

# Seeding Alignment Between Language Technology and Indigenous Methodologies: a decolonizing framework for endangered language revitalization

Craig Carpenter, Dr. John Lyon, Dr. Miles Thorogood, Dr. Jeannette Armstrong

University of British Columbia Okanagan

3333 University Way, Kelowna, BC, Canada V1V 1V7

craig.carpenter@ubc.ca, john.lyon@ubc.ca, miles.thorogood@ubc.ca, jeannette.armstrong@ubc.ca

## Abstract

The integration of a speech technology into a digital edition to support the acquisition of a critically endangered Indigenous language is a complex task. More than simply consisting of technical challenges of working with an under-resourced language, researchers face the potential of re-enacting causes of language endangerment without rigorous adherence to qualitative methodologies. Based on reflections throughout the development process of a speech technology, this paper proposes a cross-disciplinary decolonizing framework for researchers working in the field of computational linguistics for Indigenous Language Revitalization (ILR). The authors propose a series of qualitative methodologies to ensure alignment with the language community which the technology is intended to benefit. The proposed relational framework is designed to sustain the integrity of the Four Rs: a series of principles first presented by Verna J. Kirkness and Ray Barnhardt in their 1991 article, "First Nations and Higher Education: The Four R's - Respect, Relevance, Reciprocity, Responsibility".

**Keywords:** Frameworks, Linguistics, Digital edition, Speech technologies, Indigenous, Decolonizing

## 1. Introduction

The digital edition *Kʷu Sqilxʷ IWe are the People: A Trilogy of Okanagan Legends* integrates a speech-to-text aligner and highlights the orthography of recorded speech in real-time to facilitate language acquisition. The speech technology for this project was adapted to work for *nsyilxcn*<sup>1</sup>, a critically endangered Indigenous language belonging to communities spanning the US – Canadian border in western Washington state, and the interior of British Columbia, Canada. Through a collaboration between the En'owkin Centre in Penticton, British Columbia, Canada and the National Research Council of Canada's (NRC) Indigenous languages technologies project, as well as Dr. John Lyon and Dr. Jeannette Armstrong, both instructors of the Bachelor of Nsyilxcn Language Fluency (BNLF) program at the University of British Columbia - Okanagan, the speech technology is now available as a resource for 3rd year BNLF students. The outcome of the project includes not only the successful implementation of the speech technology for language learning, but a cross-disciplinary framework for settler researchers working in the field of computational linguistics for Indigenous language revitalization (ILR). As a settler researcher, and an M.A. student in the interdisciplinary field of the Digital Humanities, I acted on behalf of the En'owkin Centre, the caretaker of the material (the stories) for the *syilx* communities they serve. The En'owkin Centre is constituted and mandated to protect and perpetuate the *nsyilxcn* language through education and quality resources and other materials enhanced by this technology. It was first and foremost the Indigenous community of the *syilx* for whom the resource was developed, and to whom I had the honour to serve through its creation guided by the En'owkin Centre in cooperation with the computational linguists and academics who aided in

its development and implementation. Throughout the process of its development, what struck me was a need for a methodological framework for researchers conducting cross-disciplinary research with Indigenous communities. This paper proposes just such a post-colonial framework for computational linguists working towards Indigenous language revitalization (ILR).

## 2. Pathways to Healing: Indigenous Language Revitalization in Canada

Of 300 documented Indigenous languages in the U.S. and Canada 90 have gone dormant since European contact (Villa, 2002). Of those that remain, many are in imminent danger of being lost (2002). More recent statistics show the world's languages continue to disappear at an alarming rate — according to UNESCO's Atlas of languages in danger, one language goes extinct every two weeks, and 25 languages are lost on average every year. Federally sanctioned efforts to assimilate Indigenous people in Canada that began in the late 1800s continue to result in linguistic genocide (Fontaine, 2017) for many Indigenous languages. The devastating effects of colonialism has roots that date back to the 15th century and to the Doctrine of Discovery, a set of theories backed by written decrees from the Pope, called papal bulls. The Vatican only very recently repudiated these written decrees (CBC, 2023) whose consequences have had ongoing, devastating effects for Indigenous communities across turtle island. The Canadian government's sanctioned efforts such as the Truth and Reconciliation Commission (TRC) began directly addressing Canada's dark history in 2007, outlining 94 calls to action and the largest class action settlement in Canadian history: the Indian Residential School Settlement Agreement. More recently, the

<sup>1</sup> *nsyilxcn* is the language of the *syilx*. Their words are never capitalized.

