Acts of living with: Being, doing, and coming to understand Indigenous perspectives alongside science curricula

by

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Abstract

This inquiry engages with the complexity of bringing Indigenous and Western ways of knowing, being, and doing together; both in K-12 science curricula and research. It responds to Canadian provincial/territorial policies and programs, adopted since the turn of the century, that mandate integration of Indigenous perspectives across K-12 curricula, with a particular focus on science curricula as a complex location for integration. The inquiry began as an exploration of the intersection between policy, practitioners, and practice as a means of considering what it means to integrate Indigenous perspectives in science curricula. Given that it draws on people, traditions, and thinking that emerge from both Indigenous and Western ways of knowing, being, and doing, the inquiry also began by drawing on elements of Indigenous research methodologies and ecological interpretations of hermeneutics in order to create a space in which both traditions might circulate together. As I engaged with doing the research, I concurrently found myself struggling with what it means to take up inquiry that simultaneously honours different traditions, and what it means to decolonize research. This struggle manifested primarily through discomfort with the place of theory and methodology within research and the manner in which these concepts act and allow for action. As I engaged in conversations with policy, practitioners, and practice, I re/cognized that struggles I was having with respect to methodology paralleled the struggles practitioners were having in terms of engaging with Indigenous perspectives in science curricula. This re/cognition occurred around specific instances where both I, and the people with whom I was having conversations, bumped up against a difficulty with language. That is, while we could

clearly point to the existence of something at play, we were simultaneously without adequate language to describe and talk about it. Given the difficulty posed by a lack of words, I let go of assumptions to both reflect on and search for a means of considering the phenomena I refer to as *the inarticulable*. Guidance arose from both traditions that inform my doing and being. I was visited, guided, and accompanied by the tricky teacher, Coyote, *AND* images of the world at play and in flux via mappings of complex, recursive equations, specifically the Lorenz attractor. These visions returned me to the root of conversation as the act of living with, and allowed me to re/cognize both my own process of coming to understand, *AND* the coming to understand of the people with whom I had conversations, as recursive acts of living with where the discomfort of the inarticulable set in motion a cycle where doing and being preceded knowing. The dissertation thus represents the research *AND* it is the research, and–as a means of supporting readers in coming to understand–it is written to reflect the recursive acts of living with in which I, and the people with whom I had conversations engaged.

Preface

This thesis is an original work by Dawn Wiseman. The research project, of which this thesis is a part, received research ethics approval from the University of Alberta Research Ethics Board, "We Are All related: Meaning/ful(l) Conversations Around the Integration of Indigenous Knowledge in Science Curricula", No. Pro00026584, November 11, 2011 and "Inquiry in the Garden: Engaging with First Nations, Métis and Inuit Perspectives in Science Curricula Through Open-Ended, Living Projects", No. Pro00032988, September 27, 2012.

For Paul
who said "It's time"

for Corinne
who invited me to experience the world as a much bigger, more interesting place than
I ever imagined it could be

and

for all the young people I adore–
Jérôme, Rémi, Gabi, Toto, Isabelle, Colin, Claire and Al–
who I hope get to experience that big and interesting of a world
both in and outside of school.

You have each gifted me beyond measure.

Acknowledgements

Onen sewathonsiyost kentsyohkwa
Now you-your-ears-good-make it-is-a-group
Now listen, this assembled group

kenh nikarihwesha
this it-is-a-matter-of-a-certain-size
for a little while

shonkwawi ne Shonkwaya'tison
he-to-us-has-given, he-our-bodies-formed
to what the Creator has given us

ne Ohenton Karihwatekwen
the before it-is-a-matter-comes
the words that come before all else

ne Kanonwaraton'tshera
the it-mind-remains-in-ness
the Giving of Thanks.
(excerpt from the Mohawk Thanksgiving Address in Doolittle, Lunney Borden, &
Wiseman, 2011, p. 81)

Despite the tensions inherent in the work I do, I have found many places where the things I have learned from the world of my Scottish upbringing and the world of my Indigenous friends, family, and colleagues fit together in a comfortable, family/iar way. Perhaps the greatest of these teachings is to be thankful and use that thankfulness to give back. The list is long.

My work of the last few years is a testament to the efforts, patience, and generosity of my family–biological (Wisemans and Lipskis), chosen (Williams, Saindons, Blauers, Birdwells, Belmonts, Jettés, Keegans, Rozahegy-Pasians, MacEwans and Volpes) and by circumstance (LeClaire-Rijavecs). They have nourished me in mind, heart, body, and spirit, kept me honest, cheered me on, picked me up, dusted me off, and kept me going.

I came to the University of Alberta (UA) for the sole purpose of working with Florence Glanfield who was my friend and colleague before I arrived here. Florence invited me to UA once she rediscovered it is a good place to be. I have come to know Florence more deeply through our time together in Alberta (AB) and thank her for her incredible generosity of spirit–very few people have a supervisor who finds them a place to live. She is who and how I want to be if and when I ever grow up.

At UA, I met Dwayne Donald who has offered me talks over tea, much dry humour, and long, muddy walks in the River Valley where things always seem to become simultaneously more complicated, and infinitely simpler. Dwayne challenges me in the most frustrating and best ways possible. I look forward to many more years of the same. At UA, I also met Norma Nocente and David Pimm, committee

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List of Abbreviations

AANDC:	Aboriginal Affairs and Northern Development Canada
AB:	Alberta
AE:	Alberta Education
AEEB:	Aboriginal Education Enhancements Branch
AFN:	Assembly of First Nations
AL:	Alberta Learning
APA:	American Psychological Association
BC:	British Columbia
BCME:	British Columbia Ministry of Education
CMEC:	Council of Ministers of Education, Canada
CSSE:	Canadian Society for the Study of Education
DECE:	Department of Education, Culture and Employment
ENGAP:	Engineering Access Program
FNEA:	First Nations Education Act
FNMI:	First Nations, Métis, and Inuit
FNPPU:	First Nations Program and Partnership Unit
ICSU:	International Council for Science
IQ:	*Inuit Qaujimaningit*
IRMs:	Indigenous/Indigenist Research Methodologies
MB:	Manitoba
ME:	Manitoba Education
MECY:	Manitoba Education, Citizenship and Youth
MET:	Manitoba Education and Training
METY:	Manitoba Education, Training and Youth
MEY:	Manitoba Education and Youth
MPES:	Mount Pleasant Educational Services
NAEP:	Native Access to Engineering Program
NARST:	National Association for Research in Science Teaching
NDE:	Nunavut Department of Education
NIB:	National Indian Brotherhood
NT:	Northwest Territories
NU:	Nunavut
OME:	Ontario Ministry of Education
ON:	Ontario
RCAP:	Royal Commission on Aboriginal Peoples
SK:	Saskatchewan
SL:	Saskatchewan Learning
SME:	Saskatchewan Ministry of Education
STEM:	Science, Technology, Engineering, Mathematics
STS:	Science, Technology, and Society
STSE:	Science, Technology, Society and Environment
TEK:	Traditional Ecological Knowledge
TEKW:	Traditional Ecological Knowledge and Wisdom
UA:	University of Alberta

WEIRD:	Western, Educated, Industrialized, Rich, Democratic
WNCP:	Western and Northern Common Protocol
YE:	Yukon Education
YK:	Yukon

A Note to Readers

> If I tell you what we were talking about when I was doing this research,
> will you make the same intuitive leaps that I did? I cannot be sure of this.
> On the other hand, if I just tell you where I ended up with my ideas, will
> you be confused about how I got there? There is no real way for me to tell.
> (Wilson, 2008, p. 69)

My dissertation engages with a shift in process, a change at play, living that both emerges in and creates spaces and places between Indigenous[1] and Western ways of knowing, being, and doing. In becoming caught up in this flux, there have been numerous challenges in trying to render it into written form. There have been multiple instances where I (and others) could find no language for observable happenings. The methodology is a finding of the research and recursive, it calls for return and iteration. There are parallel yet mutually informing conversations occurring on different levels throughout the piece. Tension and struggle live in these pages, but such is the essence of life and living, and I am fundamentally interested in the livingness of teaching and learning.

Much of the conversation about what this writing might look like in its final form has not been around content, but around structure that supports readers in reading. I think perhaps the work is better suited to some hyperlinked immersive format that allows for layering text, texts that appear alongside each other and shift in response to each other, journeying and multiple returns to ideas in a way that expands understandings as one moves through the content: an act of living with. My imagination, however, exceeds my current technical abilities (and budget), and so I have made decisions about structure that I have no doubt could be changed, and in that change perhaps there would be significant shifts in meaning for readers. This is an ongoing struggle. As I wrote in my proposal:

> do I say at the beginning that I am drawing on hermeneutics and so there
> is playfulness in the text?; that I am also drawing on Indigenous research
> methodologies and so the ethics of my research are embedded in the
> relationships I write about?; that those ethics impact both how I write and
> what I include in the proposal? Where do I let you know that because

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[1] I note that in most scholarly writing the word "Western" is capitalized while the words "Indigenous" and "Aboriginal" usually are not. I cannot determine why the grammatical rules of English (in French the words would all be lower case) seem inconsistent with respect to these particular descriptors. When I write or am quoting from conversations with others I choose to capitalize the words, partly to be consistent in language use, partly as an act of resistance in challenging arbitrary (and largely invisible) hierarchies. When quoting others' writing I will capitalize (or not) the words as they appear in those texts.

Indigenous worldviews tend to the holistic, that scholars from these traditions–while writing in the academy–cross boundaries in ways not many Western scholars do? The same people who write about research, often touch on science, and education, and policy and, and, and … (Aoki, 2005b). Do I address the slipperiness of terms such as science, Western, Indigenous, Aboriginal etc. before I give you some sense of the context in which they exist in relation to my question[s]?; or do I begin with the context and have the slipperiness of terms be problematic? Some of these things exist in the same space/[place], at the same time–or in different spaces/[places], at the same time–and writing tends to force a bit of a limited, linear form that does not necessarily acknowledge the relationships between them. (pp. 2-3)

In the end what I have committed to, and the only thing I can ever really commit to, is working to remain in the space between Indigenous and Western ways of knowing, being, and doing, drawing simultaneously on examples, ideas, thoughts, philosophies etc. that arise from both Indigenous and Western traditions (as I understand them so far), and letting them sit together to talk to each other, or not, as they will. Still, there are some things I can point to that may help in reading.

The *Publication Manual of the American Psychological Association* (American Psychological Association (APA), 2010) discourages footnotes. The APA position is that if text is important enough to include as a footnote it should appear within the main body of a work. However, there is an assumption to this convention that presumes linearity, writing from the same or similar locations as the readers, and not having to make explanations regarding unfamiliar ideas underlying the text. I rely heavily on footnotes, particularly in the first parts of the writing. Footnotes provide some background and context for terminology, ideas, and thinking that may not as yet be entirely clear, but that are returned to at a later point in the writing. In addition, footnotes have the potential to disrupt the flow and reading of the text, and it is my intention, particularly in the earlier parts of the text to do so. Both my experience of the research, and the experiences of many of the people who informed this work through conversation, has been one of discomfort and tension, of having too much to deal with, too many balls in the air. It has been in attending to such complexity and multiplicity, in holding on to all the balls, and trying not to let anything drop that each of us has made/is making sense of the ways in which Indigenous and Western ways of knowing, being, and doing might circulate

together. I do note for readers who find the footnotes too disruptive that the text may be read without them.

Because the inquiry engages with change, play, and flux, because it allows Indigenous and Western ways of knowing, being, and doing to circulate together, language and languaging have been challenging throughout the writing. Here again, I engage with and hold on to the multiplicity, sliding between words and ideas, trying to find words or descriptions that might be/become more comfortable to use. In addition, the change, play, and flux alongside Indigenous conceptions of relationships between past, present, and future render verb conjugation in relation to tense difficult in certain instances. There are places where I include multiple tenses to indicate a sense of (concurrent) motion, simultaneity, and return.

As a means of trying to let the multiplicity be and live with it, throughout the writing there are a number of concepts and wordings that I borrow from other scholars and knowledge holders, and return to again and again. The borrowings fit the context of my thinking and what is at play in this work. They also serve as means for weaving recurring ideas into and through the text. Readers will likely come to recognize them as the writing develops. I reference each instance where it feels appropriate–sometimes in the first instance, other times when the idea/word is more deeply considered–but otherwise allow it to stand on its own.

