* (2nd ed.). Malden, MA, Oxford, UK, and Chichester, UK: Wiley-Blackwell.
- Castells, M., & Himanen, P. (Eds.). (2016). *Reconceptualización del desarrollo en la era global de la información*. Fondo de Cultura Económica.
- Castro-Gomez, S. (2007). Decolonizar la universidad. La hybris del punto cero y el diálogo de saberes. In S. Castro-Gomez & R. Grosfoguel (Eds.), *El giro decolonial: Reflexiones para una diversidad epistémica más allá del capitalismo global* (pp. 79–91). Bogotá: Siglo del Hombre Editores.
- Cerón-Velásquez, M. E. (1995). *Redes sociales y compadrazgo: indicadores de vitalidad etnolingüística en una comunidad indígena de Puebla*. Instituto Nacional de Antropología e Historia.
- Chacón, R. (2021, March 31). El no ser mestizo. *Gatopardo*. <https://gatopardo.com/arte-y-cultura/el-no-ser-mestizo-o-indigena-nahua-rodrigo-chacon/>
- Chan, A. S. (2018). Decolonial computing and networking beyond digital universalism. *Catalyst: Feminism, Theory, Technoscience*, 4(2): 1–5. <https://doi.org/10.28968/cftt.v4i2.29844>
- Chattopadhyay, N. (2017). Combating effect of climate change and climatic variability on Indian agriculture through smart weather forecasting and ICT application. In V. V. Belvadi, N. Narataja Karaba & N. R. Gangadharappa (Eds.), *Agriculture under climate change: Threats, strategies, and policies* (pp. 3–8). Mumbai and New Delhi: Allied Publishers.
- Chen, S. (2017, July 30). China’s ageing solar panels are going to be a big environmental problem. *South China Morning Post*. <https://www.scmp.com/news/china/society/article/2104162/chinas-ageing-solar-panels-are-going-be-big-environmental-problem>
- Chow-White, P. A. (2012). Genomic databases and an emerging digital divide in biotechnology. In L. Nakamura & P. A. Chow-White (Eds.), *Race After the Internet* (pp. 297–315). <https://doi.org/10.4324/9780203875063-21>
- Christen, K. (2012). *Does information really want to be free? Indigenous knowledge systems and the question of openness*. Retrieved July 17, 2017 from

<https://research.libraries.wsu.edu:8443/xmlui/handle/2376/5705>

- Christen, K. (2015). Tribal archives, traditional knowledge, and local contexts: Why the “s” matters. *Journal of Western Archives*, 6(1), 1–19.
- Cisco Systems. (2018a) VNI Forecast Highlights (2017-2022). Major global mobile data traffic projections and growth trends. Retrieved September 15, 2019 from https://www.cisco.com/c/m/en_us/solutions/service-provider/vni-forecast-highlights.html
- Cisco Systems. (November 26, 2018b). Global mobile data traffic from 2017 to 2022 (in exabytes per month) [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/271405/global-mobile-data-traffic-forecast/>
- Cocq, C. (2016). Mobile technology in Indigenous landscapes. In L. Dyson, S. Grant, & M. Hendriks (Eds.), *Indigenous people and mobile technologies* (pp. 201–218). New York & Abingdon: Routledge. <https://doi.org/10.4324/9781315759364>
- Coombe, R. J. (2009) First Nations intangible cultural heritage concerns: Prospects for protecting traditional cultural expressions in international law. In C. Bell & R. Patterson (Eds.), *Protection of First Nations' cultural heritage: Laws, policy and reform* (pp. 247–277). Vancouver: UBC Press).
- Coombe, R. J. & Aylwin, N. (2014) The evolution of cultural heritage ethics via human rights norms. In R. J. Coombe, D. Wershler, & M. (Eds.), *Dynamic fair dealing: Creating Canadian culture online* (pp. 201–212). Toronto: University Of Toronto Press.
- Cottier, T. & Panizzon, M. (2005). Legal perspectives on traditional knowledge: The case for intellectual property protection. In K. Maskus and J. H. Reichman (Eds.), *International public goods and transfer of technology under a globalized intellectual property regime* (pp. 565–594). Cambridge: Cambridge University Press.
- Couldry, N., & Mejjias, U. (2019). *The costs of connection: How data is colonizing human life and appropriating it for capitalism*. Palo Alto: Stanford University Press.
- Crawford, N. (2002). *Argument and change in world politics: Ethics, decolonization, and humanitarian intervention*. Cambridge, UK: Cambridge University Press.
- Curtis, S. (2014, August 16). Smartphone at 20: IBM Simon to iPhone 6. *The Telegraph*, 16.
- Cusicanqui, S.R. (2012). Ch'ixinakax utxiwa: A reflection on the practices and discourses of decolonization. *South Atlantic Quarterly*, 111(1), 95–109.
- CyberPowWow (n.d.). *About CyberPowWow. An Aboriginal determined territory in cyberspace*. Retrieved March 25, 2021 from <http://cyberpowwow.net/about.html>
- DaCosta, J. (2014, April 11). Toronto aka Tkaronto passes new city council protocol. *MUSKRAT Magazine*. <http://muskratmagazine.com/toronto-aka-tkaronto-passes-new-city-council-protocol/>

- Dance, G. J. X., LaForgia, M., & Confessore, N. (2018, December 19). As Facebook raised a privacy wall, it carved an opening for tech giants. *The New York Times*.
<https://www.nytimes.com/2018/12/18/technology/facebook-privacy.html>
- DataReportal, We Are Social & Hootsuite. (January 31, 2019). Countries with the highest internet penetration rate as of January 2019 [Graph]. In Statista. Retrieved September 12, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/227082/countries-with-the-highest-internet-penetration-rate/>
- Dark web (n.d.). In Cambridge Dictionary. Retrieved February 24, 2021 from <https://dictionary.cambridge.org/us/dictionary/english/dark-web>
- Dean, J. (2014). Apps and drive. In A. Herman, J. Hadlaw, & T. Swiss (Eds.), *Theories of the mobile Internet: Materialities and imaginaries* (pp. 232–248). Milton Park: Routledge.
- Deem, A. (2019). Mediated intersections of environmental and decolonial politics in the No Dakota Access Pipeline Movement. *Theory, Culture & Society*, 36(5), 113–131.
- Dei, G. S. (2012). Indigenous anti-colonial knowledge as ‘heritage knowledge’ for promoting Black/African education in diasporic contexts. *Decolonization: Indigeneity, Education & Society*, 1(1).
- Del Alamo, O. (2003). Esperanza tecnológica: Internet para los pueblos indígenas de América Latina. *Revista Instituciones y Desarrollo* (14–15), 43–79.
- Delgado-P, G., & Becker, M. (1998). Latin america: The Internet and Indigenous texts. *Cultural Survival Quarterly*, 21, 23–28.
- Diaz-Polanco, H. (2007). *Elogio de la diversidad: globalización, multiculturalismo y etnofagia*. Mexico: Siglo XXI Editores.
- Digital technology (n.d.). In the Random House Unabridged Dictionary. Retrieved September 1, 2019 from <https://www.dictionary.com/browse/digital-technology>
- Driskill, Q. (2008). Theatre as suture: Grassroots performance, decolonization and healing. In R. Eigenbrod, & R. Hulan (Eds.), *Aboriginal oral traditions: theory, practice, ethics*. Halifax, NS: Fernwood.
- Dyson, L. E. (2004). Cultural issues in the adoption of information and communication technologies by Indigenous Australians. In F. Sudweeks & C. Ess (Eds.), *Proceedings Cultural Attitudes Towards Communication and Technology* (pp. 58–71). Karlstad, Sweden, 27 June-1 July 2004, Murdoch University.
- Dyson, L. E. (2016). Framing the Indigenous mobile revolution. In L. Dyson, S. Grant, & M. Hendriks (Eds.), *Indigenous people and mobile technologies* (pp. 18–44). New York: Routledge.
<https://doi.org/10.4324/9781315759364>

- Dyson, L. E., Grant, S. & Hendriks, M. (2016). Epilogue. In L. Dyson, S. Grant, & M. Hendriks (Eds.), *Indigenous people and mobile technologies* (pp. 378–379) New York: Routledge.
<https://doi.org/10.4324/9781315759364>
- The Economist. (2017, May 6). The world's most valuable resource is no longer oil, but data.
<https://www.economist.com/leaders/2017/05/06/the-worlds-most-valuable-resource-is-no-longer-oil-but-data>
- Elder, L., Samarajiva, R., Gillwald, A., & Galperin, H. (2014). *Los pobres en la era de la información / The poor in the age of information: Combatiendo la pobreza con tecnología / Fighting poverty with technology*. Intl Development Research. Retrieved August 22, 2017, from
<http://www.publications.gc.ca/site/eng/463749/publication.html>
- eMarketer, & AP. (n.d.). Mobile phone user penetration as percentage of the population worldwide from 2013 to 2019*. In *Statista - The Statistics Portal*. Retrieved January 21, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/470018/mobile-phone-user-penetration-worldwide/>.
- Facebook (n.d.). Internet.org Our Approach. Retrieved February 28, 2019 from
<https://internet.org/en/approach/>
- Facebook. (2020, April 29). Number of monthly active WhatsApp users worldwide from April 2013 to March 2020 (in millions) [Graph]. In *Statista*. Retrieved September 11, 2020, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/260819/number-of-monthly-active-whatsapp-users/>
- Feenberg, A. (2012). Toward a critical theory of the Internet. In A. Feenberg & N. Friesen (Eds.), *(Re)Inventing the internet: Critical case studies*. Rotterdam; Boston: Sense Publishers.
- Fidler, D. P. (2015). *The Snowden reader*. Bloomington: Indiana University Press.
- First Nations Centre. (2007). OCAP: Ownership, Control, Access and Possession. Sanctioned by the First Nations Information Governance Committee, Assembly of First Nations. Ottawa: National Aboriginal Health Organization.
- First Nations Information Governance Centre [FNIGC]. (2016). Pathways to First Nations' data and information sovereignty. In T. Kukutai & J. Taylor (Eds.), *Indigenous data sovereignty*. Canberra: ANU Press. Retrieved from <https://press.anu.edu.au/publications/series/centre-aboriginal-economic-policy-research-caepr/indigenous-data-sovereignty>
- Fischer, B. (2013). A conceptual overview of the history of the CALICO journal: The phases of CALL. *CALICO Journal*, 30(1), 1–9.
- Flaherty, J. (2016). *No more heroes: Grassroots challenges to the savior mentality*. Edinburgh: AK Press.
- Fontanel, J. (2019). GAFAM, a progress and a danger for civilization. In *Financial architecture: Forced*