Canadian government affirmed its commitment to redress these atrocities by enacting the United Nations Declaration on the Rights of Indigenous Peoples Act formerly into law on June 21, 2021 (Department of Justice Canada, 2021).

While government sanctioned efforts are beginning to redress Canada's heinous historical relationship with Indigenous populations, language revitalization efforts are now gaining momentum through the direct efforts of Indigenous communities. Examples of efforts of cultural revitalization include the creation of language fluency programs such as the UBC Okanagan's Bachelor of Nsyilxcn Language Fluency (BNLF) program created in collaboration with the Nicola Valley Institute of Technology (NVIT) and the En'owkin Centre. It is worth noting that efforts to revitalize endangered languages, even when the language has no living fluent speakers (Mercer, 2013), have proven challenging but possible.

The survival of a language does not hinge on the work of governments, linguists, computer scientists or even the teachers of the language. First and foremost is the community of language learners, i.e. those who are teaching the language to the next generation and finding ways to make the language relevant to their own lives who ultimately determine the survival of an endangered language (Hinton, et al, 2018). According to Ethnologue, a database of world languages, as of 2021, there were approximately 200 fluent *nsyilxcn* speakers. Other estimates from the First People's Cultural Council, describe the language as critically endangered with fewer than 81 fluent speakers (FPCC, 2023). One of 23 languages in the Salishan family, *nsyilxcn* shares many linguistic properties with this language group, making developing linguistic data potentially valuable for numerous revitalization efforts. The use of automatic speech recognition and other computational linguistic technologies has the potential to revolutionize the way linguists and community members preserve and revive their languages. However, of the 70 different Indigenous languages spoken in Canada, almost none have enough speech data to even begin to develop these speech technologies (Littell et al, 2018).

In response to historical oppression and enforced assimilation, speech communities view language revitalization movements as pathways to healing, justice and empowerment (Hinton et. al, 2018). Revitalization efforts are generally part of much broader cultural traditions, the relearning of behavioural protocols, and ways of relating to family, friends, community members, to the land and to places, plants, and animals (Hinton et. al, 2018). The gathering of "data" and subsequent implementation of any speech technologies must be accomplished in collaboration, and its design and goals should align with the language community and involve members of that community during each step of the process. In this way, language data serves the community and remains integral to the healing process of the community and culture to which it belongs.

### 3. Seeding Alignment Between Computational Linguistics and Indigenous Methodologies

As non-indigenous settlers working with Indigenous communities, it is key to be aware of how binary, or more western modes, (Kovach, 2021), of speaking affect thought and threaten to shift the research process to focusing on language as data apart from the community (Bird, 2020).

Margaret Kovach explains in her seminal book, *Indigenous Methodologies*, "Given the role of language in shaping thought and culture, conflict between Indigenous and Western Epistemology and research approaches (and the involvement of each in knowledge generation) rests deeply within language and the matter of dualistic thought patterns" (2021, p.73). By acknowledging how western epistemology underpins terminology, internalised biases that lead to the disenfranchisement of the language community may be uncovered and neutralised.

Terms such as "low resourced", "data scarcity" and "target language" derive from a binary, western or a "colonial" mode of relating. For example, the term "low resourced" is understood in relation to colonially-privileged "high resource" languages, instantiating a binary. Despite intentions to avoid historical biases, research quickly shifts to being "extractive" if researchers are not able to work relationally (Bird, 2020). By relationally, we mean understanding terminology in the context of its particular function to better able to decipher colonial bias, and better able to maintain clear awareness of how it may influence methodology. Linguist and academic, Steven Bird explains how he came to see how "a preoccupation with data and technology might re-enact the causes of language endangerment" (2020, p. 3505). In his paper, "Decolonising speech and language technology", Bird "open[s] with a] discussion of a postcolonial approach to computational methods for supporting language vitality" (2020, p. 3504). He cautions how in his experience, once the focus is on what technology itself can achieve apart from the communities' goals and interests, the "target language" becomes a "lexico-grammatical code divorced from social functions" and that researchers are apt to "shift into extractive mode" (p. 3506).