I take a similar approach to the conversations that informed this work. There are 16 people who agreed to inform this inquiry through conversation. I introduce each of them in some detail in Chapter 4. Given the importance of these conversations to this work and my own coming to understand, I return to and draw upon them and examples offered by these people throughout the writing. In order to avoid overwhelming the text with referencing to conversation dates, I generally identify speakers in text by their first and last names (or where appropriate only the first name) followed by an asterisk, or in brackets by their first initial and last name following by an asterisk. The asterisk indicates that the reader can find a full list of names and dates of conversations in Appendix A.

The idea of return, recursion, and developing meaning in relationship is important throughout. Readers may find that a concept developed in any chapter can be traced back to much earlier in the text. It may feel a bit like hunting or tracking; loping back to places

that seem family/iar once you get there. I have come to think of it as chasing Coyote's tail *AND* the mapping of recursive equations. I reference back into the text at multiple points, to point to these ideas as they return and emerge. Sometimes, I repeat myself verbatim and deliberately, with the intention of recalling or echoing the physically earlier words in similar or different contexts. There are sections where what appears in linear sequence is not so much linear–a piece in the middle of a chapter may be a step back, alongside, or above what precedes and follows it to offer some meta-comment on the situatedness or connection of those thoughts to other ideas running through the text.

In order to make reading a bit easier, I have also abbreviated the official names of the various ministries and government branches which author education policy and programs of study.

There are four parts to the main text, each with more than one chapter. The parts are structured in a manner that reflects both my process of inquiry, and the processes of coming to understand what it means to integrate Indigenous perspectives in science curricula I observed among the educational stakeholders with whom I had conversations. Because the nature of the inquiry makes the language difficult and forces engagement with what I call *the inarticulable*, I ask readers to develop some understanding of the processes at play by experiencing it in the reading; the attempt to recreate the experience is, in part, the reason for deliberate disruption of reading with footnotes. To provide some sense of where the reader is at any point, I use a particular recursive equation as a metaphor for the parallel processes. I begin each part with an image related to the equation, but do not label them as figures as per APA on these pages. The images are/have been a means of seeing and reading through what is going on and at play in each part. The images will eventually re/appear labeled and discussed in more detail.

Each part, each chapter, begins with some kind of statement–a quotation, an excerpt from my research journal or field notes, some thinking that has emerged alongside the inquiry–isolated on a page. While these pieces can be read as in conversation with what follows them, to me they are a way of remembering the commitments I bring to the inquiry, a way of reminding myself to always return to being in the middle, to honour the relations I am immersed in and emergent from, the gifts I have been given. I have set these statements apart from the main text physically and

visually: statements at the beginning of parts appear in bold, and at the beginning of chapters in italics. Some chapter subsections also begin with similar types of statements. These statements appear in plain text and are in conversation with or help situate what follows.

Finally, there is a tradition in academic writing of referencing the work of scholars and knowledge holders by their last names. While I hold to this tradition in some places, I note that the practice tends to conflate a person with their work, and to render invisible or strip away relationships at play and active in that work. The practice is not an apolitical act. Therefore, I frequently choose to name people fully, to provide a better sense of who they are and where they come from, what relations stand with and alongside them and the work I have chosen share in these pages.

I will return to say some more about structuring at the closing of Part I, but, given that readers need some place for initial understanding, provide this note as a beginning place. Perhaps the most apt description I can provide at this point is that the writing presents the research *AND* it *is* the research. It is my act of living with in process, and it begins somewhere in the middle, which is, of course, always the most interesting part.

This is a sunflower seed.
It is.
Look at it.
It is what you know as a sunflower seed.
You can pick it, dry it, salt it, pop it in your mouth, crack it open, spit out the shell and eat the core.
It is a sunflower seed.

But is that all it is?

Is it just one sunflower seed?
A part of an existing sunflower?
The product of a previous seed from which the plant emerged?
The progenitor of sunflowers to come?

Yes. Yes. Yes. Yes.

It is many things and one. All at the same time.
All wrapped up in an identifiable signified.
Simultaneously bound and expansive. (Wiseman, 2010b, pp. 1-3)

PART I:
THE WHOLE WORLD IN A DOT

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IN WHICH I CONSIDER A POINT FOR BEGINNING IN THE MIDDLE

There is not much to see at the beginning (if indeed that is where we are). Just a dot. Or perhaps a sunflower seed. Maybe a question or two (or three) that have not quite come into focus yet. It could also be something hugely complex seen from a great distance. There is no real framework for understanding the dot. Insufficient information. It does not seem to be related to anything.

Except you recognize it exists. And, while you might not be able to say what it is, in that recognition some kind of relationship emerged. Perhaps what the dot becomes (or is) depends on how the relationship plays out. What else you are willing to see, or open up to. How creative you are willing to be. Perhaps we can agree that the outcome is already potential. In my experience beginnings are already caught up in something. Already in process, somewhere in the middle. Even if you walk away, you have already seen the dot (King, 2003).

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If Part IV of this writing is an extended ending to the dissertation–and it is–then Part I is an extended beginning. A means of trying to get at the potential of the dot, the sunflower seed, or the questions that have not yet appeared. There is not much to hang on to, but that is the point. This writing, and the inquiry it represents, is really about the journey, the mapping, the tracking of relationships, process, and place; the potential of the dot, and how it is possible to become comfortable with the discomfort of it. Whatever it might be. At play. In the world. So far, it does not look much like a dissertation. In some places it will, in others less so.

In this extended beginning that is Part I, I will start to lay out some of the relationships at play, provide some framing for what follows. It includes an introduction to what is at play in the whole and a background to the manner in which the questions emerged. It then examines the difficulties and slipperiness of the questions, and finally provides some outline and discussion of structure and structuring for what follows. In between, and throughout, I take time to remember the relationships at play, to let them out to play, always in order to track my way back to the middle.

Stories are wondrous things. And they are dangerous. (King, 2003, p. 9)

Chapter 1: The Whole and Parts at Play

What does it mean to integrate Indigenous perspectives in science curricula?

How are educational stakeholders coming to understand what it means to integrate Indigenous perspectives in science curricula?

What is at play in integrating Indigenous perspectives in science curricula?

What if it isn't about integration at all?

"There are no truths, Coyote," I says,
"Only stories."
"Okay," says Coyote. "Tell me a
story" (King, 2007, p. 391).

When I was in the midst of writing my Master's thesis, or–more accurately–when I was supposed to be in the midst of writing my Master's thesis, I was having a conversation with the Elder for our Native Access to Engineering Program, Elmer Ghostkeeper, about the difficulties I was having pulling it all together. At the time, Elmer had just finished his PhD and was the Director of the Office for First Nations and Inuit Education at McGill; he had a deep personal understanding of the challenges of academic writing. As I spoke he kept nodding away. This was his advice.

"You are thinking about it too hard. Let it go. It will come to you in a dream."

February 18, 2013
2:01 am
It is dark. It is chilly. I am suddenly awake.
"You have got to be kidding me!"
Paul grumbles from the other side of the bed.
If I don't get up and write it down it will be gone.

"Boy," says Coyote, "that silly dream has everything mixed up."

"That's what happens when you don't pay attention to what you're doing," I says.

"It's not my fault," says Coyote, "I believe I was in Toronto" (King, 2007, p. 68) or possibly Montréal, or New York, or Québec City, or Edmonton, or Seattle, or Maui, or Winnipeg …

In the spring of 2010, I was co-facilitating a working group on mathematics education and Aboriginal peoples at the Canadian Mathematics Educators Study Group Meeting at Simon Fraser University (SFU) in Burnaby, BC. SFU sits atop Burnaby Mountain in a clear cut which provides space for Arthur Erickson's campus design as well as a fabulous view of the greater Vancouver area and the Coast Mountains. Much of the rest of the mountain remains forested.

At the opening session, one of the housekeeping items referred to the trails through the woods. Seems that, among other wildlife around campus, there was at least one coyote who was frequently spotted on the trails.

Late the next night (or possibly the one after), walking from the main campus back to the residences with people from Ontario, Québec, and Alberta, a rather distinctive silhouette crossed the road ahead of us. There was some squealing, and nervous titters. Someone confidently stated, "Oh, don't worry it's just a raccoon."

I know raccoons. I live with them. There is one who sits two steps down from our balcony patiently outwaiting my indignation that s/he has broken into the raccoon-proof garbage can.

Back at SFU, I muttered "That's no raccoon," under my breath.

In the book based on his dissertation, Jason Wallin (2010) reviews Pinar's concept of curriculum as *currere* and suggests that–as a concept emergent from the Latin verb meaning *to run*–it conjures up both reactive and active images. Active images focus on the process and joy of running, and the multiplicity of courses which might emerge from it. Reactive images become constrained by preexisting ideas about what it means to run and where running generally occurs.

Wallin takes up a Deleuzian framework for considering curriculum in which active concepts of *currere* offer a less certain, less determinant course because they allow for ongoing, creative engagement with the world. Reactive forms of *currere* on the other hand are more certain and predictable but may, over time, become well-worn ruts, "dominated by disciplinary processes aimed at keeping students on track" (p. 5).

While he offers these definitional representations of *currere*, ultimately Wallin is not so much interested in what they are, as in what they might *do*; how it is they might be at play, and how they act in the world.

Thoughts m$\frac{e}{a}$ssaged from a dissertation notebook entry June 5, 2012

Attempting to find some way around my difficulties with methodology, I have been reading Kincheloe and Berry's (2004) work on bricolage. There are parts that seem promising in the first half of the book, particularly the acknowledgement of complexity, relationships, multiple perspectives, methodology as active process, etc. I am particularly taken by the sense in bricolage of research as a "philosophical inquiry" (p. 5) into empirical observation. Still, it breaks down in the second part of the book where the methodology appears to become codified, somewhat dog/matic.

I am stuck, however, on a particular point which seems to speak to what I have been thinking about in relation to my dissertation work recently. The idea that when research focuses on relationship the object of study can only be defined by those relationships–it "moves from the 'some-thing' of substance to the 'no-thing' of relationship" (p. 93); and thus in some ways becomes not an object at all. I am thinking this no-thingness applies not only to the object of research, but to all the layers of research–methodology, analysis, results, etc.

The no-thingness, reminds me of a question asked by Jardine, Friesen, and Clifford (2006): what if mathematics

> *is not an object at all?* What if … the *world* of mathematics (as a living, breathing, contested, human discipline that has been handed to us) needs our memory, our care, our intelligence, our work the 'continuity of [our] attention and devotion'… and understanding if it is to remain hale and whole". (p. 90-91, emphasis in original)

While I might be a little less anthropocentric about it, the sense that something comes into and maintains its being via relationship sits well with me. With respect to my own questions, it is further supported by conversations I have had with a few people about how the words which outline integrating First Nations, Métis, and Inuit perspectives in science curricula are ultimately meaningless unless and until they are in some way operationalized by teachers and students in class rooms. We somehow have to figure what relationships might be possible with programs of study and policies, in order for them to become meaningful no-things; that policy and programs of study are meaningless nothings in the absence of such relationships.

It stands to reason that particle physics is about particles, and most people have a mental image of little billiard balls caroming around in space. Yet the concept of "particle" falls apart on closer inspection.

Many physicists think that particles are not things at all but excitations in a quantum field, the modern successor of classical fields such as the magnetic field. But fields, too, are paradoxical.

If neither particles nor fields are fundamental, then what is? Some researchers think that the world, at root, does not consist of material things but of relations. (Kuhlmann, 2013, p. 42)

In my dream
the angel shrugged
and said if we fail this
time it will be a
failure of imagination

and then she
placed the world
gently in the
palm of my hand. (Andreas, 1994, p. 14)

Excerpt from a conversation with Narcisse Blood, March 15, 2012

Narcisse: What's that mindset that says that Calgary has to pollute the water? [It] is not knowing the *land*. And so you have–you know, when wolves–wolves are wonderful animals, eh? Our whole Blackfoot culture, our language, the … way for the Blackfoot is the wolf trail, *makoi-yohsikoyi*. This animal had a special place with the Blackfoot, okay? But we go to these residential schools, what did I learn? Little Red Riding Hood. Who's the culprit? The big bad wolf. Peter and the Wolf, who was the culprit? The wolf. At Halloween who is one of the characters we're supposed to [dress as]? The wolf. In Europe this animal was demonised.