- economic development in the context of external shocks and internal inconsistencies*. St. Petersburg: St. Petersburg State University of Economics.
- Forsberg, K., & Mooz, H. (1991, October). The relationship of system engineering to the project cycle. In *INCOSE International Symposium* (Vol. 1, No. 1, pp. 57–65).
- Frankel, S. & Drahos, P. (2012). Indigenous peoples' innovation and intellectual property: The issues. Victoria University of Wellington Legal Research Paper, (36). Available at SSRN: <https://ssrn.com/abstract=2138657>
- Free Prior and Informed Consent [FPIC] (2017). Indigenous rights and resource governance research. Retrieved April 6, 2018 from https://fpic.info/en/about_us/
- Gaertner, D. (2015). Indigenous in cyberspace: CyberPowWow, God's Lake Narrows, and the contours of online Indigenous territory. *American Indian Culture and Research Journal*, 39(4), 55–78.
- Garcia-Canclini, N. (2005). *Hybrid cultures: Strategies for entering and leaving modernity*. Minneapolis: U of Minnesota Press.
- Garrick, R. (February 20, 2013). Keewaytinook cell phone access growing. *Wawatay News*. Retrieved April 26, 2018 from <https://mobile.knet.ca/node/50>
- Gil-Olmos, J. (2017, November 7). Comité de apoyo a Marichuy presenta denuncia por fallas en App del INE. Retrieved December 6, 2019, from <https://www.proceso.com.mx/510140/comite-apoyo-a-marichuy-presenta-denuncia-fallas-en-app-del-ine>
- GlobalWebIndex. (November 9, 2017). Average number of online activities per device among internet users worldwide as of 2nd quarter 2017 [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/788093/average-online-activities-per-device/>
- Graveline, F. J. (1998). *Circle works: Transforming Eurocentric consciousness*. Halifax, NS: Fernwood.
- Gray, M., Coates, J., & Bird, M. Y. (Eds.). (2008). *Indigenous social work around the world: Towards culturally relevant education and practice*. Ashgate Publishing.
- Grosfoguel, R. (2007). Descolonizando los universalismos occidentales: el pluri-versalismo transmoderno decolonial desde Aimé Césaire hasta los zapatistas. In S. Castro-Gomez & R. Grosfoguel (Eds.), *El giro decolonial: Reflexiones para una diversidad epistémica más allá del capitalismo global*. (pp. 63-77). Bogotá: Siglo del Hombre Editores.
- Grosfoguel, R. (2008, July 4). Transmodernity, border thinking, and global coloniality. Decolonizing political economy and postcolonial studies. *Revista Crítica de Ciências Sociais*, 80(4).
- Gudeman, S. (1971). The compadrazgo as a reflection of the natural and spiritual person. *Proceedings of the Royal Anthropological Institute of Great Britain and Ireland*, (1971), 4–71.
- Gundermann-Kröll, H., & González-Cortéz, H. (2008). Pautas de integración regional, migración,

- movilidad y redes sociales en los pueblos indígenas de Chile. *Universum* (Talca), 23(1), 82–115.
Translation: Guidelines for regional integration, migration, mobility and social networks in the indigenous peoples of Chile.
- Haas, A. M. (2007). Wampum as hypertext: An American Indian intellectual tradition of multimedia theory and practice. *Studies in American Indian Literatures*, 19(4), 77–100.
- Heeks, R. (2003). Most E-government for Development Project Fail: how can risk be reduced?, iGovernment Working Paper Series, Paper No. 14. Institute for Development Policy and Management, University of Manchester, UK.
- Heeks, R. (2009). *The ICT4D 2.0 manifesto: Where next for ICTs and international development?* (pp. 1–33) University of Manchester. Institute for development policy and management (IDPM). Development informatics group.
- Heeks, R. (2018). *Information and Communication Technology for Development (ICT4D)* Routledge Perspectives on Development. Taylor and Francis.
- Heeks, R. & Wall, P. J. (2017). Critical realism and ICT4D research. In J. Choudrie, M. S. Islam, F. Wahid, J. M. Bass, & J. E. Priyatma (Eds.), *Information and communication technologies for development* (pp. 159–170). Cham: Springer International Publishing. Retrieved from <http://link.springer.com/10.1007/978-3-319-59111-7>
- Herman, A., Hadlaw, J., & Swiss, T. (2014). Introduction: Theories of the mobile internet: Mobilities, assemblages, materialities and imaginaries. In A. Herman, J. Hadlaw, & T. Swiss (Eds.), *Theories of the mobile Internet: Materialities and imaginaries* (pp. 13–24). Routledge.
- Holley, L. A. (2007). *Tipis, tepees, teepees: History and design of the cloth tipi*. Kaysville, UT: Gibbs Smith.
- Howe, C. (1998). Cyberspace is no place for tribalism. *Wicazo Sa Review*, 13(2), 19–28.
- Huerta, E., Bloom, P., & Velasco, K. (2017). The success of community mobile telephony in Mexico and its plausibility as an alternative to connect the next billion. In Belli (Ed.), *Community networks: the Internet by the people, for the people. Official outcome of the UN IGF Dynamic Coalition on Community Connectivity* (pp. 119–150). Rio de Janeiro: Escola de Direito do Rio de Janeiro da Fundação Getulio Vargas.
- Hughes, B (2016). *The bleeding edge: Why technology turns toxic in an unequal world*. London: New Internationalist.
- Human Rights Watch. (2019, May 1). *China's Algorithms of Repression*. Human Rights Watch. <https://www.hrw.org/report/2019/05/01/chinas-algorithms-repression/reverse-engineering-xinjiang-police-mass>
- Hungrywolf, A. (2006). *The tipi. Traditional Native American shelter*. Summertown, TN: Native Voices,

- a division of Book Publishing Company.
- Indigenous Friends. (2020). *Indigenous Friends home*. Retrieved March 1, 2021 from <https://www.indigenousfriends.org>
- Instituto Nacional de Estadística y Geografía [INEGI] (2010). *Anuario estadístico y geográfico por entidad federativa 2017*. Retrieved February 7, 2021 from http://internet.contenidos.inegi.org.mx/contenidos/Productos/prod_serv/contenidos/espanol/bvinegi/productos/nueva_estruc/aegef_2017/702825097929.pdf
- Instituto para el Federalismo y el Desarrollo Municipal [INAFED] (2010) Enciclopedia de los Municipios y Delegaciones de México. Secretaría de Gobernación. Retrieved February 7, 2016 from <http://www.inafed.gob.mx/work/enciclopedia/EMM20oaxaca/index.html>
- Iktakop (n.d.) Quienes Somos? Retrieved April 6, 2018 from <http://www.iktakop.org/quienes-somos/>
- Indonesia – Ministry of Foreign Affairs. (1955). Final Communiqué of the Asian-African Conference. [online]. In: *Asia-Africa speak from Bandung* (pp. 161–169). Jakarta. Consulted on 25-08-2020. Retrieved from <https://www.cvce.eu/s/3n>.
- International Telecommunication Union [ITU] (2018a). *Measuring the Information Society Report*. Volume 1. ICT Country Profiles 2018.
- International Telecommunication Union [ITU] (2018b). *Measuring the Information Society Report*. Volume 2. ICT Country Profiles 2018.
- International Telecommunication Union [ITU] (December 7, 2018c). Number of internet users worldwide from 2005 to 2018 (in millions) [Graph]. In *Statista*. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/273018/number-of-internet-users-worldwide/>
- International Telecommunication Union [ITU]. (2018d). Share of households with a computer at home worldwide from 2005 to 2017. In *Statista - The Statistics Portal*. Retrieved January 21, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/748551/worldwide-households-with-computer/>.
- International Telecommunication Union [ITU]. (June 24, 2019). Number of mobile cellular subscriptions per 100 inhabitants in Canada from 2000 to 2017 [Graph]. In *Statista*. Retrieved September 15, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/186118/mobile-cellular-subscriptions-per-100-inhabitants-in-canada-since-2000/>
- Internet (n.d.). In Merriam-Webster. Retrieved September 1, 2019 from <https://www.merriam-webster.com/dictionary/Internet>
- Internet World Stats. (May 9, 2019). Most common languages used on the Internet as of April 2019, by share of internet users [Graph]. In *Statista*. Retrieved September 13, 2019, from <https://www->

[statista-com.ezproxy.library.yorku.ca/statistics/262946/share-of-the-most-common-languages-on-the-internet/](https://www.statista.com/ezproxy.library.yorku.ca/statistics/262946/share-of-the-most-common-languages-on-the-internet/)

- IntersectTO (2018). IntersectTO: a BIPOC tech community in Toronto. Group Description Retrieved February 28, 2021 from <https://www.facebook.com/groups/819469708223930>
- Intrabach (2018). Quienes somos. Intrabach Project Blog. Retrieved April 6, 2018 from <https://www.intrabach.org/quienes-somos/>
- InvertMedia Inc. (2012a). *Four Directions Teachings.Com – Aboriginal Online Teachings and Resource Centre - Ojibwe Teaching*. Retrieved 17 May 2019 from <http://fourdirectionsteachings.com/transcripts/ojibwe.html>
- InvertMedia Inc. (2012b). *Four Directions Teachings.Com – Aboriginal Online Teachings and Resource Centre – Cree (Nehiyawak) Teaching*. Retrieved 28 Feb 2021 from <http://fourdirectionsteachings.com/transcripts/cree.html>
- Isaak, J., & Hanna, M. J. (2018). User data privacy: Facebook, Cambridge Analytica, and privacy protection. *Computer*, 51(8), 56–59.
- Iseke-Barnes, J. M. & Danard, D. (2007). Indigenous knowledges and worldview: Representations and the Internet. In L. E. Dyson, M. Hendriks, & S. Grant (Eds.), *Information technology and Indigenous people* (pp. 27–29). Hershey, PA: Information Science Pub.
- ISO/IEC/IEEE International Standard (2017). - Systems and software engineering–Vocabulary. *ISO/IEC/IEEE 24765:2017(E)*, 1–541. <https://doi.org/10.1109/IEEESTD.2017.8016712>
- Janke, T., & Iacovino, L. (2012). Keeping cultures alive: Archives and indigenous cultural and intellectual property rights. *Archival Science*, 12(2), 151–171. <https://doi.org/10.1007/s10502-011-9163-0>
- Jarvenpaa, S. L., & Lang, K. R. (2005). Managing the paradoxes of mobile technology. *Information systems management*, 22(4), 7–23.
- Jaszi, P. (2017, June). Existing international intellectual property instruments and traditional cultural expressions: Which gaps exist and which, if any, should be filled? Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC) Seventeenth Session. Geneva: IGC Secretariat.
- Johnson, J. M. (2015). Diaspora Hypertext, the Blog. Retrieved December 15, 2018 from <http://diasporahypertext.com/>
- Kaska, K., Beckvard, H., & Minarik, T. (2019). Huawei, 5G and China as a security threat. *NATO Cooperative Cyber Defence Center for Excellence (CCDCOE)*, 28.
- Kaspersky Lab. (April 25, 2018). Most popular mobile internet activities according to internet users worldwide as of 2nd half 2017, by device [Graph]. In Statista. Retrieved September 13, 2019,