From the perspective of the linguists and programmers the term "low resourced" refers to a lack of data required to make speech technologies function. However, to approach *nsyilxcn* as a low-resourced language that is simply "data" is unaligned, and disconnected with an Indigenous methodology that is focussed on the cyclical understanding of reciprocity and interconnectedness between all living things: language included. For Indigenous communities, language exists in relationship to the people, culture and the land (Hinton et. al, 2018).

As our research encountered obstacles related to the lack of linguistic data as applied to speech technologies for *nsyilxcn*, we considered how we might employ an indigenous-led qualitative

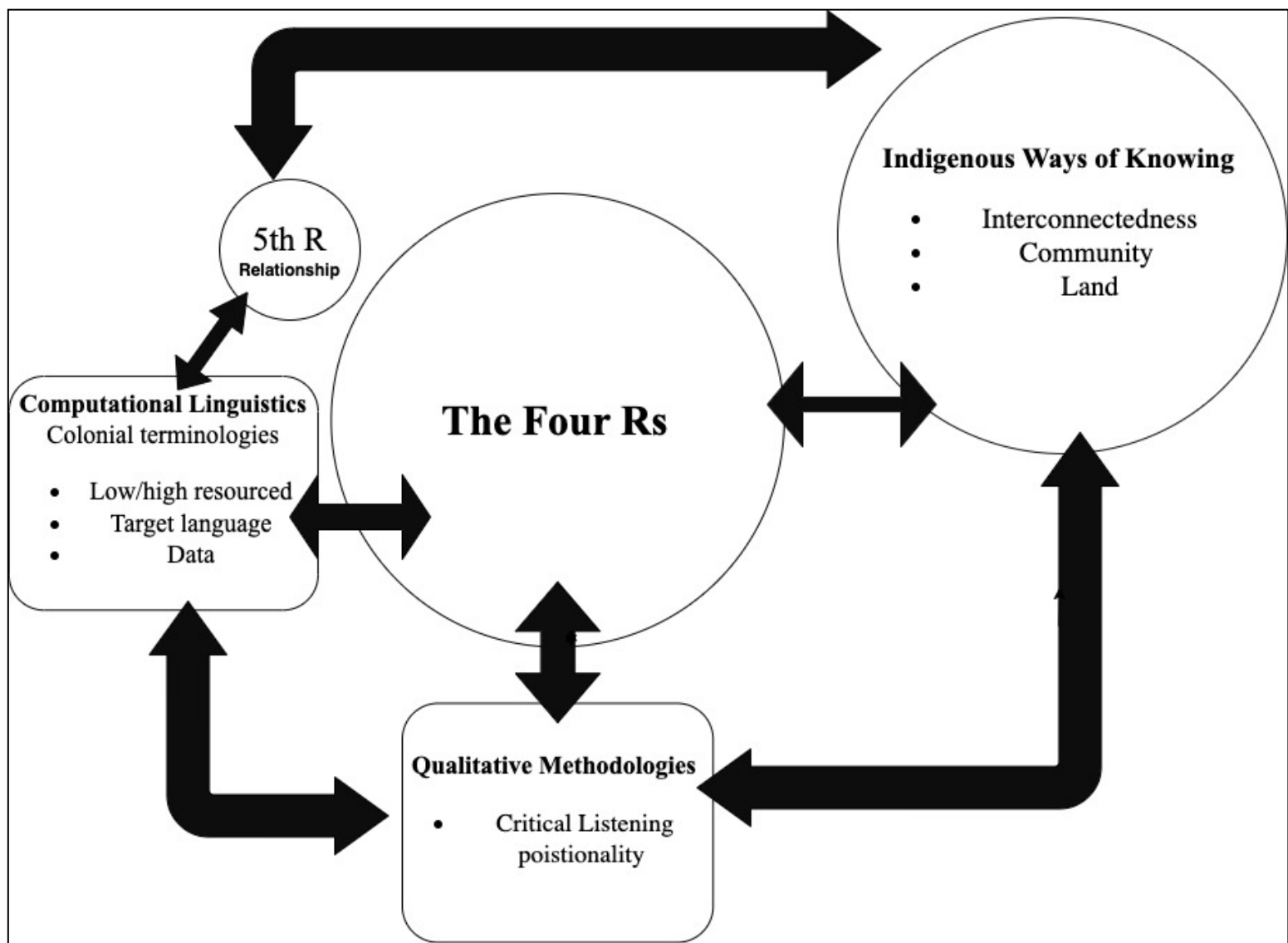


Figure 1 A relational framework for sustaining the integrity of the Four Rs during the development process of speech technologies.

pioneered by computational linguists for low resourced languages.

To "seed alignment" between computational linguistics and Indigenous methodologies we set out to answer the following research question: how can computational linguists reframe their terminologies in relationship to an Indigenous epistemology? We use the term "to seed", adopted from the technical process of "seeding alignment" employed by computational linguists working with under-resourced languages as a metaphor to represent the desired bridge between computational linguistics and Indigenous methodologies. The framework involves a process of first recognizing the epistemology underpinning the language used by the field of computational linguistics, then working reflexively with this knowledge to ensure that research adheres to the ethical principles outlined by the Indigenous community. This is an iterative process, based on a rigorous process of self-reflection and positioning (see Figure).

#### 4. Adapting the Four Rs for Computational Linguists

To begin to respond to the research question the first step was to consult with the Indigenous *syilx* community. We approached *syilx* community language authority, Dr. Jeannette Armstrong, and asked what a framework for working across disciplines to support Indigenous Language Revitalization might involve. She immediately asked if we were familiar with the four Rs. The "Four Rs" are principles first presented by Verna J. Kirkness and Ray Barnhardt in their 1991 article, "First Nations and Higher Education: The Four R's - Respect, Relevance, Reciprocity, Responsibility". The framework proposed by this paper positions the four Rs at its centre. A crucial aid in the alignment of our research with the community involved checking in with the Four Rs at every step of the development process. This process aided in an ability to maintain a critical awareness of the relationality of terms used by computational linguistics that do not align with an Indigenous way of knowing.