Dawn: Mm-hmm.

Narcisse: But look at the buffalo. What did [wolves] do to the buffalo? [Wolves] kept them strong. [Wolves] were good. And every time they, they hunted, the wolves, they fed other animals, eh.

Dawn: Yeah.

Narcisse: They'd take an animal down, they get their fill, they go away, and the coyotes would come, eh. So, you know, it reminds me of when, when we go hunting, when I was growing up and somebody got a deer.

Dawn: Mm-hmm.

Narcisse: Well, they would go make their rounds sharing that. So we're like the wolves, eh, but we, we're supposed to be afraid of them. Now, the wolves kept the herd strong, eh. We had to be really leery of wolves when they went rabid. We have a Blackfoot word for that. And when they get rabid, then they come after humans. Other than that, they stay [away]. Their food source was the buffalo, the elk. You know, animals like that. So they left us alone. And they taught us how to hunt, eh. Now, what we have, if we use [the rabid wolf] as a metaphor, is we have a runaway, unchecked way of … of finances, of an economy. It's called capitalism.

From October 3-5, 2007, I attended the Canadian Aboriginal Science and Technology Society's (CASTS) conference in Calgary, AB. One of the keynote speakers was Henry Lickers, a member of the Seneca Nation, and an Environmental Science Officer for the Mohawk Council of Ahkwesáhsne[2].

At one point in his career, Lickers had been hired by the City of Toronto to help curb its urban raccoon population. The help involved setting up and running trap lines in the alleyways of the downtown core. Given the extent of the raccoon population, the lines had to be checked very regularly.

One day, about to turn into an alley from one of Toronto's busiest, toniest streets, Lickers happened upon a coyote walking down the alley towards him. "I swear this coyote was walking along saying 'I'm a dog, I'm a dog, I'm just a dog' and no one on the packed sidewalk was paying him one bit of attention. Then he looked up, saw me, cocked his head and said 'Shit, an Indian.'"

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[2] The territory of Ahkwesáhsne is located on land in Ontario, Québec and New York State.

Cindy Blackstock is the Executive Director of the First Nations Child and Family Caring Society of Canada, an Associate Professor at the University of Alberta, and a member of the Gitxsan Nation in British Columbia. Her research examines the disproportionate representation of First Nations children in the Canadian welfare system. In looking at how tensions between Western and First Nations ontological assumptions about the world *act* within the context of the welfare system, she has identified an emergent theoretical approach for the social sciences and humanities which she calls the Breath of Life (BOL) Theory (Blackstock, 2009, 2011).

The developing theory is framed by a number of concepts including time and space. As Blackstock (2011) underlines First Nations "have expansive concepts of time where the past, present, and future are mutually reinforcing" (p. 6) and informing. Space is conceived as a "multidimensional reality" (p. 7) where some dimensions are empirically observable and others accessible through spiritual practice, dreaming etc. She points out that while these ideas appear outside of Western conceptions of space and time they are in ways analogous to ideas emergent from string theory, the field within physics that attempts to reconcile the very small of quantum mechanics with the very large of general relativity.

Excerpts from a conversation with Jules Lavallée and Randy Herrmann, December 3, 2011, or, Why I spend a lot of time looking at the tops of trees

Jules: I've noted some things for you. And I think you need to quote it.

Dawn: Okay.

Jules: One of the Elders that used to be quite a regular visitor to Manitoba, [was from Ontario][3]. Now all of these Elders that I'm going to talk to you about are no longer here. Okay, they passed on. And [this Elder] used to spend a lot of time with us. And [s/he] did a lot of work down south with–around the time of Pine Ridge, you know, the time when Pine Ridge was going through all of those conflicts with the government, the American government. Anyhow, [the Elder]one of the things that s/he said to us, and I'm going back to around 1984, and we used to sit in a circle at this … employment training program for Aboriginal people [in] the north end of Winnipeg, right. And s/he used to just love coming to sit with us and to teach us and to talk to us. And we all listened intentionally. S/he would say things like, "When the trees start to die from the top, we're in a lot of trouble," okay. And s/he said there are places in Europe where there's absolutely no trees at all. And s/he said, "And we're noticing recently, in 1984, that there are certain trees in Canada that are dying from the top. And that means that there's something wrong with our environment". Now what we probably should have done is, you know, [ask] "What is causing that?" But at that time we didn't offer many questions to Elders, we just simply listened and interacted on a personal level, right. And so another time s/he brought a bunch of Elders together at [the same place]. … I was the executive director there … Anyhow, what the Elders were saying is that it won't be long now before we start buy our water from the shelves in the grocery stores, okay. And we absorbed that information, but I know that we really didn't take that seriously.

Randy: It was almost like a joke.

Jules: We did not take that seriously.

Dawn: Because why would you buy water from a shelf?

Jules: Yeah … But here we are now around 2004 and [another Elder] is traveling across Canada and s/he's telling people that only four percent of the world's water supply is drinkable in its natural state. ... "And where do you think that water is?" was [the] next question. And we said, "Would it be Canada?" And s/he said, "Yes."

Randy: We got lots of fresh water.

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[3] Mr. Lavallée waived his own anonymity but asked that I remove identifiable references to others he spoke about in our conversations, particularly those Elders who have passed on to the spirit world. I have thus removed references to where the Elders were from and refer to them as *s/he* to anonymize their identities.

Jules: This is where the water is. And you know what's happening right now? What's happening right now is the corporate sector is doing everything possible to have the rights to that water, to be the distributors of that water, right.

Randy: To sell it back to us.

Jules: Yeah, so at that time, you know, when we were listening to all of this, we could even take it back 20 years when we were sitting around and the Elders were saying the same thing, right? Okay, and but s/he was telling us, "You know, it is our belief that the next world war that occurs will be over water," okay. So this is the kind of information that you would like to have? This is science, right?

Instead of trying to trying to kill the Indian to save the child, North America might have gone into partnership with the various nations, and, together, they could have come up with an education plan that would have complemented Native cultures and, perhaps even, enriched White culture at the same time.

Just a thought. (King, 2012, p. 119)

Coyote (and Raven, and Naapi, and Hermes, and, and, and …) can take many shapes–a dog, or a wolf, or a raccoon, or a person. The (so-called) pre-modern, modern and post-modern can be "mutually reinforcing" (Blackstock, 2011, p. 6) and informing; they can (and do) co-exist, they circulate in the same spaces and places. Objects can be some-things and no-things–and thus, not objects at all. Curriculum and running can be freeing and constraining. All at the same time. There's something going on here. Something is at play in the world.

"Boy," says Coyote, "this is a lot of running back and forth. Has anything happened?"

"Nope," said the Lone Ranger. "We didn't want to start without you."

"Yes," said Ishmael. "We always feel better knowing where you are".
(King, 2007, p. 357)

There are many ways to tell this story.
This is mine.

Indigenous education is not one site of struggle but multiple struggles in multiple sites. Thus, these diverse struggles cannot simply be reduced to singular, one-dimensional solutions. Interventions and transformative strategies must be correspondingly complex, and they must be able to engage with and react to the multiple circumstances that shape oppression, exploitation, assimilation, colonization, racism, genderism, ageism, and the many other strategies of marginalization (Battiste, 2000, p. xxi)…

Chapter 2: Recursive Beginnings at Play/Tracking to the Question(s)

…such as linearity, or beginning at the beginning. Who says a story needs a beginning, middle and end? [4] When I was much, much younger I drove my parents crazy because I did jigsaw puzzles from the middle out: Much as they tried to get me to start with the corners and edges, insisting it was easier and *the* way to do it. The whole was already there, and I could not understand why it mattered how I came at it. So, I persisted in starting with what I could already see and working out from there. I would move from the individual pieces, to blocks of multiple pieces that could be placed in relation to each other and provide a sense of some emerging pattern. It was only in the end that the final framing pieces fit together. *That* was easier, and more interesting, even if they could not understand it. Perhaps it was (is) perverse. I do tend to react poorly to being told "This is *the* way" with respect to doing anything–even more poorly if the directive is applied to being. Perhaps I have always been drawn to the uncomfortable places.

But still, beginnings–or perhaps a place to start when already in process, at least a place to support readers in reading.

The Gift: A Place to Begin in the Middle

More than twenty years ago, I was given a gift. Not a physical gift, but one that has opened the world up in remarkable and previously unimaginable ways. The gift was this: an invitation to see the world–or try to see the world–in a way other than the one[5] I had initially been given. Not to abandon that initial way, because to engage the one offered would require I was very much grounded in who I am and where I come from. The gift came with support–relationships, humour, teachings, stories that were not necessarily linear, discomfort, friendships, love. The gift came with things I did not understand, still do not understand, will likely never understand. I was invited to start with what I could understand and work out from there. I have not yet found the edges.

So, this work begins somewhere in the middle. In some language Indigenous to what we call in English, North America, the middle may emerge from and be immersed

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[4] Most of the people who have taught me about story in schools, particularly those in my Masters' program in Media Studies.
[5] Not that either way is singular.

in a named set of relationships that encompass what it is to live and learn in this place. Some word that when spoken aloud releases the very essence of those relationships into the world to resonate with the core of a listener's being; a recognizable *that* (Gendlin, 1995, p. 584, emphasis in original) that I can describe only by waving my hands around something largely inarticulable because I understand only English and French. [6] As hand-waving is less than ideal within the confines of a dissertation, I choose to name the middle in a language very old–some might say dead–but nonetheless still at play in work by others. *Inter esse,*[7] Latin that translates into English literally as "to be between"[8], but perhaps better described by Jardine (1998a), as a "being in the middle of things" (p. 7), in a manner that is deeply and fundamentally interested in life and living[9]–in how the puzzle might emerge and grow from the middle. The middle is an interesting place. As Deleuze has described to Parnet (1987), "It is never the beginning or the end that are interesting; the beginning and the end are points. What is interesting is the middle. … Being in the middle of a line is the most uncomfortable position" (p. 39). Here again, I bump up against the difficulty–making primary readers of a dissertation uncomfortable from the start is not a wise strategy. The discomfort requires some kind of return to a beginning that is, perhaps, less uncomfortable.

Beginning Again: Tracking to the Question(s)

I graduated with a Bachelor of Engineering degree from Concordia University (Montréal, QC) into the recession of the early 1990s. Unlike many of my classmates, I had secured work prior to graduation within the management training program of a large para-public utility. Happily, it was such a miserable experience that it underlined, early in my professional life, how poorly I fit in corporate culture[10]. My exit from there,

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[6] Although I have recently realized the French can support me in following the general sense of Michif if the speaker does not speak too quickly.

[7] I will explore this location more deeply further into the writing.

[8] About as much as I can remember from two years of high school Latin.

[9] Jardine (1998b) takes up the *inter esse* from hermeneutics, and particularly Gadamer's (1989) interpretation that locates hermeneutics in the "*in-between*" (p. 295, emphasis in original).

[10] I am fundamentally interested in the complex of relationships that living simultaneously emerges from and generates. My experience of the corporate world suggests it provides little room for relationships with any degree of separation from profit. Corinne for many years tried to get me to rethink my fundamental difficulty with profit motives to little avail.

combined with relationships I had formed as an undergraduate in student government at Concordia, eventually lead to my job as Communications Officer in the university's Faculty of Engineering and Computer Science. [11]

There my direct supervisor was Corinne Mount Pleasant-Jetté.[12] Corinne was a professor and a member of the decanal team in the Faculty. She was also member of the Tuscarora nation from Ohsweken[13] in ON. Corinne had significant experience in work force advocacy for First Nations, Métis, and Inuit people, peoples, and communities within Canadian urban contexts, and addressing racism more broadly across public and government service sectors.[14] Her portfolio within the Faculty included outreach to communities traditionally underrepresented in engineering. One day, she walked into my office and asked, "You know those engineering camps you ran as an undergraduate? Do you think we could run a similar program for Aboriginal kids?" I replied, "Sure we can". In this moment unknowingly, and knowing nothing, walking through the unseen door that had silently opened. Of course, Corinne had a bit of Coyote about her, so perhaps it was more of a push.