- from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/249761/most-popular-activities-carried-out-on-mobile-internet-devices/>
- Kedron, T. (2016) Brand pollution. in K. Thomas (Ed.), *Regulating style: Intellectual property law and the business of fashion in Guatemala* (pp. 101–144). Oakland: Univ of California Press.
- Kemper, K. R. (2016) Cultural hybridity, resilience and the communication of contemporary Cherokee culture through mobile technologies. In L. Dyson, S. Grant, & M. Hendriks (Eds.), *Indigenous people and mobile technologies* (pp. 299–317). New York: Routledge.
<https://doi.org/10.4324/9781315759364>
- Kendall, K. E., & Kendall, J. E. (2011). *Systems analysis and design (8th ed.)*. Upper Saddle River, NJ: Prentice Hall.
- Kestler-D'Amours, J. (2020, March 1). Understanding the Wet'suwet'en struggle in Canada. Aljazeera.com; Al Jazeera. <https://www.aljazeera.com/news/2020/3/1/understanding-the-wetsuweten-struggle-in-canada>
- Kim, P., Alfaro, K. & Miller, L. (2016). Ecosystemic innovation for Indigenous people in Latin America. in Dyson, L., Grant, S., & Hendriks, M. (Eds.) *Indigenous People and Mobile Technologies* (p. 91-98). New York & Abingdon: Routledge. <https://doi.org/10.4324/9781315759364>
- Kinetz, E. (2018, November 30). *In China, your car could be talking to the government*. AP NEWS; Associated Press. <https://apnews.com/article/4a749a4211904784826b45e812cff4ca>
- KNET (n.d.). *Network Services*. Retrieved April 26, 2018 from https://knet.ca/network_services
- KNET (2003). Kuh-ke-nah Network of Smart First Nations Update. Retrieved April 26, 2018 from <https://knet.ca/documents/network-description-May2003.pdf>
- Koleszar-Green, R. (2016). *Understanding your Education: Onkwehonwe and Guests Responsibilities to Peace, Friendship and Mutual Respect* [Thesis].
<https://tspace.library.utoronto.ca/handle/1807/73051>
- Kōrero Māori (n.d.). Kōrero Māori – About. Retrieved September 1, 2020 from <https://koreromaori.com/>
- Kovach, M. (2009). *Indigenous methodologies: Characteristics, conversations, and contexts*. Toronto: University of Toronto Press.
- Kristofferson, K., White, K., & Peloza, J. (2013). The nature of slacktivism: How the social observability of an initial act of token support affects subsequent prosocial action. *Journal of Consumer Research*, 40(6), 1149–1166. <https://doi.org/10.1086/674137>
- Kukutai, T., & Taylor, J. (Eds.) (2016). *Indigenous data sovereignty*. Canberra: ANU Press. Retrieved from <https://press.anu.edu.au/publications/series/centre-aboriginal-economic-policy-research-caepr/indigenous-data-sovereignty>
- Kundnani, A. (1999). Where do you want to go today? The rise of information capital. *Race & Class*,

40(2–3), 49–71.

- Landzelius, K. (2006). *Native on the Net: Indigenous and diasporic peoples in the virtual age*. London; New York: Routledge.
- Larkin, B. (2013). The politics and poetics of infrastructure. *Annual review of anthropology*, 42, 327–343.
- Latour, B. (2005). *Reassembling the social: An introduction to actor-network-theory*. Oxford: Oxford University Press.
- Lavallée, L. F. (2009). Practical application of an Indigenous research framework and two qualitative Indigenous research methods: Sharing circles and Anishnaabe symbol-based reflection. *International Journal of Qualitative Methods* 8(1), 21–40.
<https://doi.org/10.1177/160940690900800103>
- Lee, J. A. (2014). *Non-profits in the commons economy* (No. ID 2567547). Rochester, NY: Social Science Research Network. Retrieved from <https://papers.ssrn.com/abstract=2567547>
- LeQuesne, T. (2018). Petro-hegemony and the matrix of resistance: What can Standing Rock’s Water Protectors teach us about organizing for climate justice in the United States? *Environmental Sociology*, 5(2), 188–206. <https://doi.org/10.1080/23251042.2018.1541953>
- Lewis, J. E. (2004). Terra nullius, terra incognita. *Blackflash*, 21(3). Retrieved March 25, 2021 from cyberpowwow.net/cpw04_text.html.
- Local Contexts (n.d.) Communities. Tribal Museums, Archives, Libraries. Retrieved July 19, 2017, from <http://www.localcontexts.org/sharing/#collaborations>
- Lopez-Beltran, C., Wade, P., Restrepo, E. & Ventura-Santos, R. (2017). *Genómica mestiza. Raza, nación y Ciencia en Latinoamérica (Antropología) (Spanish Edition)*. Translation: Mestizo genomics. Race, nation and science in Latin America.
- Lovink, G. (2009). *Dynamics of critical internet culture (1994-2001)* (Vol. 1). Amsterdam: Institute of Network Cultures.
- Luyt, B. (2004). Who benefits from the digital divide?. *First Monday*, 9(8).
- Magallanes-Blanco, C. & Ramos-Rodriguez, J. M. (2016). *Miradas Propias. Pueblos Indígenas, comunicación y medios en la sociedad global*. Quito: Ediciones Ciespal.
- de Magalhães, N., Evangelista, H., Condom, T., Rabatel, A., & Ginot, P. (2019). Amazonian biomass burning enhances tropical Andean glaciers melting. *Scientific reports*, 9(1), 1–12.
- Malik, F., Nicholson, B., & Heeks, R. (2017). Understanding the development implications of online outsourcing. In J. Choudrie, M. S. Islam, F. Wahid, J. M. Bass, & J. E. Priyatma (Eds.), *Information and Communication Technologies for Development* (Vol. 504, pp. 425–536). Cham: Springer International Publishing. Retrieved from <http://link.springer.com/10.1007/978-3-319-59111-7>

- Mandujano, A. (2017, October 18). Marichuy denuncia fallas en sistema del INE para recolectar firmas vía teléfono celular. Retrieved December 6, 2019, from <https://www.proceso.com.mx/507976/marichuy-denuncia-fallas-en-sistema-del-ine-recolectar-firmas-via-telefono-celular>
- Mapping Black Futures (2020). Mapping Black Futures. Retrieved September 1, 2020 from <https://mbf.blackfuturesnow.to/about/>
- MarketingCharts. (July 7, 2017). Most important attributes that smartphone users worldwide find vital in building trust in mobile app and service use of data as of July 2017 [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/736576/trust-mobile-apps-smartphone-users/>
- Matsakis, L. (2019, February 15). Personal data collection: The complete WIRED guide. Retrieved from <https://www.wired.com/story/wired-guide-personal-data-collection/>
- Mayoral-Baños, A. (2016). *Decolonizing technology through a Tipi: Creation of an Indigenous mobile application at York University* [unpublished master's thesis]. Retrieved September 1, 2017 from <http://yorkspace.library.yorku.ca/xmlui/handle/10315/32700>.
- Mayoral-Baños, A. (2018). Decolonizing technology: Presence, caring, sharing, and orality within the Indigenous Friends mobile app. In S. Driver, S. & N. Coulter (Eds.), *Youth Mediations and Affective Relations* (pp. 33–51). Springer International Publishing. https://doi.org/10.1007/978-3-319-98971-6_3
- McMahon, R. (2014). From digital divides to the first mile: Indigenous peoples and the network society in Canada. *International Journal of Communication*, 8, 25.
- McMahon, R., & Mangiok, T. (2014). From the First Mile to outer space: Tamaani satellite Internet in northern Quebec. *The Journal of Community Informatics*, 10(2).
- McPherson, T. (2012). Why are the digital humanities so white? Or thinking the histories of race and computation. In M. K. Gold (Ed.). *Debates in the digital humanities* (Chapter 9). Minneapolis: University of Minnesota Press. <https://dhdebates.gc.cuny.edu/read/untitled-88c11800-9446-469b-a3be-3fdb36bfb1e/section/20df8acd-9ab9-4f35-8a5d-e91aa5f4a0ea#ch09>
- Mendoza-Ontiveros, M. M. (2010). El compadrazgo desde la perspectiva antropológica. *Alteridades*, 20(40), 141–147.
- Mignolo, W. (2010). Introduction: Coloniality of power and de-colonial thinking. In W. Mignolo & A. Escobar (Eds.), *Globalization and the decolonial option*. London: Routledge.
- Mignolo, W. (2011). *The darker side of Western modernity: Global futures, decolonial options*. Durham, NC: Duke University Press.
- Middleton, C., & Crow, B. (2008). Building wi-fi networks for communities: Three Canadian cases.

- Canadian Journal of Communication*, 33(3).
- Miles, T. (2018, March 12). U.N. investigators cite Facebook role in Myanmar crisis. Retrieved March 1, 2021, from: <https://www.reuters.com/article/us-myanmar-rohingya-facebook-idUSKCN1GO2PN>
- Miller, R. W. (2016). How the Dakota Access pipeline battle unfolded. *USA Today*. Retrieved December 4, 2016 from <http://www.usatoday.com/story/news/nation/2016/12/02/timeline-dakota-access-pipeline-and-protests/94800796/>
- Mobile (n.d.). In the Random House Unabridged Dictionary. Retrieved September 1, 2019 from <https://www.dictionary.com/browse/mobile>
- Molyneaux, H., O'Donnell, S., Kakekaspan, C., Walmark, B., Budka, P., & Gibson, K. (2014). Social media in remote First Nation communities. *Canadian Journal of Communication*, 39(2).
- Monasterios, G. (2001). Aproximaciones al movimiento indígena en Internet. In *Anais do: XXIII Congresso Internacional de la Latin American Studies Association—LASA*. (pp. 6–8). Washington, DC.
- Monasterios, G. (2003). Usos de Internet por Organizaciones Indígenas (OI) de Abya Yala: Para una alternativa en políticas comunicacionales. *Revista Comunicación, Caracas*, (122), 60–69.
- Montes, S. (1979). *El compadrazgo: Una estructura de poder en El Salvador*. UCA 317ditors.
- Montfort, N., Baudoin, P., Bell, J., Bogost, I., Douglass, J., Marino, M. C., ... Vawter, N. (2012). *10 PRINT CHR\$(205.5+RND(1)); : GOTO 10*. Bellingham, WA: The MIT Press.
- Moorosi, N., Thinyane, M., & Marivate, V. (2017). A critical and systemic consideration of data for sustainable development. In J. Choudrie, M.S. Islam, F. Wahid, J. M. Bass, & J. E. Priyatma (Eds.). *Information and Communication Technologies for Development* (Vol. 504, pp. 232–241). Cham: Springer International Publishing. Retrieved from <http://link.springer.com/10.1007/978-3-319-59111-7>
- Morozov, E. (2011). *The net delusion: The dark side of Internet freedom*. New York: PublicAffairs.
- Mosco, V. (2017). *Becoming digital: Toward a post-Internet society*. Bingley, UK: Emerald Group Publishing.
- Mukaro-Borrero, R. (2013). Innovation and technology for Indigenous Peoples. United Nations. Report Retrieved March 10, 2016 from <http://www.un.org/esa/socdev/egms/docs/2013/ict/innovation-technology-Indigenous.pdf>
- Nakamura, L. (2010). Race and identity in digital media. In J. Curran (Ed.), *Media and Society* (pp. 336–347). London: Bloomsbury Publishing.
- Navarrete, F. (2016). *México racista. Una denuncia*. Mexico City: Grijalbo.
- Nemser, D. (2011). *Toward a genealogy of Mestizaje: Rethinking race in colonial Mexico*. Dissertation. University of California, Berkeley.