The Four Rs are as follows: 1) **Respect**: research acknowledges human connection to all living things and aligns with the world view of interconnectedness and relationality. 2) **Relevance**: keeps research grounded for and by the needs and experiences of the community. 3) **Reciprocity**: further ensures the research is respectful and relevant to the community by acknowledging Indigenous ways of knowing, and cyclical, non-hierarchical ways of working. 4) **Responsibility**: stresses ethical obligations when working with Indigenous populations. This includes respecting cultural protocols, obtaining informed consent, protecting confidentiality, and sharing research findings in accessible and culturally appropriate ways.

Since their introduction, the Four R's have been reimaged and adapted by various researchers and scholars to address the unique needs and contexts of different Indigenous communities. This has led to the development of additional principles and guidelines that build on the original Four R's. For the purposes of our work, we add another "R" that ties all the others together: **Relationship**.

This fifth R strengthens the relationship to the community by underscoring an understanding of the "relational" in research. The effects of colonization remain embedded in the language of computational linguistics and other academic disciplines, yet digital tools and their use to create multi-modal research spaces are emergent. Digital tools are at the centre of leveraging new learning spaces key to saving critically endangered languages. Along with these digital tools, must be new ways of thinking to produce anti-colonial digital spaces. By clarifying relationships, it's understood how terms steeped in colonial ways of knowing threaten to reinscribe causes of language endangerment. This fifth R helps to reposition colonial biases by acknowledging and aligning with the holistic, transformative Indigenous knowledge systems that often go unrecognized in the research process. Further to and aiding in aligning with the Four Rs, the fifth R strengthens the development of a "critical listening positionality" (2020, Robinson; see section 5 below).