That fateful question about summer camps began what would become the Native Access to Engineering Program (NAEP), a national program with the long-term goal of increasing Aboriginal participation in post-secondary studies and careers related to science, technology, engineering, and mathematics (STEM). Our primary focus was supporting young Aboriginal people and their teachers in the context of K-12 science and mathematics teaching and learning. NAEP began with summer camps, moved on to professional development for pre- and in-service teachers, K-12 outreach and classroom resource development, and, eventually, policy intervention/consultation at federal, provincial, and more local levels.

In my sixteen years at NAEP, and its successor Mount Pleasant Educational Services (MPES), I developed lasting relationships with Indigenous and non-Indigenous

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[11] A position for which I had no formal qualifications.

[12] Shawn Wilson (2008) writes about feeling accountable to many people in his research, but particularly to his father, Stan Wilson, because of the role Stan played in his coming to know. I am also accountable to many people, and in my case, for the same reasons, Corinne is the person to whom I feel most accountable. That sense of accountability remains despite the fact that she passed on in February 2014.

[13] Or Six Nations of the Grand River.

[14] For this work she was inducted into the Order of Canada in 1992.

people from across North America who were (and largely still are) involved in science and mathematics education alongside Indigenous people, peoples, and communities. Through these relationships, through the stories and experiences we have shared (and continue to share), I have come to know that there is some very interesting work in this regard occurring in many local places around North America. While the individual projects are usually labelled as science, technology, engineering *or* mathematics, closer examination suggests that they are actually more integrated explorations of interesting questions and problems that ask for science, technology, engineering *and/or* mathematics in their uptake. What might be referred to as STEM[15] in education.

An example of the type of work I am referring to is illustrated in Figure 1. Here Tod Shockey[16] (University of Toledo) shares work undertaken alongside Jerry Lipka, Barbara Adams, and Yup'ik knowledge holders in Alaska.

Figure 1. Planning kayaks based on body measurements.
Tod Shockey discusses the mathematics of kayak design with educators at
DreamCatching 2009. [*Image credit: D. Wiseman*]

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[15] As will become clear, I have some tensions with naming things, but STEM is certainly the terminology we used at NAEP and MPES for discussion with educational stakeholders and potential funders, as well as in grant applications. In our case STEM was taken up as (1) appropriate to a location within a faculty of engineering where each of the individual fields come together in problem solving, (2) priority career areas identified in public consultations with Aboriginal people, peoples, and communities (e.g. Royal Commission on Aboriginal Peoples, 1996), and (3) an approach to teaching and learning that was less fragmented, less abstract, and more grounded in the livingness of the world.
[16] All faces in this image, except for Tod Shockey's, have been blurred so as to be unidentifiable. Tod provided permission for his image to appear in this photo (February 9, 2015).

The lesson is one young Yup'ik people might learn alongside community kayak makers who understand how a kayak must be designed in proportion to its rower's body so that the person is "more closely connected … to the sea and the movement of paddling" (Lipka, Shockey, & Adams, 2003, p. 184) when navigating cold, turbulent waters. Lipka, Shockey, and Adams label the lessons emerging from the exploration of kayaks as mathematics because their intent is to get at mathematical concepts such as proportionality, measurement, and mapping. In practice, however, the making of kayaks extends well beyond mathematics to include planning, construction, loading, buoyancy, choice of materials, etc.–concepts usually considered within one or the other STEM disciplines.

The educators we worked with through NAEP told us that in their experience projects such as the example provided had an impact in places where they were taken up. Educators noticed increased student engagement, higher attendance, and, sometimes, improvements in academic success[17]–all elements of interest within the broad field of Indigenous education (e.g. Cleary & Peacock, 1998; Dussault, et al., 1996; McKinley, 2007). So, when I applied to the University of Alberta (UA), my intention was to develop a dissertation program that closely examined such projects in the places where they are being taken up, to try and tease out what it is about them that seems to work for young Indigenous people and their teachers.

Changing my mind in the face of parallel struggles

My struggle. My work with Corinne and the community of people who came together through NAEP and MPES[18] fundamentally changed who I am and the manner in which I engage with the world and all my relations. While I was aware of these changes prior to my arrival at UA, they had become somewhat taken-for-granted because I had worked for so long in a context where the people I dealt with on a daily basis shared a similar set of commitments. These commitments included working collaboratively,

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[17] All the evidence with regard to such projects was anecdotal. However, the anecdotes arose on multiple occasions over time from multiple people who were focused on different STEM subjects areas in various places in North America. It was the consistency of the anecdotes they shared which suggested there is something worth looking into with respect to such projects.
[18] Who I still turn to for support on a regular basis.

taking Indigenous ways of knowing, being, and doing[19] seriously (Stewart-Harawira, 2005) and creating spaces where Indigenous and Western ways of knowing, being, and doing might circulate together.[20]

When these commitments tried to circulate with what was being presented in my UA courses as seemingly required commitments for doing doctoral work in a research-focused university, I encountered a number of tensions around the activity of research. In light of these tensions, as I began to imagine how the work for my dissertation might play out, I grew more and more uncomfortable. Knowing that research has frequently not served Indigenous people, peoples, and communities well (Brown & Strega, 2005; Kovach, 2009; Smith, 1999; Stewart-Harawira, 2005), I spent significant time considering and having conversations about how I might navigate the values and assumptions being presented in my courses, given that I no longer subscribe/d to them wholesale. I struggled (and continue to struggle) with conventions around authorship, the general structure of dissertations[21], expected elements of research such as theoretical frameworks and methodology, and the UA's position that graduate defenses are not public[22]. I began to question what I was doing in a doctoral program and how I could ethically and responsibly[23] take up the research I was proposing[24]. Ultimately, however, the exposure of my taken-for-granted commitments and the discomfort I experienced as

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[19] I will tend to use the wording "ways of knowing, being, and doing" as opposed to epistemology, ontology, worldview, etc. as a means of underlining active process and relationships between these words that I will expand on shortly.

[20] The wording "circulate together" comes from conversations with Dwayne Donald. I take it up as way of indicating that multiple perspectives are usually present in any place whether they are recognized or not, whether they can be reconciled or not. What is important to me is that the different ways of knowing, being, and doing are present and active.

[21] As should be becoming obvious.

[22] A key commitment to work alongside Indigenous people, peoples and communities is giving back (Smith, 1999; Weber-Pillwax, 1999). I find it difficult to reconcile how important the people who agreed to contribute to this work are to it with the fact that they cannot be present to witness how their contributions are received in the academy.

[23] Within the limits of my understandings of those ethics and responsibility.

[24] In my first term, much of this struggle centered around methodology, which I will expand on considerably, and the issue of authorship. I had imagined my doctoral work occurring in close collaborative partnership with people in community, and could not reconcile that approach with a final document that bore only my name. While I now understand there are sometimes options around such conventions, it was a real struggle at the beginning of my degree.

they tried to have conversations with what I was hearing in my courses was incredibly fruitful[25]. To explain how, I must return again to the beginning of my doctoral work.

The struggles of my colleagues. I arrived at the UA in the late summer of 2009, seven years after the province had adopted its *First Nations, Métis and Inuit Education Policy Framework* (Alberta Learning (AL), 2002b). The policy represents a significant shift in thinking with regard to Indigenous education in the province. While, like previous policy (Alberta Learning, 2002a), the new framework focuses on improving educational outcomes of Indigenous students[26], it also "supports education programs and services which provide enhanced opportunities for *all* Alberta (AB) students to develop an understanding and appreciation of Native histories, cultures and lifestyles" (p. 2, emphasis added); a goal which includes increasing "awareness, knowledge and understanding of First Nations, Métis and Inuit history, lands, rights, languages, cultures, and contemporary perspectives on governance, education, *science*, wellness and other issues" (p. 17, emphasis added). Read as a whole, the policy essentially mandates the integration of First Nations, Métis, and Inuit perspectives across K-12 curricula in all subject areas, including the sciences[27].

In my first terms at UA, many of my course colleagues were practicing science teachers from Alberta (AB). Where my work at NAEP had made me aware of policy shifts[28] such as the *First Nations, Métis and Inuit Education Policy Framework*, my colleagues had been less aware of the shift in process until it began to appear in the provincial programs of study[29] for science that directly impacted their daily practice and

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[25] As such discomfort generally is in my experience. Sometimes, I have a hard time remembering the fruitfulness when caught up in the discomfort.

[26] Who have been poorly served by the education system in Canada and other countries where colonial policy is prevalent.

[27] As I will get to, the sciences can be a particularly complex location for such integration.

[28] While Corinne and I had been involved in a number of provincial and national conversations/consultations where the idea of engaging all students in Canadian schools with Indigenous ways of knowing, being and doing, we were still somewhat surprised by the emerging policy changes. They struck us as simultaneously sudden and long overdue.

[29] In Canadian educational jurisdictions, the documents which outline philosophical and pedagogical approaches to and content within specific subject areas are named differently–e.g. integrated resource packages (BCME, 2005), curriculum (OME, 2007a), programs of study (AE, 2005)–depending on the jurisdiction. These documents are also vary considerably in terms of how they are laid out, and the depth of detail they contain with regard to definition of terms, approved resources, assessment practices etc. Despite the differences, they are the primary documents from

lives in classrooms with students. Their lack of familiarity with policy was in no way unusual–researchers (Ball, 1993; Barrett & Pedretti, 2006; Hart, 2002) note that teachers often have little engagement or familiarity with broad political processes, policy statements and principles that inform the development of programs of study and so, for many classroom teachers specific programs of study serve as their first and only insight into government "vision" (Barrett & Pedretti, 2006, p. 237) and policy. In AB, the first program of study in the sciences to take up the mandate for integration in any fashion appeared in 2005 (Alberta Education (AE), 2005) the next ones in 2007 (AE, 2007a, 2007b, 2007c, 2007d). So, when I arrived at UA, the policy changes with respect to science curricula were still relatively new, and very much in process, in flux, at play. Given what I was hearing from practicing teachers in my courses, the change was also uneasy, and, to exacerbate the situation, the general consensus seemed to be that the programs of study for science were not terribly helpful in figuring out what the changes meant in terms of practice.

In this context, when I spoke about the initial focus for my doctoral work–the fertile projects I had come to know through NAEP–it triggered responses in my colleagues that I now understand as emergent from and immersed in the tensions they were experiencing. I heard things like, "I have no Aboriginal students in my classroom," "*I* see the value of doing this, but *others* do not," "I want to meet the requirements of the program of study, but I have no expertise or knowledge of Aboriginal perspectives", "What if I say something wrong, or worse, offensive to these people?", "Why FNMI[30] and not worldview?", "Where do I find this information?", "Why are we including Aboriginal perspectives in the curriculum anyway?"[31] At first, listening to these statements in combination with the struggles I was having around research made me

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which K-12 teachers plan to teach. In my dissertation I will refer to these documents as *programs of study*, the term used in AB, in order to minimize confusion between curriculum in this specific sense and curriculum in the broader sense as posited in curriculum studies (Aoki, 2005f; Pinar, 2004).

[30] The AB policy framework (AL, 2002b) refers collectively to Aboriginal people in the province through the acronym FNMI. It stands for First Nations, Métis, and Inuit. The acronym has made it into educators' discourse, as this is the term I frequently heard/hear used in my courses.

[31] These statements were clearly trying to get met to pay attention to something. When I look back in my course notes, they can be found among the doodles and other marginalia I jotted down while in class.

further question what I was doing at UA. Then I decided to step back, let go of how I was feeling, and listen. In doing so, I was able to find a voice and position myself ethically and responsibly in the research.