- Niang, I. & Scharff, C. (2014). Foreword. In I. Niang, C. Scharff, & C. Wamala (Eds.), Proceedings of the 4th International Conference on M4D Mobile Communication for Development: M4D 2014, General Tracks. In *International Conference on Mobile Communications for Development-M4D 2014*. Karlstads universitet.
- Nicholas, G. (2014) Indigenous cultural heritage in the age of technological reproducibility: Towards a postcolonial ethics. In R. J. Coombe, D. Wershler, & M. Zeilinger (Eds.) *Dynamic Fair Dealing: Creating Canadian Culture Online* (pp. 213–224). Toronto: University of Toronto Press
- Nicholas, G. & Bannister, K. P. (2004) Copyrighting the Past? *Current Anthropology*, 45(3), 327–350.
- Nicolescu, B. (2006). Transdisciplinarity: past, present and future. *Moving Worldviews: Reshaping sciences, policies and practices for endogenous sustainable development, ETC/COMPAS, Leusden*, 142-166.
- Non-Profit (n.d.). In Cambridge Dictionary. Retrieved February 24, 2021 from <https://dictionary.cambridge.org/us/dictionary/english/non-profit>
- Obar, J. A., & Wildman, S. (2015). Social media definition and the governance challenge: An introduction to the special issue. *Telecommunications Policy*, 39(9), 745–750. <https://doi.org/10.1016/j.telpol.2015.07.014>
- Okune, A., Hillyer, R., Albornoz, D., Posada, A., & Chan, L. (2018). Whose infrastructure? Towards inclusive and collaborative knowledge infrastructures in open science. ELPUB 2018, Jun 2018, Toronto, Canada. <https://hal.archives-ouvertes.fr/hal-01816808>
- Olaniran, B. A., & Rodriguez, N. (2013). ICT and healthcare: A closer look at the role of ICTs in providing support for female victims/survivors of domestic violence (DV). In M. Cruz-Cunha, I. Miranda, & P. Gonçalves (Eds.), *Handbook of research on ICTs and management systems for improving efficiency in healthcare and social care* (pp. 720–733). Hershey, PA: IGI Global. <https://doi.org/10.4018/978-1-4666-3990-4.ch037>
- Onandaga Nation (n.d.) Wampum. Retrieved September 1, 2020 from <https://www.onondaganation.org/culture/wampum/>
- Open Source Initiative [OSI] (n.d.) Frequently Asked Questions. What is “Open Source” Software? Retrieved September 1, 2020 from <https://opensource.org/faq#osd>
- Organization for Economic Co-operation and Development [OECD] (2019), Mobile broadband subscriptions (indicator). Retrieved on September 10, 2019 from <https://doi.org/10.1787/1277ddc6-en>
- The Orlando Project (2019). The Orlando Project. Feminist literary history and digital humanities. Home. Retrieved September 1, 2019 from <http://www.artsrn.ualberta.ca/orlando/>
- Ortiz-Ocana, A., & Arias-Lopez, M. I. (2019). Hacer decolonial: desobedecer a la metodología de

- investigación. *Hallazgos*, 16(31), 147–166.
- Oxford Analytica (2020). Public resistance to make 5G rollout patchy in the EU. *Expert Briefings*.
<https://www.emerald.com/10.1108/OXAN-DB252667>
- Padilla, M. (2017) Soberanía tecnológica: ¿De qué estamos hablando? In Spideralex (Eds.) *Soberanía Tecnológica 2* (p.113–128). Descontrol: Barcelona. Retrieved from
<https://sobtec.gitbooks.io/sobtec2/content/es/>
- Palestine Open Maps (2019). About Palestine Open Maps. Retrieved September 1, 2019 from
<https://palopenmaps.org/about>
- Palmer, G. (2002). Big Brother: an experiment in governance. *Television & New Media*, 3(3), 295–310.
- Palmer, M. H. (2009). Engaging with indigital geographic information networks. *Futures*, 41(1), 33–40.
- Peltier, C. (2018). An application of two-eyed seeing: Indigenous research methods with participatory action research. *International Journal of Qualitative Methods*, 17(1).
<https://doi.org/10.1177/1609406918812346>
- Pereira, S. K. (2019). Using eBird data to track changes in migration patterns of Vaux’s swifts (*Chaetura vauxi*) due to climate change. Retrieved March 2, 2021, from Digital Commons @ TRU Library website: <https://digitalcommons.library.tru.ca/urc/2019/sessiona/6/>
- Persily, N. (2017). The 2016 U.S. election: Can democracy survive the Internet? *Journal of Democracy* 28(2), 63–76. <http://doi.org/10.1353/jod.2017.0025>
- Petersen, R. (2012, October) *Decolonizing the digital North: why Inuit need better broadband, now*. Retrieved April 1, 2015 from
<https://globalnativenetworks.wordpress.com/2012/10/10/decolonizing-the-digital-north-why-inuit-need-better-broadband-now/>
- Philip Cote (n.d.) Biography. Retrieved September 1, 2020 from
<https://tecumsehcollective.wixsite.com/philipcote/about-me>
- Phillips Exeter Academy [PEA] (2007). *Face-to-Face with Mark Zuckerberg ‘02. Zuckerberg transcripts*. 13. Retrieved April 30, 2020 from https://dc.uwm.edu/zuckerberg_files_transcripts/13
- Powell, A. (2014). Openness and enclosure in mobile Internet architecture. In A. Herman, J. Hadlaw, & T. Swiss (Eds.), *Theories of the mobile Internet: Materialities and imaginaries* (pp. 25–44). Routledge.
- Pullen, D. (2009). Technoethics in schools. In R. Luppicini & R. Adell (Eds.), *Handbook of research on technoethics* (pp. 680–699). IGI Global. <http://doi:10.4018/978-1-60566-022-6.ch044>
- Quijano, A. (2000). Coloniality of power, eurocentrism, and Latin American, en Nepantla. *Views from South*, 1(3), 533–580.
- Radoll, P. (2015). Aboriginal peoples, education and information and communication technologies in

- Australia. In N. Bidwell & H. Winschiers-Theophilus (Eds.), *At the Intersection of Indigenous and Traditional Knowledge and Technology Design*. (pp. 19–34). Santa Rosa: Informing Science Press.
- Rainforest Connection (n.d.) Our Work. Retrieved April 6, 2018 from https://rfcx.org/our_work.html.
- Rainie, S., Kukutai, T., Walter, M., Figueroa-Rodriguez, O., Walker, J., & Axelsson, P. (2019) Indigenous Data Sovereignty. In T. Davies, S. Walker, M. Rubinstein, & F. Perini (Eds.), *The State of Open Data: Histories and Horizons*. Cape Town and Ottawa: African Minds and International Development Research Centre. <https://doi.org/10.5281/zenodo.2677800>
- Raiti, G. C. (2007). The lost sheep of ICT4D literature. *Information Technologies & International Development*, 3(4), 1–5.
- Reed, T.V. (2019). *Digitized lives: Culture, power, and social change in the Internet era (2nd edition)*. Routledge.
- Research Data Alliance International Indigenous Data Sovereignty Interest Group [RDA IIDS Group]. (September 2019). “*CARE Principles for Indigenous Data Governance*.” The Global Indigenous Data Alliance. Retrieved from <https://www.GIDA-global.org>
- Rhizomatica (December 23, 2015) Who we are. Retrieved January 21, 2019 from <https://www.rhizomatica.org/who-we-are/>
- Ricaurte, P. (2019). Data Epistemologies, The Coloniality of Power, and Resistance. *Television & New Media*, 20(4), 350–365. <https://doi.org/10.1177/1527476419831640>
- Rice, E. S., Haynes, E., Royce, P., & Thompson, S. C. (2016). Social media and digital technology use among Indigenous young people in Australia: A literature review. *International Journal for Equity in Health*, 15(1). <https://doi.org/10.1186/s12939-016-0366-0>
- Riley, A. (2005) “Straight stealing”: Towards an Indigenous system of cultural property protection. *Washington Law Review*, 80(1).
- Risam, R. (2015). Beyond the margins: Intersectionality and the digital humanities. *DHQ: Digital Humanities Quarterly*, 9(2).
- Rodriguez-Lonebear, D. (2016). Building a data revolution in Indian country. In T. Kukutai, & J. Taylor (Eds.), *Indigenous data sovereignty* (pp. 253–273). Canberra: ANU Press. <https://press.anu.edu.au/publications/series/centre-aboriginal-economic-policy-research-caepr/indigenous-data-sovereignty>
- Rodriguez-Prieto, R. & Martinez-Cabezudo, F. (2016). *Poder e Internet. Un análisis crítico de la Red*. Madrid: Cátedra, Signo e Imagen.
- Russell, S., & Norvig, P. (2009). *Artificial Intelligence: A Modern Approach* (3rd ed.). Upper Saddle River, NJ: Pearson.