## 5. Reflexivity and Critical Listening Positionality

As a settler researcher working in the field of computational linguistics, developing "critical listening positionality" supports integration of the Four Rs into the field and helps to avoid disconnecting research from the community of language learners. Stó:lō scholar Dylan Robinson's (2020) book *Hungry listening: resonant theory for indigenous sound studies* presents the concept of "critical listening positionality" (p.11) as a means to develop a dialogue of self-reflexivity that reveals "internalised unmarked biases" (p.11) and evolves the researcher's ability to "listen otherwise" (p.11). The concept of "listening otherwise" relates to the researcher's ability to hear anew, differently, and to exercise self-reflexivity. As speech technologies relate to how we hear, it follows naturally to extend the concept of listening to our

research methodology. As settler scholars focussed on growing capacity for allyship with Indigenous communities and finding ethical means to employ Indigenous praxis within our research, developing a "critical listening positionality", not only makes sense but is a necessary part of this process.

Robinson writes: "As part of our listening positionality, we each carry listening privilege, listening biases, and listening ability that are never wholly positive or negative; by becoming aware of normative listening habits and abilities, we are better able to listen otherwise" (p.11). As a settler, critical listening positionality is essential for understanding how terms used by linguists and other scholars schooled in Western traditions, are colonial in their framing. When applying the "Four R" framework to methods that weave separate knowledge systems like Indigenous methodologies and computational linguistics, we understand "critical listening positionality" as key to avoid unconsciously reinscribing colonial praxis. This concept may also be understood as the development of reflexivity, or the ability to pause and reflect from one's own position as a settler researcher to reveal subjective, unmarked biases.

For example, as it became clear during our work that the speech technology implemented into the digital edition would function as hoped, I stepped back to observe my own reaction. The sense of accomplishment around solving word-level alignment using a cross-lingual transfer method was disconnected from the community of language learners. Was our project at risk of becoming a version of the cliché of new technologies saving ancient languages, perpetuating colonial dichotomies of advanced vs. primitive, of domesticated vs. wild (Goody, 1977)? While I knew the process of applying speech technologies for Indigenous language revitalization needed to maintain a vigilant awareness of how research has long been the domain of the colonizer, the methodology was missing. More than simply an awareness, I required a reframing of the development process. I kept asking how the research benefitted the language community and hoped an adherence to reflexivity would evolve a way to work relationally and with accountability. However, with no definitive framework, there was too much room shift back into a colonial research model that seeks to extract "data" for the sake of the research alone.

Aligning research practices with Indigenous methodologies is a complex task when we "live in a binary world" (Kovach, 2021, p. 72). To begin, understanding how epistemology underpins methodology is key. Figure 1 visualizes a rigorous iterative process whereby researchers maintain the integrity of the Four Rs in their research through reflexive qualitative methodologies that aid in the alignment with Indigenous ways of knowing. The aligning of research with an Indigenous way of knowing begins with a keen awareness of one's own internal, unmarked biases. This shift to working with an Indigenous methodology requires a deep and ongoing commitment that is responsive and dynamic.

It is a paradigmatic shift demanding a sustained ability to embrace the messy qualitative work of revealing our own internal biases (Leavy, 2014). Alignment between Western ways of knowing and Indigenous methodologies necessitates researchers unpack terms like “epistemology” and “methodology” as they relate to Indigenous ways of knowing.

An Indigenous way of knowing is interconnected or, as Kovach (2009) explains, relational by nature. She states, “relational research is about doing research in a good way” (p. 35). Above all, Kovach (2009) stresses the importance of cultivating relationships, and that ethical engagement involves a conversation of trust and truth (Kovach, 2009). A relational understanding rises through an Indigenous epistemology of interdependence and “holism” underpinning research design (Kovach, 2021). As Kovach explains, because holism recognizes the intangible it challenges and “test(s) Western research” that remains “committed to material proof for substantiation” (2021, p. 70).