   An aside on sitting with the difficulties: Struggle and discomfort as a sign of learning. Being in the *inter esse* is frequently uncomfortable, it is risky (Jardine, 2000a), it requires work and struggle. In my experience, the struggle is often a tangible physical experience that manifests as a wriggling, knotty feeling just below the sternum but above the stomach, a heaviness in the head, a tension around and behind the eyes, and–in certain moments–a bruisedness resulting from walking into too many walls. These feelings describe my early days at UA, when it would have been easy to give up, go home, and return to my life already in progress. At the same time, I have a particular stance on struggle, on the bodily sense of frustration that occurs in bumping up against something unfamiliar or something that exposes the previously taken-for-granted. That kind of discomfort is a signal–a visceral sign– that something is going on, at play, in flux, that learning might be potential.[32] As I tend to position myself as a learner, I make attempts to live with the struggle and discomfort. I call this act of living with *sitting with the difficulties*, and recognize similar approaches/experiences among others who work in contexts akin to my own. Lisa Lunney Borden (Lunney Borden & Wagner, 2013) has referred to it as "This is it, maybe" (p. 105), and Marlene Atleo (2008) as "watching to see until it becomes clear to you" (p. 221).[33]

   In stepping back, in letting go of how I was feeling and listening to my teacher colleagues at UA, I began to re/cognize their struggles as something more akin to my own. Where I was/am trying to remain in the *inter esse* in the face of a strong set of assumptions based in Western academic traditions[34], they were/are being "forced" (D. McKee*) into the *inter esse* based on changes to their programs of study. My advantage

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[32] I discuss this kind of struggle with students in the courses I teach, particularly elementary science curriculum and instruction where many of the students enter the course with anxiety-ridden relationships to science. The idea that what they are struggling with might be indicative of learning seems to help them engage with ideas they might otherwise resist. It also helps them to understand that part of the nature of science is about learning.

[33] Atleo (2008) seems to have reached more resolution than either Lunney Borden (Lunney Borden & Wagner, 2013) or I, but she has significantly more experience than either of us.

[34] I will admit that there are good reasons for some of these traditions.

was in understanding its fertility of and potential in terms of learning, if one is able to find ways to become comfortable with the discomfort.

Being addressed

In listening to my colleagues, I was particularly addressed by two statements.

"Science is science". The first was, "I get why we might integrate Aboriginal perspectives in social studies or language arts. But science? Science is science."[35] This statement brought me up short, and then intrigued me, because–on some level that the person who said it could not quite express–in saying "science is science" he hit on what has been broadly identified in research (e.g. Aikenhead, 1997; Barsh, 2000; Bartlett, Marshall, & Marshall, 2007; Brayboy & Castagno, 2008; Cajete, 1994; Elliott, 2008; Kawagley & Barhardt, 1999; Little Bear, 2000; MacIvor, 1995; McKinley, 2007; Sutherland & Henning, 2009)–that science curricula can be a particularly challenging location for Western and Indigenous ways of knowing, being, and doing to circulate together. Much of the research has been undertaken in Canadian educational contexts and examines challenges and barriers–and ways of mitigating challenges and barriers–to Indigenous students' participation in K-12 science.

Given what I was hearing in my courses, similar challenges and barriers seem to be at play in science educators' considerations of integration; perhaps not a surprising similarity given that researchers identify the difficulties for students as immersed in and emergent from epistemological and ontological tensions between Indigenous and Western conceptions of the world and the way it works. These tensions include, but are not limited to, the degree to which nature is knowable; the position of humans in relation to a system; the generalizability of observations; the view of life as whole or fragmented; and, connections to the spiritual. My understanding of these tensions comes from the literature and my experience at NAEP where I learned to take Indigenous ways of knowing, being, and doing seriously. It also comes from my experience in engineering, where tension occurs only in relationship and can be harnessed to open things up, to create spaces and generate ways of doing things that are not necessarily present in the

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[35] This statement was actually made by an undergraduate student in a class I was visiting one day.

absence of the tension. The teachers I was listening to, however, did not seem to be framing the tension they were experiencing in this creative/generative manner.

"I don't even know what this looks like". The second statement that addressed me was, "I don't even know what this looks like". Almost without fail, when I listened to or had conversations with K-12 science educators or post-secondary science teacher educators about integrating or engaging with Aboriginal perspectives in science curricula, they responded with some variation on this statement[36]. It was usually followed up by a list of other statements, "I only have so much time, there is so much else to cover", "It's not a priority for my school or school board", "No one holds us accountable for it", and many of the other statements I heard in my courses. While a cohesive body of literature with respect to integration is still emerging, researchers (Aikenhead & Huntley, 1999; Blood, 2010; den Heyer, 2009; Donald, 2009; Kanu, 2011)[37] working with pre- and in-service teachers and post-secondary educators have identified statements such as the above as indicative of barriers, challenges, and resistances to integration[38]. In my own work (Wiseman, Onuczko, & Glanfield, 2015), I "have to come to understand that the underlying assumption in [many of these statements] is that engaging with Aboriginal perspectives is an add-on to what teachers already do" (p. 245)–the assumption is that integration is about adding content, not about approaching curricula in a fundamentally different manner. In nearly all the conferences and consultations I have participated in over the years, Indigenous community knowledge holders and Elders have been remarkably clear that bringing Indigenous and Western ways of knowing, being, and doing together in curricula (science or otherwise) is not so much about what[39] we teach (or content), but much more about how and why we teach (or pedagogy and philosophy).

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[36] I still hear variations on this statement. I now think of it as evidence people are caught in the tensions between Indigenous and Western ways of knowing, being, and doing.

[37] Donald's (2009) work, in part, presents responses by pre- and in-service teachers to integration of Indigenous perspectives in AB social studies programs of study. Some of the teacher responses to integration in his inquiry are almost verbatim what I have heard from pre- and in-service science educators, as well as science teacher educators.

[38] To be clear, it is not solely non-Indigenous educators who make these statements. Donald (2009) holds the position that nearly everyone in Canada–to a greater or lesser extent–has gone through a school system defined by Western ways of knowing, being, and doing. So, all educators are struggling with what integration might be because they all have been educated in a largely colonized context–some of them are just more aware of it than others.

[39] Although we have to teach something.

I was struck by "I don't even know what this looks like" because I heard it so often. I was also struck by the statement because AB's mandate regarding integration is not an isolated policy shift. Since around the turn of the century, eight of thirteen educational jurisdictions in Canada[40] have adopted broad policy and/or K-12 programs of study (see Appendix B) that in some way mandate integration of First Nations, Métis and/or Inuit[41] perspectives across all K-12 curricula.[42] As such, I began to imagine how many educators in Canada were saying, "I don't even know what this looks like".

As I continued to struggle with my own difficulties regarding research, I returned to "I don't even know what this looks like" again and again. It addressed me, it made me take notice. There was something recognizable and familiar in the statement that I could not let go, that I could not quite put into words, that I needed to understand more. In my second term, I developed an unwieldy research description around the statement, but still no question emerged. Then,

> just as I know an Elder would tell me, the question arrived in a moment of letting go, of half consciousness, in an airplane somewhere over the Atlantic. It was not so much an 'Aha!' moment, as one of sighing recognition. I have come back to the question once asked of me[43], *What does it mean to integrate Indigenous perspectives in science curricula?* And it fits. (Wiseman, 2010a, p. 8)

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[40] The Yukon (YK), Northwest Territories (NT), Nunavut (NU), Ontario (ON), Manitoba (MB), Saskatchewan (SK), Alberta (AB), and British Columbia (BC).

[41] The groups represented in policy generally have identifiable communities within the province or territory in question. For instance, SK (SL, 2003) only names First Nations and Métis peoples in their policy.

[42] Some jurisdictions are more clear on the scope of integration than others. For instance, Ontario's (OME, 2007b) policy is reasonably clear that integration is across all subject areas. The province has, however, subsequently produced supporting resources for elementary and middle school teachers that emphasize integration in social studies and language arts (OME, 2010, 2011), and so my conversation with an educator in Ontario (C. Laflamme*) returned frequently to these subject areas.

[43] This question came up quite frequently during my work at NAEP/MPES.

The questioner becomes the one who is questioned. (Gadamer, 1989, p. 457)

Chapter 3: The Questions at Play

What does it mean to integrate Indigenous perspectives in science curricula? is the first question that arose in my inquiry and the one around which I structured my proposal. While at times it faded into the background, it nonetheless remained active in the inquiry process and returned on numerous occasions to remind me that questions of meaning and the act of understanding (or trying to understand) run deep here.

In undertaking the inquiry two other questions emerged. At first, I imagined the second question, *How are educational stakeholders coming to understand what it means to integrate Indigenous perspectives in science curricula?*, as a reworking of the first question more focused on the methods of my inquiry. As the project progressed, however, it became evident that the two questions are in conversation with each other. They play off each other in a back and forth from broader considerations of meaning to specific, local instances of practice and thinking that are meaningful in and of themselves, *AND* that, when considered collectively, speak back to the idea of meaning and developing understandings (both my own and that of the people I spoke with as part of the research) with respect to integration (and research conducted in the *inter esse*) more broadly. The third question, *What is at play in integrating Indigenous perspectives in science curricula?* arose in my consideration of provincial and territorial policy, but is applicable to the research as a whole. As I worked through the writing, this question became, perhaps, *the* guiding question of the inquiry, but still very much in conversation–at play–with the other two.

In what follows, I look at these questions more deeply, to tease out ideas and relationships active within them. My goal here is not to define carefully and pin the questions down, but rather to consider what is at play in them, and–perhaps–what they put into play, how they are active in the world. To begin, I consider play, flux, and my troubling relationship with Coyote.

Considering Play and Flux/Flux and Play: Making Some Peace With Coyote

Methodologically, I began[44] my inquiry by drawing on ecological interpretations of Gadamer's (1989, 2004) ontological hermeneutics and Indigenous/Indigenist research methodologies (IRMs) (Kovach, 2005, 2009; Smith, 1999; Weber-Pillwax, 1999, 2001; Wilson, 2007, 2008). As such when play arose[45] within the inquiry there were ways for re/cognizing, framing, and understanding it in relation to the methodologies.

Play in Gadamer's (1989) sense has "a special relation to what is serious … 'for the sake of re[/]creation'" (p. 102), and ongoing renewal; for the acknowledgement of what might constitute lives and living together. In this way, play reminds me of Leroy Little Bear's (2012) description of the flux, the chaos that in Blackfoot thinking underlies all of creation. Within the flux there are regular patterns–places where living is possible–that are maintained through deliberate and careful renewal of relationships taken up via ceremony (Little Bear, 2000; Wilson, 2008). I sense a meeting place between Western and Indigenous ways of knowing, being, and doing around play and flux that has been at work in my inquiry since before it began.

Gadamer's (1989) play is an almost essential element for the questioning of hegemonic practice or practice that has become "simply … 'the way things are'" (Jardine, 2012, p. 97), such as the dominance of Western ways of knowing, being, and doing as the underlying and defining assumptions of K-12 programs of study in Canada. In this way, it can be allied (Kovach, 2009; Stewart-Harawira, 2005) with IRMs in that it provides an opening for "researching back to power [with a] purposeful agenda for transforming the institution of research, the deep underlying structures and taken-for-granted ways of organizing, conducting, and disseminating research and knowledge" (Smith, p.88). Play can thus serve as a means of uncovering relationships which may otherwise remain hidden, and point to patterns in the flux as ways of decolonizing practice (Denzin, 2005; Smith, 1999).

I could just as easily begin that last sentence by saying the commitment to decolonizing practice of IRMs puts things into play. I do not mean to privilege play over

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[44] And only began. More on methodology later.

[45] One might consider whether play arose because the methodologies provide a place where it is welcome, or if I chose the starting methodologies because–on some level that I could not articulate at the time of proposal–play was already active in the inquiry. This is a consideration for another time and place.

flux, or vice versa. The point is that the two approaches can have fruitful and, sometimes, unsettling conversations. While some scholars (Kincheloe & Berry, 2004; Somerville, 2007, 2008) report resistance in the academy to research which engages with multiplicity and pushes at the edges of accepted and normalized practice (or creates tension around the edges), Indigenous scholars (Battiste, 2013; Brown & Strega, 2005; Smith, 1999; Stewart-Harawira, 2005) embrace the tensions and insist on the need for research to push at those edges; to open up, create space, and admit voices too long excluded not only at the edges, but right up into the heart of accepted research and research practice in order to consider what might be and how the world can be understood differently. Stewart-Harawira (2005) says such change begins with taking Indigenous ontologies seriously. When ideas, concepts, language etc. from different ways of knowing, being, and doing to circulate together it puts into sharp relief practices normalized, accepted, and largely taken-for-granted. It is risky, and play acknowledges that in coming to understand we are always on risky, tricky ground that might shift or change without much warning. When things are at play, something is at stake, at risk, there is the decided danger of becoming uncomfortable and vulnerable (Jardine, 2000a, 2012), and/or of making others feel uncomfortable and vulnerable–which is also dangerous.