- Salazar, J. (2002). Activismo indígena en América Latina: estrategias para una construcción cultural de las tecnologías de información y comunicación. *Journal of Iberian and Latin American Research*, 8(2), 61–80.
- Salazar, J. (2007). Indigenous peoples and the cultural construction of information and communication technology (ICT) in Latin America, In L.E. Dyson, M. Hendriks, & S. Grant, S. (Eds.), *Information technology and Indigenous people* (pp. 14–26). Hershey, PA: Information Science Pub.
- Salazar, J. (2015). Social movements and video Indígena in Latin America. *Media, Anthropology and Public Engagement*, 9, 122.
- Sarath, P., Bonda, S., Mohanty, S., & Nayak, S. K. (2015). Mobile phone waste management and recycling: Views and trends. *Waste Management*, 46, 536–545.
- Saravanan, K., Anusuya, E., & Kumar, R. (2018). Real-time water quality monitoring using Internet of Things in SCADA. *Environmental Monitoring and Assessment*, 190(9), 1–16.
- Schnarch, B. (2004). Ownership, control, access, and possession (OCAP) or self-determination applied to research: A critical analysis of contemporary First Nations research and some options for First Nations communities. *International Journal of Indigenous Health*, 1(1), 80.
- von Schnitzler, A. (2018). 5. Infrastructure, apartheid technopolitics, and temporalities of “transition”. In A. Anand, H. Gupta & H. Appel (Eds.), *The promise of infrastructure* (pp. 133–154). Durham, NC: Duke University Press. <https://doi.org/10.1515/9781478002031-007>
- Semple, J. (1993). *Bentham's prison: A study of the panopticon penitentiary*. New York: Clarendon Press.
- Serrador, P., & Pinto, J. K. (2015). Does agile work?—A quantitative analysis of agile project success. *International Journal of Project Management*, 33(5), 1040–1051.
- Shade, L. R. (1998). A gendered perspective on access to the information infrastructure. *The Information Society*, 14(1), 33–44.
- Shade, L. R., & Crow, B. (2005). Gender, digital divides and ICT agendas in Canada. *Critical perspectives on the world summit on the information society (WSIS): Civil society participation and issues*. Oxford Internet Institute.
- Sharma, A. K. (2014). Indigenous knowledge communication in the 21st century. *International Journal of Digital Library Services*, 4.
- Sillitoe, P., Dixon, P., & Barr, J. (2005). *Indigenous knowledge inquiries: A methodologies manual for development*. Rugby, U.K., Dhaka, Bangladesh: ITDG Publishing.
- Simpson, L. R. (1999). *The construction of traditional ecological knowledge, issues, implications and insights*. [unpublished doctoral dissertation]. University of Manitoba. <https://mspace.lib.umanitoba.ca/xmlui/handle/1993/2210>

- Singel, R. (2010, May 28). Epicenter: Mark Zuckerberg: I donated to open source, Facebook competitor. Wired News, Condé Nast Publishing. Retrieved from <https://www.wired.com/2010/05/zuckerberg-interview/>
- Singh, V., Jain, S. K., & Goyal, M. K. (2021). An assessment of snow-glacier melt runoff under climate change scenarios in the Himalayan basin. *Stochastic Environmental Research and Risk Assessment*, 1–26.
- Smith, D.E. (2016). Governing data and data for governance: the everyday practice of Indigenous sovereignty. In T. Kukutai, & J. Taylor (Eds.), *Indigenous data sovereignty* (pp. 117–138). Canberra: ANU Press. <https://press.anu.edu.au/publications/series/centre-aboriginal-economic-policy-research-caepr/indigenous-data-sovereignty>
- Smith, L.T. (1999). *Decolonizing methodologies: Research and Indigenous Peoples*. London, UK: Zed Books.
- Smyrniotis, N. (2016). The GAFAM effect: Strategies and logics of the internet oligopoly. *Communication & languages*, (2), 61–83.
- Snipp, C. M. (2016). What does data sovereignty imply: what does it look like? In T. Kukutai, & J. Taylor (Eds.), *Indigenous data sovereignty* (pp. 39–56). Canberra: ANU Press. <https://press.anu.edu.au/publications/series/centre-aboriginal-economic-policy-research-caepr/indigenous-data-sovereignty>
- Snively, G. & Williams, L. (2016). *Knowing home: Braiding Indigenous science with Western science*. Victoria, BC: The University of Victoria.
- Snowshoe, A., Crooks, C. V., Tremblay, Paul. F., & Hinson, R. E. (2016). Cultural connectedness and its relation to mental wellness for First Nations youth. *The Journal of Primary Prevention*, 38(1–2), 67–86. <https://doi.org/10.1007/s10935-016-0454-3>
- Soriano, C. R. (2011). The arts of Indigenous online dissent: Negotiating technology, indigeneity, and activism in the cordillera. *Telematics and Informatics*, 29(1), 33–44.
- Spangler, S. (2010). When Indigenous communities go digital: Protecting traditional cultural expressions through integration of IP and customary law. *Cardozo Arts Entertainment Law Journal* 27(3), 709–736.
- Speedtest. (2019, August 23). Countries with the fastest average mobile Internet speeds as of July 2019 (in Mbps) [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/896768/countries-fastest-average-mobile-internet-speeds/>
- Stallman, R. (2009). *Why open source misses the point of free software*. Free Software Foundation. <https://www.gnu.org/philosophy/open-source-misses-the-point.html>
- StatCounter. (2019a, August 14). Mobile operating systems' market share worldwide from January 2012

- to July 2019 [Graph]. In *Statista*. Retrieved September 17, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/272698/global-market-share-held-by-mobile-operating-systems-since-2009/>
- StatCounter. (2019b, February 18). Distribution of online traffic in Canada as of January 2019, by device [Graph]. In *Statista*. Retrieved September 15, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/505773/canada-online-traffic-device-share/>
- StatCounter. (2019c, September 9). Mobile internet traffic as percentage of total web traffic in August 2019, by region [Graph]. In *Statista*. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/306528/share-of-mobile-internet-traffic-in-global-regions/>
- StatCounter. (2019d, September 9). Most popular mobile social media websites in Canada in August 2019, based on share of visits [Graph]. In *Statista*. Retrieved September 15, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/696537/canada-share-social-mobile/>
- Statista. (2019a, February 18). Number of mobile phone internet users in Canada from 2017 to 2023 (in millions) [Graph]. In *Statista*. Retrieved September 15, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/482507/canada-mobile-phone-internet-users/>
- Statista. (2019b, February 19). Number of smartphone users in Canada from 2013 to 2023 (in millions)* [Graph]. In *Statista*. Retrieved September 15, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/467190/forecast-of-smartphone-users-in-canada/>
- Stevenson, D. (1997). *Information and communications technology in UK schools: An independent inquiry*. London: Independent ICT in Schools Commission.
- Stingl, A. I. (2015). *The digital coloniality of power: Epistemic disobedience in the social sciences and the legitimacy of the digital age*. Washington, DC: Lexington Books.
- Summerfield, J. (n.d.). Mobile website vs. mobile app: Which is best for your organization? For broad marketing outreach, a mobile website is the place to start. Human Service Solutions. Retrieved April 4, 2016 from <http://www.hswsolutions.com/services/mobile-web-development/mobile-website-vs-apps/>
- Suzukovich III, E., Pochel, F., Bender, D., & Pochel, J. (2015). Mōnahaskwēwin pahki-nahâpaminâkonan (Harvesting is a part of our identity). In E. S. Huaman , & B. Sriraman (Eds), *Indigenous innovation. Advances in innovation education*. Rotterdam: SensePublishers.
https://doi.org/10.1163/9789463002264_012
- Svensson, J., & Wamala-Larsson, C. (2016). Situated empowerment: Mobile phones practices among market women in Kampala. *Mobile Media & Communication*, 4(2), 205–220.
- Taylor, A. (2012). Information communication technologies and new Indigenous mobilities? Insights from remote northern territory communities. *Journal of Rural and Community Development*, 7(1),

59–73.

- Taylor, D. (2003). *The archive and the repertoire: Performing cultural memory in the Americas*. Durham, NC: Duke University Press.
- Tech-savvy (n.d.). In Cambridge Dictionary. Retrieved February 24, 2021 from <https://dictionary.cambridge.org/us/dictionary/english/tech-savvy>
- TeHikuMedia (2018). Kaitiakitanga license. Retrieved September 1, 2020 from <https://github.com/TeHikuMedia/Kaitiakitanga-License/blob/tumu/LICENSE.md>
- Telecomunicaciones Indígena Comunitarias [TIC] (n.d.) Telefonía celular comunitaria. Retrieved September 1, 2020 from <https://www.tic-ac.org/>
- Tessaro, D., Restoule, J. P., Gaviria, P., Flessa, J., Lindeman, C., & Scully-Stewart, C. (2018). The five r's for indigenizing online learning: A case study of the First Nations schools' principals course. *Canadian Journal of Native Education*, 40(1), 125–143.
- Thompson, R. A. (1971). Structural statistics and structural mechanics: The analysis of compadrazgo. *Southwestern Journal of Anthropology*, 27(4), 381–403.
- Thunderbird, S. (2009). Wisdom of the ages: From houses to monsters, the naming practices of the Coast Tsimshian Nation. In Proceedings of the 23rd International Congress of Onomastic Sciences. Chicago.
- Tsai, P. Y., Ko, C. J., Chia, S. Y., Lu, Y. J., & Tuanmu, M. N. (2021). New insights into the patterns and drivers of avian altitudinal migration from a growing crowdsourcing data source. *Ecography*, 44(1), 75–86.
- Tuck, E., & Yang, K. W. (2012). Decolonization is not a metaphor. *Decolonization: Indigeneity, education & society*, 1(1).
- Tunney, J. (1998, September). EU, IP, Indigenous people and the digital age: Intersecting circles? *European Intellectual Property Review*, 20(9).
- Turner, J. (2015). African gamer: Whose story is it anyway? In N. Bidwell & H. Winschiers-Theophilus (Eds.), *At the intersection of Indigenous and traditional knowledge and technology design* (pp. 35–66). Santa Rosa: Informing Science Press.
- Union de Cooperativas Tosepan [UCT] (n.d.) Retrieved May 5, 2015 from the Tosepan Website <http://www.tosepan.com/>
- Unwin, T. (2017). *Reclaiming information and communication technologies for development*. Oxford: Oxford University Press.
- US Indigenous Data Sovereignty Network [Internet] (n.d.). Defining Indigenous Data Sovereignty. [cited 2018 Sept 18]. Available at: <https://usindigenousdata.arizona.edu/about-us-0>
- Vaidhyathan, S. (2001) *Copyrights and copywrongs: The rise of intellectual property and how it*

- threatens creativity*. New York: New York University Press.
- Vázquez, B. (2013). Educación decolonial-liberadora. *Perspectivas. Revista de Historia, Geografía, Arte y Cultura*, 1(2), 177–196.
- Wagner, S. (2014). Mobile inclusion in the information age: The relevance of Indigenous media movements to M4D. In I. Niang, C. Scharff, & C. Wamala, C. (Eds.), *Proceedings of the 4th International Conference on M4D Mobile Communication for Development: M4D 2014, General Tracks*. Karlstads universitet, Sweden.
- Watson, I. (2014). Re-centring First Nations knowledge and places in a terra nullius space. *AlterNative: An International Journal of Indigenous Peoples*, 10(5), 508–520.
- Watson, H. A. & Duffield, L. R. (2016). Private mobile phones and public communication drums in rural Papua New Guinea. In L. Dyson, S. Grant, & M. Hendriks (Eds.), *Indigenous People and Mobile Technologies* (pp. 127–148). New York & Abingdon: Routledge.
<https://doi.org/10.4324/9781315759364>
- WeAreSocial, DataReportal & Hootsuite. (2019a, January 31). Internet usage frequency in Canada as of January 2019 [Graph]. In Statista. Retrieved September 15, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/686835/canada-internet-usage-frequency/>
- WeAreSocial, DataReportal & Hootsuite. (2019b, July 18). Global digital population as of July 2019 (in millions) [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/617136/digital-population-worldwide/>
- WeAreSocial, Hootsuite & DataReportal. (2019a, January 31). Active mobile social media penetration in American countries as of January 2019 [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/308282/active-social-network-usage-penetration-of-the-americas/>
- WeAreSocial, Hootsuite, & DataReportal. (2019b, January 31). Digital population in Canada as of January 2019 (in millions) [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/418219/canada-digital-platform-audience/>
- Wemigwans, J. (2018). *A digital bundle: protecting and promoting indigenous knowledge online*. Regina, SK: University of Regina Press.
- White Hat Sr, A. (1999). *Reading and writing the Lakota language: Lakota iyapi un wowapi nahan yawapi*. Salt Lake City: University of Utah Press.
- Wikimedia Foundation (n.d.) About Wikimedia Foundation. Retrieved September 1, 2019 from <https://wikimediafoundation.org/about/>
- Wilson, S. (2008). *Research is ceremony: Indigenous research methods*. Halifax, NS: Fernwood .
- Wilson, W. A., & Bird, M. Y. (2005). *For Indigenous eyes only: A decolonization handbook*. Santa Fe,