Throughout the development of the speech technology for the digital edition, I considered reciprocity and the circular epistemology on which Indigenous methodologies are based (Kovach, 2021). To begin to understand how this could be accomplished I practised my ability to “listen otherwise” (Robinson, 2020), reflexively and critically. The concept of braiding in Indigenous methodologies provided by Dr. Shawn Wilson, an Opaskwayak Cree Manitoba, in his book *Research is Ceremony: Indigenous Research Methods* (2008) emphasizes the importance of building relationships and connections between different knowledge systems, particularly in the context of research involving Indigenous communities.

Researchers must make a conscious effort to work reflexively to successfully apply the “Four Rs” as means to work with qualitative methodologies alongside an Indigenous epistemology. Conflict occurs when working across disciplines, but it is precisely within this experience of conflict that “critical listening positionality” (Robinson, 2020) becomes crucial to understand the community needs better, ensuring the purpose and intention behind the work is aligned with the broader relational understanding of the community. Kovach (2009) states: “Reflexivity is the researcher’s own self-reflection in the meaning making process” (p. 32). As our own research process revealed the complexity of technical processes involved in the developing of language technology, it underscored how, as settler researchers, the relationship with the community must be continually renewed. As the research evolved, we made conscious efforts to communicate clearly with the *syilx* community, ensuring the research maintained alignment as it progressed.

Applying critical listening positionality as well as other qualitative methodologies support the application of the Four Rs framework through iterative cycles of feedback and implementation (Saldana, 2015). This

process and way of working with the Four Rs as central to a relational framework supports a research paradigm that continually realigns the research process to serve the community. Given the more than a century of harm colonizing research has wrought on Indigenous populations, it was crucial that our research avoid reinscribing the power relationships that have, as Maori scholar Linda Tuwai Smith writes, made the term research one of the “the dirtiest words in the indigenous world’s vocabulary” (2008, p. 113). Through reflexivity and a constant understanding of the necessity to work relationally and with accountability, settler researchers, according to Wilson can also learn to work within an Indigenous paradigm. Wilson stresses: “If your research doesn’t change you as a person, then you haven’t done it right” (2008, p. 135).

## 6. Narrative

The final qualitative method effective in upholding the Four R framework is narrative. Sharing narrative both with ourselves as part of our research process and with the Indigenous community we are working with and for supports relational research and upholds the Four Rs. Storywork is an Indigenous methodology (1990, Archibald) at the heart of an Indigenous way of knowing. It is also a means to uphold the Four Rs, a way to maintain critical listening positionality and to begin to reveal the colonial conditioning within western research methodology, but more importantly—within our own ways of knowing.

As I learned computer science terms like “scrape” and computational linguist terms such as “target language” and began to explore the magic of automating tasks through a CLI, what’s often called the “Hello World” moment threatened to overshadow the greater purpose. “Hello World” is a program traditionally used by computer scientists as a test message to ensure that the development environment is set up correctly and is often used as an introduction to programming language (Kernighan and Richie, 1978). This “Hello World” excitement around the learning process threatens to shift the goals of the research to the outcome or the product. As research into speech technologies for low resources languages (LRL) deepened, I paused to consider the process more carefully. The use of linguistic data in the project, while done transparently, did not strictly adhere to the Four R framework. It took only seconds to “scrape” 15,000 *nsyilxcn* words from a website for use in the creation of a pronunciation dictionary. I paused to question if the speed of “the scrape” created a disconnection between the data and the community of language activists? By honouring this intuition, I was recognizing my own responsibility and accountability to what Kovach and other Indigenous scholars have referred to as the ineffable or intangible aspects to Indigenous methodologies that western science ignores. We ignore the intangible elements of the process at the peril of not only the community the tools are being designed to benefit but our own deep learning. To be decolonizing, revitalization of Indigenous languages must not focus solely on the production of tools or

outcomes for pedagogy of the language. The research process must be carefully considered.