Hermeneutics is named for Hermes, the Greek messenger to the gods. Hermes is the patron of cunning, oration, and wit, and hence his relation to studies involving interpretation and understanding (Ross & Jardine, 2009; Smith, 1991). Hermes is also a well-known trickster and teacher (Jardine, 2006a; Prasad, 2005; Smith, 1991), and so is a (perhaps unwelcome) European relative of more local tricky beings, like Coyote, Raven, and Naapi who are always stalking around the places where we are trying to understand.

In undertaking this inquiry, I have surprisingly found myself physically, theoretically, and in others ways accompanied by Coyote, in various forms. In retrospect, Coyote (or perhaps Naapi, Raven, or Hermes depending on where I have found myself) has been skulking around this work since before it began, nipping at my heels, sitting off in the distance, leaving tracks, and body checking me into large, seemingly immovable objects[46]. I recognize there is the possibility for concern around cultural appropriation in

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[46] But both my experience in engineering and the teachings of Indigenous friends, colleagues, and teachers suggest that nothing is immovable.

acknowledging Coyote in this work. Watts (2013) has raised concerns that while such engagements by non-Indigenous people "may serve to change the imperialistic tendencies in Euro-Western knowledge production, Indigenous histories are still regarded as story and process–an abstracted tool of the West" (p. 28). Baldy (2015), similarly suggests that there is value to scholarship which "demonstrates Indigenous epistemologies and intellectualism" via "Coyote discourse" (p. 2). She also cautions against consideration of Coyote solely in as a metaphoric archetype of trickster, as this positioning erases and ignores Coyote as Teacher and Decolonizer. In my case, Coyote has been anything but abstract, anything but archetype. He is/has been joyfully at play in this work. Still, in the beginning, I tried very hard to ignore him[47], to shush him away and remain grounded in the theoretical and academic where such insistent beings do not traditionally belong. That type of dismissive approach does not work well in the *inter esse*[48], so there was always some opening for him to sneak back in, and leave tracks for me to follow. Moreover, IRMs take such visitations seriously (Kovach, 2009; Smith, 1999). In addition, I share some kinship with Coyote and other tricky, transformative beings–my family name carries the same duality of their being; Wiseman meaning "The wise, discreet man, or ironically a fool" (Seary, 1998).[49] So, while I remain wary of Coyote (and all his relations), over the course of the inquiry we have made some peace with each other. As much as he has lead me down the garden path, picked up and walked away with words and ideas only to put some of them down again in places where I might trip over them, in the end that may not have been such a terrible state of affairs. In order to keep the conversation open, I have risked following his tail instead of chasing my own and closing down the possibilities for life, living, and learning via this work.

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[47] The gender is an assumption.

[48] In attempting to be so dismissive I risk stepping out of the *inter esse*.

[49] The family relationship is perhaps apt, in the moments where Coyote is most present in my work I simultaneously have a sense of the presence of my paternal grandparents, who were both tricky beings themselves.

Interrogating the Questions: Play, Flux, and Slippery Words as a
Hint to the Inarticulable

Given the inherent trickiness of the work, given the play, the flux, the presence of Coyote and friends, I use *the inarticulable*[50] throughout the writing. I take *the inarticulable* up in multiple ways to indicate events/experiences/happenings/ideas emergent in the *inter esse* where Western and Indigenous ways of knowing, being, and doing circulate together; things/not things recognizable, but for which I[51] have–as yet–no or extremely inadequate language. It has been suggested to me that the inarticulable might be indicative of ideas, concepts, or relationships that exist only in an Indigenous language or languages and, because I speak only English and French, appropriate words to describe such things will remain elusive. It has also been suggested to me that in the conversations between Indigenous and Western ways of knowing, being, and doing that can occur in the *inter esse* new ideas, concepts, or relationships emerge for which there is–as yet–no language (Doolittle et al., 2011). In addition, I have wondered if the inarticulable might be indicative of something at play, meaning in flux, change in process, learning, instances where language might be ambiguous and slippery. The inarticulable is likely all of those things and more, a multiplicity that is recognizable but not entirely describable in itself.

There is a certain amount of irony to drawing on Gadamer's understanding of hermeneutics and on IRMs–methodologies that both assign significant importance to language as a means of and location for understanding–and then finding myself at a lack for words. Still, given my observations in this particular piece of research, the inarticulable seems deeply appropriate to the processes, places, and relationships in which I am and have engaged. To be clear, I[52] can often talk around what I am trying to get at, but not directly at it, and so I try on different words and approaches in attempts to get at an elusive *that*. The process can be frustrating and uncomfortable, but it sets things in motion.

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[50] I will delve further into the inarticulable as the dissertation progresses.
[51] And many of the people with whom I had conversations as part of this inquiry.
[52] And many of the people with whom I had conversations with as part of this inquiry.

Shawn Wilson (2008) explains how in Indigenous ontologies and epistemologies "concepts or ideas are not as important as the relationships that went into forming them" (p. 74), in Indigenous languages relationships and how they act are thus often apparent within words. By contrast, in English,[53] "It requires but one word to describe something (a noun or a pronoun), but many words to describe its use" (p. 73). In other words, there is ambiguity and/or abstractness to words[54] in English until you understand how they are being used, until you place them in relation to something else. Again, I can find meeting places where Wilson's thinking seems to converse with thinking based in more Western (and other) traditions. Smith (2008) discusses how identifying this type of relationship within and between words is essential to understanding the use of terms such as "East" and "West"; words that, while constituted in the "West", are actually mutually defining, both as locational constructs and as relationships between real people(s) in the world. Maybin (2001) suggests Bakhtin would concur with this sentiment[55] as his writings indicate that "normative definitions of words are only a starting point in understanding how language creates meaning in particular contexts" (p. 68); that there is a "taste" (p. 68) to words related to the intention of their use–how they act or are at play in the world. Aoki (2005b) points to the slipperiness of words sometimes used in curriculum and curriculum studies to underline that "the choice of which [of the slippery] meanings to count is a legitimating process, a political process, conscious or unconscious" (p. 267); there is intent here as well, intent to include some things (and ideas and peoples, and, and, and …) and keep others out.

Boisseron (2010) writes that French philosopher Georges Bataille played with ambiguity, assumptions regarding normative definitions, and legitimating processes using *mots glissants*[56] to demonstrate that meaning can only be discerned in its ontological expression; in the use of words in practice, or how they act when freed into the world. While Boisseron's description of Bataille's work places it in a poststructuralist frame–in that he deconstructs words to demonstrate their meaninglessness–Bataille also seems postmodern in that he plays with the words to reconstruct the very meaning to which they

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[53] And I would assume many other European languages.
[54] I would argue of most types.
[55] And no doubt broaden its application to European languages.
[56] Trans: Words that slip, or slippery words.

were antithetical. In this way he uses narrative and discourse to disrupt (or introduce slipperiness into) dominant strains of thought by having "readers slip on [a word or concept's] true meaning" (p. 172), essentially demonstrating that the meaning in discourse is tricky and might be whatever the writer intends. This kind of intention and playfulness, however, is not solely modern or post-modern. As Hawai'ian scholar Manulani Meyer (2008) explains, there is a old and once wide-spread belief among her relations on the Pacific islands, "In the causative agency of intention … that effect begins with intention" (p. 222), and so one chooses words, and whether to speak or not, carefully.

Given the inarticulable, the difficulty with language that can occur in the *inter esse*, the very words, wordings and meanings of my questions (1) *What does it mean to integrate Indigenous perspectives in science curricula?*, (2) *How are educational stakeholders coming to understand what it means to integrate Indigenous perspectives in science curricula?*, (3) *What is at play in integrating Indigenous perspectives in science curricula?* are at play. Moreover, I tend to let them out to play because my inquiry is about change; it is focused on engaging with a shift in process, the world in flux, where meaning is caught up in the shift. Nonetheless, I recognize that when words or ideas are slippery, some understanding regarding the relationships in which they are immersed and from which they emerge, is helpful in discerning or at least tracking some sense of meaning. As such, in what follows I interrogate the questions to expose some of their relations. Given that the ending of each question is very similar, I begin by briefly discussing the beginning of the questions focusing particularly on the meaning of meaning. I then move into a deeper consideration of specific words and word groupings at the end of sentence.

The beginning of each sentence

The first two questions begin *What does it mean* and *How are educational stakeholders coming to understand*. In both questions the question of meaning or understanding is central.

I take meaning to be complex and to arise from very human struggles, dialogues, and negotiations about and around ideas/concepts and how they actually manifest and act

in the world. Here, I draw on Gadamer's (1989) understanding of understanding, as laid out by Grondin (2002), as a threefold "plurality" (p. 36) that arises from a personal (or collective) grasp[57] of a text/idea, the relationship between knowing and being[58], and the establishment/existence of some kind of common ground[59] between reader and text.[60] *Texts* I take in a very broad sense to mean entities/objects/events (both concrete and more ephemeral) that can carry meaning and have things to say. Here I include human and other-than-human beings, books, movies, and documents of all sorts, but also the land, and actions, particularly collective actions of bureaucracies and other institutions; essentially, whatever can be read, interpreted, listened to or acted upon. In this way, I attempt to move from meaning in a philosophical sense (Gadamer, 1989, 2004) to meaning in an ecological sense (Basso, 1996;, Jardine et al., 2006; Kulnieks, Longboat, & Young, 2010). This type of understanding assumes there is an active, living, interpretative relationship between places/fields (as geographical, metaphorical, and/or disciplinary locations) and beings, and–certainly from Indigenous perspectives[61]–that places/fields have unique understandings to share (Basso, 1996; Cajete, 1994). It is meaning as an ongoing process of coming to know that is grounded in relationship particular to the place or places (physical and/or metaphorical) in which beings live. It opens up in my work a space for Indigenous perspectives in the conversations that will occur around my questions.

For the third question, *What is at play in integrating Indigenous perspectives in science curricula?,* I have already considered the focus of play in some detail. As such, the question can be considered as asking what is going on or changing, what is at stake, what might be exposed and thus rendered questionable or at risk, what (or potentially who) is made vulnerable in integration Indigenous perspectives in K-12 science curricula?

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[57] Grasp as in "I get it" (Grondin, 2002, p. 36).
[58] It is actually a search for understanding that arises from being, but that in my reading establishes a vital simultaneity (Davis & Sumara, 2006) between knowing and being (and doing).
[59] And, perhaps, almost good will since there has to be some impetus for understanding.
[60] Text in a very broad sense.
[61] Although there are echoes of this type of understanding in much of Jardine's (e.g. 2000b, 2012) work.

Specific words at play

      Educational stakeholders. *Stakeholders* is a term I came to know through the policy work Corinne and I engaged in at NAEP. In my experience, a stakeholder is any person or identifiable group of people who have some relation with and interest in a particular field or process. Educational stakeholders thus include students, educators at all levels, policy makers, education administrators, parents and other family members, textbook publishers, school bus drivers etc.–anyone with a relationship to and interest in education.

      Integrate. Documents in different jurisdictions use different words to describe the process by which K-12 curricula is opened up to Indigenous ways of knowing, being, and doing. Ken Ealey* provides some background to the terminology at play. He says various Canadian jurisdictions have tried on different words–*include, infuse, integrate, incorporate*–in this regard and that there have been discussions about what word to use at the level of the Western and Northern Canadian Protocol (WNCP) for Collaboration in Education. WNCP (2011) uses both the terms *integrate* and *infuse* (p. 1).

      There are difficulties with each of the words used in English. In conversations with people, I generally used the word with which they are familiar[62] in their own jurisdictional discourse for ease of conversation. In writing, I have chosen to use the word *integrate* because it is widely used in the current context, but also because it has a long history in the Canadian context with regard to Aboriginal education, an idea I explore more fully in Chapter 8. More broadly, *integrate* also frequently seems to be the term used in other countries with respect to work aimed at decolonizing education (Council of Australian Governments, 2009; Gitari, 2003; Longboat, 2012; Owuor, 2007; Ritchie, 2012). As will become clear, however, integration becomes a poorly fitting description for some of the processes at play in its name in the Canadian context. As the dissertation progresses, I will begin to slip into and try on other terminology.