- NM: School for Advanced Research Press
- Wong, T. & Fernandini, C. (2011). Traditional cultural expressions: Preservation and innovation. In T. Wong, & G. Dufield (Eds.), *Intellectual property and human development: Current trends and future scenarios*. Cambridge: Cambridge University Press.
- World Bank [WB] (2019), Mobile cellular subscriptions (per 100 people). Retrieved Sep 10, 2016 from: <https://data.worldbank.org/indicator/IT.CEL.SETS.P2>
- World Intellectual Property Organization [WIPO]. (2010a, December). List and brief technical explanation of various forms in which traditional knowledge may be found. Intergovernmental committee on intellectual property and genetic resources, traditional knowledge and folklore (IGC) seventeenth session. Geneva: IGC Secretariat.
- World Intellectual Property Organization [WIPO]. (2010b, December). Note on the meanings of the term “public domain” in the intellectual property system with special reference to the protection of traditional knowledge and traditional cultural expressions/expressions of folklore. Intergovernmental committee on intellectual property and genetic resources, traditional knowledge and folklore (IGC) seventeenth session. Geneva: IGC Secretariat.
- World Intellectual Property Organization [WIPO]. (2017a). *Protect and promote your culture: A practical guide to intellectual property for indigenous peoples and local communities*. WIPO: Geneva.
- World Intellectual Property Organization [WIPO]. (2017b, June). The protection of traditional knowledge: Draft articles. Intergovernmental committee on intellectual property and genetic resources, traditional knowledge and folklore (IGC) thirty-fourth session. Geneva: IGC Secretariat.
- World Intellectual Property Organization [WIPO]. (2017c, June). The protection of traditional cultural expressions: Draft articles. Intergovernmental committee on intellectual property and genetic resources, traditional knowledge and folklore (IGC) thirty-fourth session. Geneva: IGC Secretariat.
- World Intellectual Property Organization [WIPO]. (2018, August). The protection of traditional cultural expressions: Updated draft gap analysis. Intergovernmental committee on intellectual property and genetic resources, traditional knowledge and folklore (IGC) thirty-seventh session. Geneva: IGC Secretariat.
- Wortham, E. (2016). Valor y materialidad efimera: Medios indigenas y futuros digitales. In C. Magallanes-Blanco & J. M. Ramos-Rodriguez (Eds.), *Miradas propias. Pueblos indígenas, comunicación y medios en la sociedad global*. Lupus-Inquisitor. Universidad Iberoamericana Puebla.
- York University (n.d.) Land Acknowledgement. *Blog of Faculty of Liberal Arts & Professional Studies*.

<https://www.yorku.ca/laps/land-acknowledgement/>

Zenith. (2019, June 14). Daily time spent with the Internet per capita worldwide from 2011 to 2021, by device (in minutes) [Graph]. In Statista. Retrieved September 13, 2019, from <https://www-statista-com.ezproxy.library.yorku.ca/statistics/319732/daily-time-spent-online-device/>

ZeroNet (n.d.) ZeroNet Landing Page. Retrieved September 1, 2019 from <https://zeronet.io/>

Appendix A. Glossary

The terms were selected based on the high frequency with which they appear in the literature that articulates between coloniality and digital technologies. Moreover, these terms are foundational for the epistemic construction of new conceptual imaginaries around digital decoloniality and decolonial computing.

Artificial Intelligence (AI): AI is the art and science to create a machine with the capability of thinking humanly, acting humanly, thinking rationally⁸³ or acting rationally (Russell & Norvig, 2009, pp. 1–2).

According to the ISO/IEC/IEEE Systems and Software Engineering Vocabulary (2014), AI is a branch of computer science devoted to developing data processing systems that perform functions typically associated with human intelligence, such as reasoning, learning and self-improvement (3.234). In a more colloquial and cultural form, AI is the intelligence demonstrated by machines.

Big Data: According to boyd & Crawford (2011), big data is the use of advanced data analytics methods to extract value from data. Mosco (2017) defines big data as “analytics to describe the application of statistical tools to extensive data sets to develop predictive algorithms. [...] big data is a system for the quantitative analysis of large datasets” (p. 8, 27). Heeks (2018) frames big data with the significantly increased amount of data available (i.e., volume), increased speed in which data is available (i.e., velocity), and the increased number of forms and types of data (i.e., variety), (p.330).

Cloud Computing: According to the American National Institute of Standards and Technology (NIST), cloud computing, also called the cloud, is “a model for enabling convenient, on-demand network access to a shared pool of configurable computer resources (e.g., networks, servers, storage, application and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (as cited in Mosco, 2017, p. 17). For Heeks (2018), cloud computing is a growing tool to store, manage and process data that consists of the practice of using a network of remote servers

⁸³ In this case, 'rationally' refers to an ideal performance measure. It is a mere differentiation to mark that humans are not perfect in thinking or acting (Russell & Norvig, 2009, p. 2).

hosted on the Internet (p. 319).

Digital technologies or the “digital”: The word “digital” comes from the Latin *digitus* which means “finger,” one of the oldest human tools for counting. When information is stored, transmitted or forwarded in a digital form, it is transformed into digits at the most basic machine-level as “zeroes and ones” (Pullen, 2009, p. 698). Digital technologies are a “branch of scientific or engineering knowledge that deals with creating and practical use of digital or computerized devices, methods and systems” (digital technology, n.d.). In the context of this chapter, the term represents devices and systems that rely on the use of microprocessors to handle information such as personal computers, calculators, automobiles, traffic light controllers, smartwatches, mobile devices, communications satellites, high-definition television sets, among others. The term “digital technologies” is used in the plural to acknowledge the diversity of devices.

Information and Communication Technologies (ICTs): they are “devices or techniques that apply knowledge in order to process or communicate data” (Heeks, 2018, p. 10). The term 'ICT' was coined in the context of education by Lord Stevenson in 1997 in the UK to incorporate the telecommunication and broadcasting components into digital technologies (Fischer, 2013, p. 1; Stevenson, 1997, p. 12). The focus of ICTs is more on using machines to communicate and exchange data among each other and the meaning that information acquires when it is transmitted and communicated. From an empirical point of view, the term ICTs has been adopted in the majority of development projects related to digital technologies and marginalized communities (Heeks, 2018, p. 11–12; Urwin, 2017).

Internet of Things (IoT): IoT is the “internetworking of physical devices, vehicles, building, and other items [things] - embedded with electronics, software, sensors, actuators and network connectivity that enable these objects to collect and exchange data” (Heeks, 2018, p. 318). In the words of Mosco (2017), IoT is “a system for measuring, monitoring, and controlling the activity of objects and living organisms through sensors that gather, process, and report data over networks, including the Internet” (p. 39). With IoT, ICTs can be embedded into increasing numbers of objects and places, which means that sensors gather data on various aspects of the environment (Heeks, 2018, p. 50).

Mobile: A mobile device is defined as “pertaining to or noting a cell phone, usually one with computing ability or a portable, wireless computing device used while held in hand” (mobile, n.d.). However, as Heeks (2018) stresses in his analysis of mobile technologies, it is important to clarify several connotations and scopes of this concept in order to avoid misconceptions and assumptions around these technologies. According to this author, the meaning of mobile devices has rapidly changed in a short time. He states that the first generation of mobile phones consisted of basic phones with the capability of only calls and texts. However, new features and tools started to be incorporated, such as calculator, light, camera, speaker, music player and voice recorder. The mobile devices slowly began to include the capability to access the Internet through a basic web browser. Later, the generation of smartphones⁸⁴ came to the global market, which incorporated PC-like features: their operating systems (OS), mobile apps, touchscreens and better access to the Internet. Finally, the tablet as a symbiosis between PCs and mobile devices was introduced worldwide (Heeks, 2018, pp. 49–50). In a few words, new design and features are continually adding new capabilities and improving the performance of mobile devices (Jarvenpaa & Lang, 2005, p. 7).

In the scope of this research, a mobile device or mobile technologies include any digital portable wireless computing device, whether or not it allows connection to the Internet. This conception includes basic phones (i.e., only Call/SMS capabilities), smartphones and tablets. These devices range from smartphones such as Apple devices (e.g., iPhones), Microsoft Windows Phones, Nokia Symbian phones and the diverse manufacturers of Android-OS telephones and other types of devices such as tablets (e.g. Desktop OS-based & Mobile OS-based).

Mobile app: A mobile app is an application; typically a small, specialized program downloaded onto mobile devices. Dean (2014) defines an app as “a small piece of software designed for a specific narrow purpose” (p. 234).

⁸⁴ Smartphone: A mobile device category that provides advanced capabilities beyond a typical mobile phone. Smartphones run a complete operating system (OS) software that provides a standardized interface and platform for application developers.

Online Outsourcing (OO): the OO (also called 'gig workers') is “an [online] industry with many one-off or on-demand jobs, where workers are hired in a digital marketplace mainly for companies with a strong tech presence” (Mosco, 2017, p. 110). In other words, the gig worker means independent contractors that enter into formal agreements with on-demand online platforms. In the words of Heeks (2018), this form of hiring means “the targeting of IT outsourcing contracts to marginalized groups. Impact [online] sourcing combines market and welfare logics and explicitly seeks a win-win outcome of cost savings and other benefits for clients and improved livelihoods for those who are economically or socially disadvantaged” (p. 185).

Social Media: they are “interactive platforms via which individuals and communities share, co-create, discuss, and modify user-generated content” (as cited in Heeks, 2018, p. 319). Social media are (currently) Web 2.0 Internet-based applications where individuals and groups create user-specific profiles and content to facilitate the development of social networks online by connecting such user-profiles (Obar & Wildman, 2015, pp. 746–747).