The process must involve iterative cycles of understanding relationships between disparate epistemologies. Narrative aids in clarifying relationships that often go unnoticed. Armstrong (2008) underscores the need for forging new relationships that reframe our connections. In particular, she underscores how definitions of “indigenous” reside in “an oppressive framework of systemic struggle based in ‘losses’ and ‘recoveries’ of control over indigenous customs, laws, jurisdiction and tenures through various forms of colonization and imperialism” (Armstrong, 2010, p. 80). To reclaim “Indigenous” as a word more closely connected to the ontology with which it is related, I suggest the concept of “settler listening positionality” (Robinson, 2020, p.11) might aid in this process by exposing constructed biases. One of the most powerful methods to exercise settler listening positionality is through our own storywork.

## 7. Conclusion

From an Indigenous way of knowing everything is connected. This integration and interconnectedness of all life is in our language, our thoughts and therefore our actions. When we understand this experientially, it becomes clear there are new ways involving decolonizing methodologies that are needed to engage with disciplines such as computer science, linguistics, and the academy more broadly. Computational linguists benefit from decolonizing frameworks to avoid the re-inscription of colonial praxis. However, the development of this framework needs to be done in relationship with the language community. Researchers must work in iterative cycles, remaining open to how their own comprehension of research terms and methods may change in relationship. They must exercise their ability to listen closely and pay attention to differences, understanding that at the intersection of disciplines, when working towards ILR it is the Indigenous community that must lead the process. This incorporation of a new paradigm that values interdependence supports the Four Rs and evolves research that is accountable to diverse knowledge systems at each step in the development process.

The concept of “data scarcity” and “acutely low resourced languages” creates a call to arms for linguists to urgently round up every bit of data they can to “save” these languages, so they can be on par with dominant languages, or at least not go dormant. This theory of hegemony threatens to re-enact the cause of their endangerment because its approach is colonial, viewing the language as “data” to be “extracted.” The importance of designing language programs with and for communities, is wherein lies the need for a rethinking of how research terms color relationships with language communities.

While the term to “decolonize” has become popular across many disciplines, it’s especially critical to understand how to “decolonize” disciplines that have long been steeped in colonial ways of thinking and

methodology when working with Indigenous communities. The risk of “reinscribing causes for language endangerment” (2020, Bird) and continuing the long disingenuous history of research with Indigenous populations is all too likely if the axiomatic understandings of terms used by computational linguists are not considered. For research to be truly decolonizing it’s key that the creators of the speech technologies for ILR understand how when working across disciplines, there are often ways of knowing that are beyond our immediate comprehension. Honouring these separate knowledge systems often means listening closely to these ineffable feelings before stepping back and employing reflexivity. In other words, ensuring the process always takes precedence over the product.

As a settler researcher, as an ally, what I see more and more as I take small steps towards understanding *nsyilxcn*, are the incalculable benefits to all humanity Indigenous language and knowledge provides. Our work as settler researchers must extend beyond the technical functioning of speech technologies. Researchers from western disciplines may wish to consider how an Indigenous knowledge paradigm can support qualitative research methodologies. In this way traditionally western disciplines can evolve a way of working that is relational, dynamic, and innovative while maintaining strict adherence to Indigenous holistic ways of knowing. There is much to be learned from Indigenous ways of knowing, but first there is much to unlearn. It is through our own storywork that much of this “unlearning” can happen.

As I continue to work across disciplines, the process evolves and, most importantly, the Indigenous community of language learners are further empowered to take control of each stage of development. Next steps may be to consider replacing more colonial terms with new terminology in alignment with Indigenous ways of knowing.

Ultimately, the best way to decolonize research may be to learn Indigenous languages. “Non-Indigenous researchers must learn Indigenous languages to understand Indigenous worldviews” (Battiste and Henderson, 2000, p.133). The issue of translatability, especially as it relates to technical terminologies, foregrounds the need not only for language acquisition but critical listening positionality. The reflexive act of “settler listening positionality” (Robinson, 2020) if it does not bridge, can at least help expose “what gets lost in translation”. If researchers apply the framework outlined in this position paper, rigorously adhering to the iterative work of reflexivity, critical listening positionality, and narrative throughout the development process, we are confident a post-colonial, relational research paradigm can emerge.

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