      Indigenous, Aboriginal, Western, settler, etc. I recognize that terms such as *Aboriginal*, *Western*, and *Indigenous* are very broad and do not reflect the locatedness, specificities and/or complexities of peoples' epistemological and ontological

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[62] I.e. *Incorporate* or *infuse* in ON (OME, 2007b, 2009a) and *incorporate* in AB (AE, 2005).

relationships with the world[63]. At the same time, working within the current literature, and for ease of understanding, I use these broad terms. In this work, *Aboriginal* is used as a collective term within the Canadian context to refer to First Nations, Métis, and Inuit[64] peoples and their epistemologies/ontologies. *Indigenous* is used as a broader term than *Aboriginal* that includes contexts beyond Canada. *Western* is used as a collective term to refer to ontologies/epistemologies arising from European enlightenment traditions and people(s) that adhere to those traditions. This last term raises some difficulties with regard to how I might broadly refer to people and peoples in Canada who are not Aboriginal given the country's contemporary commitments to multiculturalism and immigration. That is, not all non-Aboriginal people in Canada are *Western* or *Canadian*[65]. In these cases I use the terms *settler* and *non-Aboriginal*[66] people, peoples, and/or communities. The term *Indian* is largely a colonial remnant in legal documents that nonetheless specifies a particular legal status in Canada. I will use it only in these cases, or where it is used by others. When I speak of specific people, or peoples, I will refer to them by their own nationalities. When paraphrasing or quoting the work of others, I will use the terms they use in order to honour their work.

Indigenous perspectives. I understand Indigenous perspectives as the ways of knowing, being, and doing of peoples with extremely long-term relationship to specific places. In other words, Indigenous perspectives are in some ways emergent from and constrained by physical geography; that is, the worldview of the Mohawk people whose traditional territory covers significant parts of contemporary QC, ON, and New York is quite different from that of the Blackfoot people whose traditional territory covers parts of AB and Montana. At the same time, there are commonalities that appear to run across different Indigenous nations with respect to ideas concerning learning, where learning is very much based in the processes of life. I understand Indigenous perspectives in Cajete's (1994, 2000) manner as perspectives held by contemporary Indigenous peoples in the

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[63] Given my experience as a Québecoise and the make up of my family, I would not suggest that Mohawk and Cree people (as either language groups or nations) are the same because they are both Aboriginal, any more than I would suggest English and French people (as either language groups or nations) are the same because they are both Western.

[64] I include in this grouping people who fall under the legal distinction of non-Status Indian.

[65] For the sake of acknowledging the complex, I will also note that not all Indigenous people in Canada are Aboriginal.

[66] Or *non-Indigenous* in broader contexts.

world, and thus, while based on long-term knowledge of a place, entirely contemporary and complexified by exposure to and intermingling with perspectives of other Indigenous peoples as well as those of settler peoples (McKinley, 2007). At the same time, I recognize that this interpretation of Indigenous perspectives is very broad. In relation to science the term is often more specifically narrowed to something perhaps more congruent with what science might be. Alternate terms at play include traditional ecological knowledge (TEK) (e.g. Hamlin, 2013) and Indigenous ways of living in nature (e.g. Aikenhead & Michell, 2011).

Science. Part of the challenge with regard to the questions is that *science* itself is an elusive term. Its definition is one of the ongoing conversations in the philosophy and nature of science (e.g. Charlesworth, 1982; Kuhn, 1962; Polanyi, 1964; Taylor, 1996). Within the contexts where I work, *science* as a term (and practice) is interrogated by both Indigenous and non-Indigenous people and scholars examining positions of agreement, disagreement, congruence, and complementarity between Western and Indigenous conceptions of the world and the way it works. While there is inadequate space for a complete overview of the challenges around the term and proffered/preferred alternatives to it in contexts where there is some coming together of Indigenous and Western ways of knowing, being, and doing, I provide a brief sense of the relationships at play.

Brayboy and Castagno (2008) and Sutherland and Henning (2009) have examined uses and understandings of the term *science*. Both pairs of authors draw heavily on work by Garrison (1995) and Garoutte (1999) that posits science as a "way of knowing", " a certain style of thinking, and certain ways of asking questions and finding out answers" and a study of things, "which impinge on the wakeful senses from the physical world" (Brayboy and Castagno, 2008, p. 736). Both Brayboy and Castagno, and Sutherland and Henning also provide a sense of science as an active process of coming-to-know, and distinguish between *Western science* (emergent from Western ways of knowing, being, and doing) and *Native/Aboriginal/Indigenous science* (emergent from Indigenous ways of knowing, being, and doing). Other authors posit that Indigenous conceptions of the world and the way it works should not be represented by the word *science* at all because science is so closely associated with Western and colonial epistemologies and ontologies (El-

Hani & Bandeira, 2008). I have, on occasion, heard this sentiment expressed in community by Aboriginal people[67].

Aikenhead and Elliot (2010) use the terms *Eurocentric science* and *Indigenous knowledge* (IK) to discuss changes in Saskatchewan (SK) K-12 science programs of study that account for integration. They describe how within the programs IK is defined for teachers via a definition of traditional knowledge provided by the International Council for Science (ICSU):

> a cumulative body of knowledge, know-how, practices and representations maintained and developed by [Indigenous] peoples with extended histories of interaction with the natural environment. These sophisticated sets of understandings, interpretations and meanings are part and parcel of a cultural complex that encompasses language, naming and classification systems, resource use practices, ritual, spirituality and worldview. (p. 331)

They then explain how a group of Aboriginal educators and advisors, in collaboration with bureaucrats at Saskatchewan Education, decided to continue the use of the term *science* in programs of study rather than replace with it with *Eurocentric science* because of "an extraordinarily strong parallel between the scientific enterprise (as understood from a humanistic perspective) and the ICSU's definition of traditional knowledge" (p. 332). In a slightly later book aimed at supporting pre- and in-service teachers as they work towards integration of Indigenous perspectives in K-12 science curricula, Aikenhead and Michell (2011)[68] distinguish between *Eurocentric* or *Western science* and *Indigenous way of living in nature*. As with Brayboy and Castagno, and Sutherland and Henning, for Aikenhead and Michell *Eurocentric* or *Western science* is science emergent from Western ways of knowing, being and doing[69], whereas *Indigenous ways of living in nature*[70] are positioned as place-based, holistic, dynamic, and as accounting for the material, sacred and mysterious.

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[67] Not with respect to whether science should or should not be taught, but with respect to what language it should be taught in.

[68] Aikenhead and Michell (2011) provide a deeper interrogation of a number of the terms I consider in this writing.

[69] There is some circular reasoning at play here in using the term science to position Western science. This kind of reasoning is quite frequent in the literature and without writing another dissertation I am at a loss for how to avoid it myself.

[70] In his dissertation, Michell (2007) uses the term *Indigenous-based science* and so there is slipperiness and change even within the work of individuals.

In pointing to these differences in terminology, I am not critiquing the shifting definitions as much as pointing to the many challenges at play around what terminology to use, and how such terminology is active in the world. I suspect part of what is going on in these debates and discussions is the difficulty of finding a suitable term or phrasing in a noun-based language, such as English, for what is essentially a process from which particular kinds of understandings emerge. Darren McKee* explains that:

> I grew up in a world that we interacted with science on a daily basis, only we didn't call it science. You know we really did call it what it was, which was, you know, interacting with, in a very ... well, I guess both informal and formal way, but it was really an opportunity to learn, to become competent.

Darren's description of science meshes both with the description of traditional knowledge presented by the ICSU and with the working definition of science provided by Cajete (2000). Cajete returns to the Greek root of the word to take up science "in terms of the most inclusive of its meanings, that is, as a story of the world and a practiced way of living in it" (p. 14). I tend to take up the word *science* in this manner because my experience with practicing scientists and Elders suggests that science as practiced and Indigenous understandings of the world–also as practiced–are often much closer together than usually conceived[71]. At the same time, I remain aware of discussions and debates around terminology as means of considering alternatives.

Curriculum. Like Aoki (2005g), my understanding of curricula is broad. I take it to be both the curriculum-as-plan, as laid out in official programs of study that emerge from and reflect government policy and priorities, teacher intentions, and expectations, and curriculum-as-lived, the manner in which programs of study are taken up and negotiated by teachers and students together in classrooms. Conceived in this manner, curricula become not stringent outlines of what must be taught, but complex locations in which subject matter, pedagogy, and philosophy of education intertwine and interact within the livingness of particular classrooms. As will become evident further into the writing I also view curriculum as an entity that acts (Wallin, 2010).

Science curricula. There is a difference between science as practiced by scientists and science as curricula in schools. While the two are related, the first is

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[71] Although there remain areas of tension.

practice at the edge of understanding, and the second focuses on what scientists have come to understand about the world and the way it works so far. As a general rule, K-12 students are not pushing at the edges of scientific understanding and producing new knowing[72]. Instead science curricula in schools explores what science is (and is not), ideas around which there is existing consensus among practicing scientists, coming to understand via inquiry and problem solving, and the skills required for engaging in inquiry and problem solving. Within this writing, I will refer to K-12 science curricula or school science as a means of distinguishing between science and science curricula.

A Few Final Thoughts on the Questions and Parallels in My Own Process

For her masters degree, Kathy Denning* also undertook research in a place where Indigenous and Western ways of knowing, being, and doing circulate together; a place where meaning is slippery. In our conversation, she explained that she has not published the primary (and interesting) results from her Masters' research because the question with which she entered into the research is not the one she answered. It seems to me that when and where meaning is at play, at risk, in flux, questions that are well-defined and precise may allow little room within which understanding (new or otherwise) might emerge and be re/cognized. My questions are far from perfect, the words and wording are at play, throughout the writing they shift and transform, it is messy. Given the context of my research, however, they have been good enough. They have allowed me to engage in inquiry by opening up conversations, creating space for consideration of meaning and practice, and providing a place where some kind understanding has begun/is beginning to emerge.

As I noted at the beginning of this chapter, research where Indigenous and Western ways of knowing, being, and doing circulate together is not solely about the questions being asked (from which the inquiry may begin), but also about decolonizing, and particularly about decolonizing research. A complex of conversations emerges in and

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[72] There is at least one recent exception to this rule. A group of elementary school students in the United Kingdom undertook original research on bee behaviour and had their results published (Blackawton Primary School et al., 2011) in *Biology Letters*, a peer reviewed journal of the Royal Society.

from these simultaneous projects. So while I have had conversations around and about the questions

1) *What does it mean to integrate Indigenous perspectives in science curricula?*

2) *How are educational stakeholders coming to understand what it means to integrate Indigenous perspectives in science curricula?*

3) *What is at play in integrating Indigenous perspectives in science curricula?*, all the way through the inquiry process I have asked myself similar questions regarding my own practice of researching/inquiry (and teaching). Here I replace the word *integrate* with *engage* and leave out the words *in science curricula*, to consider deeply what it means to engage with Indigenous perspectives in academic inquiry, how I am coming to understand what it means to engage with Indigenous perspectives in academic inquiry, and what might be at play in engaging with Indigenous perspectives in such inquiry. The two processes and sets of questions have been/are in conversation with and reflective of each other throughout the process. In attending to educators' struggles with integration, I learned so much about and how I might live with my own commitments and processes both with respect to integration and academic inquiry. It was these conversations that ultimately allowed me to recognize return and conversation as something that extends beyond the verbal, and engage with the inarticulable via doing.

It is only by doing that we learn. (Meyer, 2003, p. 6)

Chapter 4: The Messiness of Letting Things Out to Play:
The Importance of Doing and Being

I was initially hesitant to connect this work to my Masters' thesis (Wiseman, 2002), which took place in another Faculty[73], another field[74], but it was still focused on trying to bring Western and Indigenous ways of knowing, being, and doing together around science curricula. While that work is quite different from this one, I have come to realize there is a strong underlying relationship between the two in that they both attempt to break down the episteme/phronesis split. In both processes, I have had to take up research, play with it, and dig into the messiness of actually doing something in order to come to some kind of knowing or understanding.