The Internet: it was conceptualized as a global system of interconnected computer networks that use a standard protocol (i.e., TCP/IP) to serve users worldwide (Olaniran & Rodriguez, 2013). From a technical point of view, the Internet is an “electronic communications network that connects computer networks and organizational computer facilities around the world” (internet, n.d.). According to the ISO/IEC/IEEE Systems and Software Engineering Vocabulary (2014), the Internet is the worldwide interlinked computer systems and networks connected by gateways that enable the transfer of data between them (3.2088). It is important to highlight that technically speaking (i.e., from the perspective of Computer Science), the Internet only refers to the physical basis, the network of linked computers, making digital culture possible. On the other hand, the World Wide Web is the most popular Internet Interface that makes the information visible and accessible to Internet users (Reed, 2019, p. 21). However, the Internet has become the popular word that englobes both of them. In this sense, from the perspective of cultural studies and in the context of this research, the Internet can mean “everything digital (our use of digital devices, including laptop computers and mobile devices especially), everything social media, and also the

machinery on which the Internet “runs”—the servers, stacks, and bandwidth. The Internet is also cultural—both in the sense of digital culture [...] to the form that the digital plays in our imagination” (Burnham, 2018, p. 1).

Appendix B. Statistics of Digital Technologies Worldwide

The number of internet users has consistently increased in the last 15 years. From 1.024 billion users in 2005, the number has almost quadruplicated by 2018, with 3.896 billion users (ITU, 2018c). That means that at the end of 2018, 51.2 percent of the global population was using the Internet (ITU, 2018a, p. 13). The Connect 2030 Agenda has set a target of 70% of the population connected by 2023 (ITU, 2018a, p. 13).

All indicators of digital access and usage (e.g. Internet, mobile infrastructure, the number of users) continue increasing except for fixed-telephony that has been replaced by mobile technologies (ITU, 2018a, p. 2). In 2011, it was estimated that the average daily time spent with the Internet worldwide per capita was 75 minutes (43 on a desktop, 32 on mobile) while in 2019, that number increased to 170 minutes (39 on desktop, 132 on a mobile), (Zenith, 2019). Elder et al. (2014) claim that the increase in internet usage is directly linked to mobile technologies (p. 21). In the same line, according to Unwin (2017), the significant increase in internet access is due to three main reasons: (1) the mobile internet access established in 2000 through the General Packet Radio Service (GPRS) technology; (2) the creation of iPhone in 2007, which enabled to have access to the Internet via mobile phone as it was on a personal computer, and (3) the transformation of human-interaction by social media (p.32). In this matter, Landzelius (2006) noted this inclination ten years earlier with the increase in wireless and satellite infrastructures and the rise in the public-private mobile partnership to target ICTs in remote areas (p. 6).

Nowadays, there are more mobile subscriptions than people on the planet (ITU, 2018a, p. 5). At the end of 2017, there were 102.953 mobile subscriptions⁸⁵ for 100 inhabitants globally, which means that the global penetration rate of mobile cellular subscriptions stands above 100% (WB, 2019). However, this fact does not mean that every person owns a mobile phone, and it is not the same in all regions (ITU, 2018a, p. 2); in 2017, 76.4% of the global population owned a mobile phone ranging from 92.1% in

⁸⁵ Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service that provides access to the Public Switched Telephone Network (PSTN) using cellular technology (WB, 2019).

developed countries down to 56% in the least developed countries, (ITU, 2018a, p. 12). Heeks (2018) emphasizes that there is a risk to over-highlight the new generations of phones or tablets when in marginalized communities, users tend to have basic and feature phones; however, he also indicates that there is also a risk if smartphones are under-estimated because the majority of the online traffic is happening through a mobile device, (p. 50).

In most regions of the world, the digital devices that dominate all others in usage are the mobile phone, and also, it is the preferable means to access the Internet (Elder et al., 2013, p. 2). Moreover, the mobile-broadband Internet is becoming the most natural way for people to access the Internet (ITU, 2018a, p. 17). In 2018, the global penetration rate of mobile-broadband subscriptions⁸⁶ per 100 inhabitants was 69.3% (ITU, 2018a, p. 4). In 2007 the penetration rate was only 4% (ITU, 2018a, p. 9). In July 2019, it was estimated that there were 5.117 billion (66% of penetration) mobile users (with & without internet access) across the globe. At the same time, it is estimated that there were 4.333 billion Internet users (56% of penetration),⁸⁷ which 3.937 billion were active mobile internet users (46% of penetration) (WeAreSocial, DataReportal & Hootsuite, 2019b). These facts had a direct impact on data traffic: from the total Internet data traffic across the globe, 51.65% was mobile internet traffic in August 2019, which means that a significant percentage of the population is accessing the Internet through a mobile device (StatCounter, 2019c). Moreover, mobile data traffic has been continuously increasing in the last two years. From 2017 to 2018, the mobile traffic increase by 65.2% (from 11.51 to 19.01 exabytes) and from 2018 to 2019, the estimated increase will be approximately 50.2% (from 19.01 to

⁸⁶ According to Organization for Economic Co-operation and Development [OECD] (2019), mobile broadband subscriptions are “mobile subscriptions that advertise data speeds of 256 kbit/s or greater. The subscription must allow access to the Internet via HTTP and must have been used to make a data connection via Internet Protocol (IP) in the previous three months. Standard SMS and MMS messaging do not count as an active Internet data connection even if they are delivered via IP. This indicator is measured in the number of subscriptions per 100 inhabitants.”

⁸⁷ It is vital to clarify that this statistic contrasts with the number presented by ITU in December 2018 (3.896 billion). The significant variance (+11.26%) in the calculation relies on the methodological procedure and sources of data, as well as the difference in the time of the study between ITU (December 2018) and the consortium of WeAreSocial, DataReportal & Hootsuite (July 2019).

28.56 exabytes) (Cisco Systems, 2018b). The average mobile connection worldwide will generate 8.8 GB of mobile data traffic per month/user by 2022 compared to 1.6 GB in 2017 (Cisco Systems, 2018b). The most common language used on the Internet is English, with 25.2% of the content, followed by Chinese with 19.3% as of April 2019 (Internet World Stats, 2019).

The most common mobile internet activities worldwide as the second half of 2017 were (a) Email; (b) Using social media Sites; (c) Watching videos online; (d) Reading News (Kaspersky Lab, April 25, 2018). From the 3.937 billion internet users, there are 3.534 billion social media users (46% of penetration), of which 3.463 billion are mobile social media users (WeAreSocial, DataReportal & Hootsuite, 2019b). By the first half of 2017, the average number of online activities that internet users did on their cellphones (14) had surpassed the activities on laptops/Pcs (12.1) (GlobalWebIndex, 2017). Moreover, less than half of the total global households had a computer, which means that more than half of the world's population is accessing the Internet through a mobile device (ITU, 2018a, p. 2).

Regarding infrastructure, mobile Internet is manifested in the 3G (third-generation), 4G (fourth generation) and the upcoming 5G data transfer networks that are accessed via mobile devices (Herman, Hadlaw & Swiss, 2014, p. 1). Nowadays, 96% of the global population is covered by a mobile-cellular network, and 90% is included under 3G coverage (ITU, 2018a, p. 8).

This high penetration of infrastructure is because a higher level of ICT access and usage creates the conditions for reliable business cases because they benefit from economies of scale and scope. Commonly, this factor translates to lower prices for customers (ITU, 2018a, p. 97). According to ITU, mobiles are providing significantly cheaper options to access the Internet than fixed-line services (as stated by Wagner, 2014, p. 72). “Lower prices drive ICT adoption up and, in turn, higher ICT adoption enables lower prices” (ITU, 2018a, p. 97). In this matter, mobile cellular prices followed a sustained decreased from 2008-2015 (ITU, 2018a, p. 96). Mobile-Cellular prices maintained a downward trend from 2008 to 2017; simultaneously, there was a continuous increase in mobile penetration. Also, mobile-broadband uptake has exploded from 2013 to 2018, while its price went down (ITU, 2018a, p. 97). ICT regulation and policy-making have played a key role in creating the conditions for reducing prices (ITU,

2018a, p. 96).

As it is shown, mobile technologies have changed the dynamic of how people worldwide get connected among them and how they play a role in creating the Internet. The lower prices of mobiles and high levels of penetration quickly increased their usage. Moreover, nowadays, the preferable form to connect to the Internet is via mobile devices. The coverage of broadband Internet via 3G technology is changing how people are participating in the network because this type of infrastructure is allowing people that commonly have been socially and politically excluded from participating in the process of knowledge creation to actively create and produce all types of media content and share it instantly to people around the world.

Appendix C. Penetration of Mobile Technologies in Canada

In Canada, as of January 2019, it is estimated that there are 34.56 million (93% of penetration) mobile users (with & without internet access). At the same time, it is estimated that there are 33.84 million Internet users (91 of penetration), of which 27.64 million are active mobile internet users (Statista, 2019a). There are 25 million social media users from these internet users (67% of penetration), of which 22 million are mobile social media users (WeAreSocial, DataReportal & Hootsuite, 2019a). As of January 2019, in Canada, the usage frequencies of the Internet are: (1) 89% of the population uses it every day while (2) 8% at least once per week (WeAreSocial, DataReportal & Hootsuite, 2019a). The average weekly time spent online in 2018 was 40.5 hours, which is translated to almost 6 hours per day (CanadaMediaFund, January 14, 2019).

According to ITU (2019), the number of mobile subscriptions per 100 inhabitants in Canada has increased from 42.21% in 2003 to 89.23% in 2018. According to the Canadian Wireless Telecommunication Association [CWAT], in the first quarter of 2019, there were 33,284,139 wireless phone subscribers (prepaid and postpaid) in Canada (CWAT, 2019). This number means that over 100% of the Canadian population aged 15-and-over has a phone subscription. In the scope of 15 years, the number of mobile subscribers doubled. In Canada, there are 34.56 million mobile connections (93% of the population), and 96% of those connections are under the 3G and 4G broadband (WeAreSocial, HootSuite & DataReportal, 2019b). In Canada, there are three main operators—Rogers, TELUS and Bell— accounting for 90% of the market share (ITU, 2018b, p. 33).

Regarding the mobile Internet, in 2018, the penetration rate of mobile-broadband subscriptions per 100 inhabitants in Canada was 76.3 (OECD, 2019). Mobile online traffic has gradually increased in the last years. In January 2015, 70% of the online traffic was on a laptop or desktop, while 29% was on a tablet or mobile. However, in the scope of four years, the online traffic in a laptop/desktop decreased to 56% while the mobile/tablet increased to 43% (StatCounter, 2019b). The average mobile connection in Canada will generate 4.2 GB of mobile data traffic per month by 2022, compared to 1.3 GB in 2017

(Cisco Systems, 2018a). LTE-advanced technology (4G) is now available for 83% of the population. However, this outreach is increased if LTE is considered alongside WIMAX technology, covering 98.5% of the population (ITU, 2018b, p. 33). As of July 2019, Canada rates sixth place worldwide in the countries with the fastest average mobile internet speed with an average connection of 60.72 Mbps (Speedtest, 2019). The most significant disparity lies in the Internet speed available in the rural areas where 87% of the rural population only has only access to 5 Mbps while 6% have access to 100Mbps or above (ITU, 2018b, p. 33).

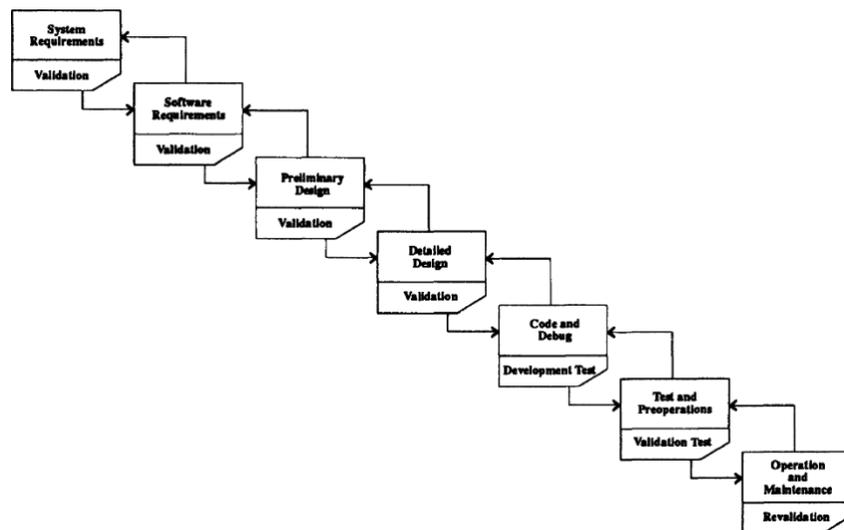
According to Google Consumer Barometer, in 2018 in Canada, 86% of the adult population has a phone, and 76% has a smartphone (as cited by WeAreSocial, HootSuite & DataReportal, 2019b). In Canada, the usage of smartphones has significantly increased in a short time. In 2014, there were 18 million smartphone users; however, it is estimated that by the end of 2019, there will be 26.6 million smartphone users and 30.4 million by 2023 (Statista, 2019b). The most common activities for users in Canada are mobile messengers (70% of internet users), watching videos (70% of internet users), mobile map services (63% of internet users), mobile banking (51% of internet users) and online gaming (49% of internet users), (WeAreSocial, HootSuite & DataReportal, 2019b). As it is happening elsewhere globally, the usage of mobile infrastructures in Canada continues to increase. Although the tendency is not as high as the global statistics due to the saturation of the markets, it is clear that all communities in Canada are using mobile devices. The challenge continues to be the rural and remote areas that, although they have high penetration levels, the connection speed is not as good as other areas in the country.

Appendix D. Software Engineering Models and Methods

Based on this first cycle of research and development, in the seventies, the Software Development Life-Cycle model (SDLC), Sequential Life-Cycle Program or Waterfall model was developed (Bischofberger & Pomberger, 1992, p. 1). The Waterfall model is a sequential development model with a sequence of stages in which the output of each stage becomes the input for the next (Figure 1). It was the first framework to be created in the early stages of software development. The requirements must be precise before going to the next phase. Each part of development proceeds in order without any overlapping and the tasks are completed in a specified time (Balaji & Murugaiyan, 2012, pp. 26–27). Several approaches emerged within this model with one aspect in common: prescribed activities, results, and sequence. In other words, the requirements are specified from the beginning, then the structure of the system is designed, and finally, the application is constructed and tested (Bischofberger & Pomberger, 1992, p. 1).

Figure D1

The Waterfall Model



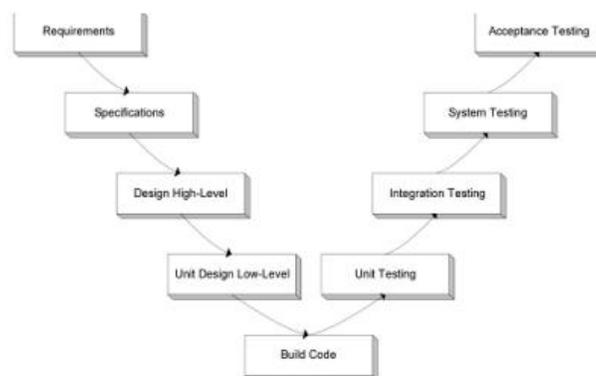
Note. Waterfall model. Reprinted from *Prototyping-oriented software development: Concepts and tools* by Bischofberger & Pomberger, 1992, p. 2. Copyright Springer Science and Business Media.

However, the complexity and size of information systems made it extremely difficult and costly to continue implementing the waterfall approach because the users commonly do not precisely know what

they need, do not know the entire process of implementation is feasible and cannot anticipate risk (Balaji & Murugaiyan, 2012, p. 27; Forsberg & Mooz, 1991, p. 3). Within this approach, several derived methods were created in the 1980s, such as the Vee Model. The Vee Model consists of starting with user needs on the upper left of a vee graph and ending with a user-validated system in the upper right. On the chart's left side, the model descends like the waterfall model (Figure 2) (Forsberg & Mooz, 1991, p. 4). This developmental process is based on the verification from the previous steps. The developer and tester work parallel in the Vee Model because it provides a relationship between the development stages and testing stages.

Figure D2

The Vee Model



Note. Vee Model. Reprinted from *Waterfall vs V-Mode vs Agile: A comparative study on SDLC* by Balaji & Murugaiyan, 2012, p. 28. Copyright JITBM & ARF Sourcing Islamabad Pakistan

As a response to this sequential model, during the 1980s and 1990s, several approximations were designed based on iterations, prototyping⁸⁸ and incremental builds.⁸⁹ Some examples of these approximations were the iterative development model and the prototyping-oriented software life-cycle or

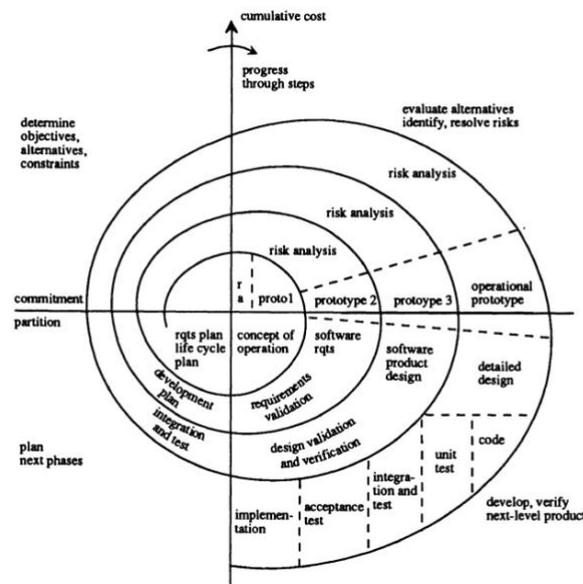
⁸⁸ Prototyping: It is the framework based on creating incomplete versions of the software program being developed (Bischofberger & Pomberger, 1992, p.19-22). Prototyping, in the context of software engineering, refers to user requirements clarification models and technical feasibility models (Forsberg & Mooz, 1991, p. 3).

⁸⁹ Incremental builds: the product is designed, implemented and tested incrementally (a little more is added each time) until the product is finished.

Spiral Model. The Spiral Model is based on prototyping in order to reduce the risks of incomplete and erroneous requirements (Figure 3). It allows identifying risks and the definition of appropriate actions (Forsberg & Mooz, 1991, p. 3). It is an iterative or cyclical software life cycle (Bischofberger & Pomberger, 1992, p. 3). However, it continues to be a sequential model.

Figure D3

The prototyping-oriented software life-cycle or Spiral Model

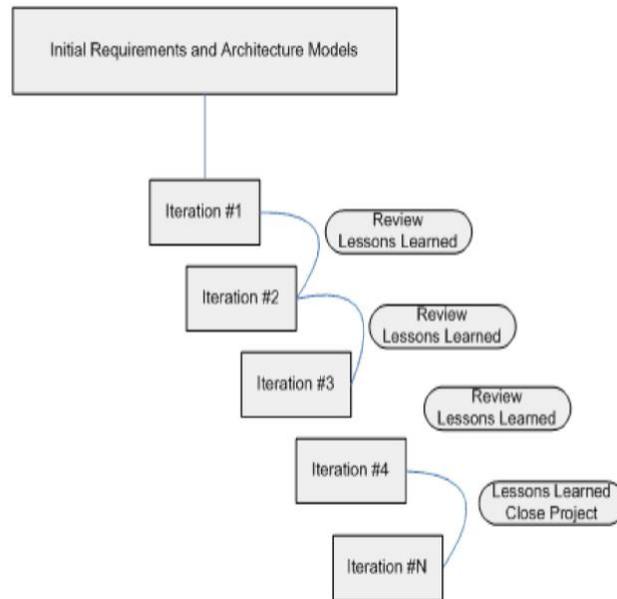


Note. Spiral model. Reprinted from *Prototyping-oriented software development: Concepts and tools* by Bischofberger & Pomberger, 1992, p. 3. Copyright Springer Science and Business Media.

Until 2001, a group of software engineering consultants wrote the Agile Software Development Manifesto, which started the Agile Movement in the industry (Abrahamsson et al., 2002, p. 9). The terms 'agile' means 'moving quickly,' and this methodology is primarily based on customer satisfaction by quick delivery of useful software (Figure 4). The timeframe regularly is counted in weeks rather than months (Balaji & Murugaiyan, 2012, p. 28).

Figure D4

Agile Model Life Cycle



Note. Agile Model Life Cycle. Reprinted from *Waterfall vs V-Mode vs Agile: A comparative study on SDLC* by Balaji & Murugaiyan, 2012, p. 29. Copyright JITBM & ARF Sourcing Islamabad Pakistan.

Agile model denotes “the quality of being agile; readiness for emotion; nimbleness, activity, dexterity in emotion” (Abrahamsson et al., 2002, p. 9). Some of the principles of this framework are (1) Individual and interactions over processes and tools; (2) working software over documentation; (3) customer collaboration over contract negotiation; (4) responding to change over following a plan (Abrahamsson et al., 2002, p. 11). These postulates are translated in several characteristics:

- a) The problem or need is divided into modules (modularity).
- b) Iterative short cycles to enable corrections.
- c) Time-bound cycles.
- d) Parsimony for unnecessary activities.
- e) Adaptative with new possible risks.
- f) Incremental process approach.

- g) Convergent to minimize risk.
- h) People-oriented through allowing self-assignment of tasks
- i) Collaborative and communicative style.

It has been proved that this software design framework is successful for planning and execution over other sequential methodologies in all types of projects and among industries regardless of the team experience and the project complexity (Serrador & Pinto, 2015, pp. 1049–1050). Nowadays, several derived methodologies have been developed based on the agile framework, e.g., Scrum, Kanban, Extreme Programming (XP), Adaptive Software Development, Rapid Application Development (RAD), among others.

All the previous methodologies for creating software are the most common standard techniques of software engineering. However, as I pointed earlier in the text, other forms of knowledge are not considered for their interpretation and practical applications. Moreover, the processes to create these coded applications are based on Western methodologies that mismatch Indigenous worldviews and do not address communities' socio-cultural and ethical aspects. In the next section, an analysis of the possibilities of including non-Western forms of knowledge into software engineering is discussed.