I came to notice this commonality late in this writing while reflecting on my own learning. I cannot say with any certainty where this approach to engaging with academic inquiry arose; it does not seem to have been entirely conscious. I can say that in my understanding engineering is all about addressing the episteme/phronesis split, and that I still draw on many of the ways of coming to understand that I learned in engineering. In addition, I know from my time at NAEP, as well as my interactions with and reading of work by Indigenous scholars (e.g. Battiste & Barman, 1995; Brant Castellano, Davis, & Lahache, 2000; Cajete, 2000; Meyer, 2013b; Shenandoah, 2001), Elders, and knowledge holders (e.g. N. Blood*, P. Garrow*, J. Lavallée*, L. McGregor, April 4, 2002; D. McKee*) that knowing in the absence of being and doing is unbalanced (Meyer, 2013b), and therefore unhealthy. I also know that for my grandmothers one of the most derisive evaluations of a person was "She isn't very good with her hands". To my understanding, this very Scottish statement implies a similar relationship between knowing, being, and doing as that received from my Indigenous relations. They both suggest that knowledge is a rather static, limited thing, whereas knowing (as an active doing and being) is freed into and acts in the world in creative ways; that in fact, doing, and being might precede knowing.

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[73] Arts and Science.
[74] Media Studies.

Manulani Meyer (2013b) is explicit about the beginning points for knowing. She explains that doing and being precede knowing and once a person understands this as cycle it can lead to an embodied understanding that is reflected in how s/he acts and is in the world. In Hawai'ian, Meyer names the process *māramatanga* and, in English, effulgent coherence. I have chosen to frame my dissertation in this approach. It is explored in more depth in Chapter 6.

So, the focus here is doing and being as a means of coming to know. Given the focus, I have made deliberate choices to try and keep the process of doing the research as open as possible, to let the inquiry be what it is, not to try to frame or bracket anything out from the start. The result is a little messy, but life is messy, and I am fundamentally interested in life and livingness in teaching and learning. Large parts of the learning within this work thus come from play in and with the messiness of researching and writing.

Methods and Locations of Evidence: What I did

Given the importance of doing to what has emerged in the inquiry I lay out my methods–or what I have done–up front without significant connection to or grounding in methodology. I understand this is unconventional practice, but within a framing of *māramatanga*/effulgent coherence this structure allows me to more accurately reflect process and coming to know as it has occurred, and may better support reader understanding of the complexities at play in the work as a whole.

I take up three distinct, but related, elements in the inquiry:

1) consideration of provincial/territorial policy with respect to integration of Indigenous perspectives in K-12 curricula and the manner in which Indigenous perspectives appear in K-12 science programs of study (policy);

2) conversations with 16 educational stakeholders from the provinces and territories where integration of Indigenous perspectives in science curricula is in some way mandated (practitioners);

3) explorations from the Indigenous Teaching and Learning Gardens project in the Faculty of Education at UA that emerged alongside my dissertation research (practice).

While I present the elements in this order both here and within the dissertation as a whole, it would be false to assume that each element follows the previous element and builds on it. They are very much co-temporal, very much intertwined and mutually informing. Within the writing I will return briefly to expand on methods as required.

Policy: Reading and rereading documents

In reviewing policy, I examined documents from each of the eight jurisdictions that have mandated integration of Indigenous perspectives in K-12 curricula. The review includes 15 broad policy documents that speak to integration across curricula generally, and more than 50 K-12 science programs of study (see Appendix B)[75]. Given the volume of text to be reviewed I limited my consideration of science programs of study to those that lead to university entrance. Curriculum renewal–in general and with respect to integration of Indigenous perspectives in K-12 science curricula–is an ongoing process. Every effort was made to remain current with documents through the end of December 2013. New programs, amendments or additions after that date are not considered.

The initial review of documents was comprehensive and fine-grained. I read and reread documents to consider the manner in which key ideas related to the integration of Indigenous perspectives were presented and put into play. I also tracked similarities and differences across jurisdictions, not so much to compare and contrast, but more as a means of considering what might be possible, and what might be at play in specific jurisdictions based on how possibilities with respect to integration of Indigenous perspectives in K-12 science curricula are framed. In addition, I attended to language in some detail in order to consider how and what language works to support, ignore, and/or rupture relationships, where there are hegemonic assumptions underlying the texts, where the texts invite consideration of the new, what is said by the absence of certain ideas, etc.

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[75] Given the length of this list of references, I have included a list of what I have examined in terms of policy and programs of study, broken down by province and territory in Appendix B. From this point on, I will reference Appendix B instead of providing the entire list of documents when I refer to them collectively. Where specific documents are referenced as examples I will continue to refer to them within the text.

I have presented some of the results of this analysis on more than one occasion (Wiseman, 2012, 2013; Wiseman & Onuczko, 2014).

In earlier versions of this dissertation, the policy review and analysis ran to over 100 pages. While it included elements of the analysis that remain in this piece, it considered in much more depth and detail how specific ideas and concepts arose within documents, how they were defined and framed, and the manner in which they flowed (or did not) within and between documents both within and across jurisdictions. I looked specifically at points of disjuncture, where ideas developed in certain documents were not taken up in the same manner in others, and offered multiple example of how this occurs in different jurisdictions and types of documents. In addition, I considered how specific words (e.g. sustainability, stewardship) are understood differently in their Indigenous and Western beings, and how these differences in understandings might lead to quite different interpretation and implementation of curricula in classrooms. Parts of the initial analysis remain in this writing. However, in order to render it more manageable within the limits of the dissertation, I have drawn on it alongside my conversations with educational stakeholders, to focus on the commitments made to integration of Indigenous perspectives in K-12 curricula via policy and science programs of study and how such commitments frame relationships in particular ways.

Practitioners: Conversations with educational stakeholders

In order to grasp how educational stakeholders are coming to understand what it means to integrate Indigenous perspectives in science curricula, I proposed having conversations with Elders, K-12 teachers, and education policy makers, although my ethics were structured so that K-12 students, pre-service teachers, parents, and other stakeholders might be included. Indigenous scholars (Kovach, 2009; Archibald, 2008) point to conversation and story as appropriate means for conducting research in a manner that moves it from "an extractive exercise serving the fragmentation of knowledge to a holistic endeavour that situates research firmly within the nest of relationship" (Kovach, 2009, p. 99). More importantly, I have extensive experience with conversation as a means of listening to and engaging with people and ideas via my work with Corinne at NAEP and thus know conversation as appropriate to the contexts of my work. In doing the

research, in having conversations, I have come to understand conversations much more deeply as acts of living with–processes which may lead to knowing, but that begin with being and doing within the complex of relationships from which we emerge and in which we are embedded.

Cree scholar Laara Fitznor explains the importance of pre-existing relationships in research, "They know me, I have a good reputation and they know I would be trustworthy" (in Kovach, 2009, p. 98). As such, I initially approached people I knew through NAEP. My familiarity with the initial group of people with whom I had conversations (and theirs with me) provided a level of trust and comfort which might otherwise be unattainable, and allowed for the opening of conversations in which stories, concerns, and hopes might be frankly expressed. As per protocol, I, or someone acting on my behalf, offered Elders tobacco prior to our conversations. In conversations with this initial group, I asked them to suggest other people who I should reach out to for additional conversations. Given the scope of my work at NAEP, some of the referrals were to people I already knew. In total, I approached 23 educational stakeholders in all eight Canadian jurisdictions mandating integration of Indigenous perspectives in K-12 science curricula. Two referred me to other people who might know more, one was unavailable due to ill health, two provided brief anonymous feedback/advice/directions along which to look, and two did not respond to my invitations[76]. In the end 16 stakeholders from six of the eight jurisdictions agreed to inform my inquiry in conversation. The jurisdictions in which I was unable to have conversations were British Columbia (BC) and the Yukon (YK).[77]

Conversations lasted from 30 minutes to over 2 hours. They took place in coffee shops, cafeterias, restaurants, conference rooms, classrooms, cars, and peoples' homes. Given distance and scheduling, four conversations occurred via Skype. While the conversations were quite informal and did not follow a predetermined set of questions, they usually began with an overview of the research and why I had asked to have a conversation with the person in question. This introduction often led to the person just starting to talk. If an initiating question was required, I usually asked how they had come

[76] These last two were people with whom I had no pre-existing relationship.
[77] The absence of these two jurisdictions is unfortunate, because they are closely related geographically an in terms of science programs of study (see Appendix A).

to know about the mandate to integrate Indigenous perspective in K-12 science curricula in their own jurisdiction. The people I spoke with were clearly ready to have such conversations. To a person they had/have clearly spent lots of time thinking about integration and how it might be related to larger considerations of relationships between Indigenous and settler people, peoples, and communities in Canada. They had so much to say that, in many cases, after my introduction, I spoke very little. In the time I spent with transcripts and recordings it frequently seemed as if they were speaking with each other rather than with me. Initially, I played out this "found" conversation within the bounds of the dissertation, but realized that it might not read the same for people unfamiliar with the whole of the conversations I had engaged with. When I stepped back into the whole, I realized the found conversation was indicative of patterns in the flux. In this version of the writing, the conversations are woven into and throughout the chapters sometimes explicitly, sometimes less so. In places where I have chosen specific conversations or pieces of conversation to focus on, or to illustrate a point, it is not because there are no other conversations that might serve, but rather that the conversation highlighted is more representative of the overall pattern I am tracking.

All conversations were audio recorded and later transcribed.[78] Transcriptions were sent back to individuals for them to consider and edit as desired. During conversations, I took field notes of points that stood out and questions emerging. I followed up with several people either in person or by email as a means of clarifying specific points in conversations and asking if my interpretation of their thinking fit their intentions and meaning. Everyone received a small gift–jam, apple or raspberry butter, maple syrup[79]–as a token of appreciation for sharing their time, knowledge, experience and wisdom with me. My ethics allowed for people to waive anonymity which most people chose to do, those people who did not have been assigned a pseudonym.

In doing the research, through engaging with the inquiry, most of the people I spoke with brought all of their relations–as parents, grandparents, children, aunts and uncles, healers, researchers, hunters, friends etc.–to the conversations. So, while I identify

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[78] I used a transcription service for most of the work, and then worked extensively in a back and forth between written word and audio recordings in order to understand conversations.
[79] Jim Kreuger*, who lives in Baker Lake, NU, said the maple syrup was the equivalent of "pure gold" in his community.

them by their status as a particular type of stakeholder within the education system, what they shared extended well-beyond such narrow confines. The following people have informed my inquiry via conversations.

Narcisse Blood[80]. Narcisse Blood was a Blackfoot Elder from the Kainai Territory in southern AB. He had a long relationship with Red Crow Community College, where he was the former director of Kainai Studies program. An internationally recognized scholar and knowledge holder, Narcisse travelled widely for teaching, learning, and research. I had known of Narcisse for a number of years, and had heard him speak several times before we met. I met him through his wife, Alvine Mountain Horse, a friend and colleague from UA. She was the person who suggested I speak with him as part of my dissertation work. Our conversation occurred in a café in Edmonton on March 15, 2012.

Steven Daniel. Steven Daniel is the Sciences and Secondary Education Coordinator in the Northwest Territories (NT) Department of Education, Culture and Employment. Over the last 35 years, he has worked in the Northwest Territories (NT) as a science and mathematics teacher, school administrator, and curriculum developer. I met Steven through NAEP and have worked with him in on a number of occasions over the last 15 years. Jim Kreuger (see page 66) suggested that I speak with Steven because of the understandings and commitments he has developed with respect to science teaching and learning in northern Canada, and his role in the development of the territory's *Experiential Science 10-20-30* course (Department of Education Culture and Employment, 2006). Our conversation occurred by Skype on April 4, 2012.

Kathy Denning (pseudonym). Kathy Denning is a former high school mathematics teacher. She currently works in a large Canadian university in central Canada supporting Aboriginal students' entry into professional degrees through skills upgrading. She also works with both Aboriginal and non-Aboriginal K-12 students and their teachers through outreach and professional development related to science and mathematics in the province in which she resides. I know Kathy in a professional capacity and have worked with her on a number of occasions for more than a decade. A mutual colleague suggested that I speak with Kathy because of her work both in the

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[80] Narcisse was killed in a multi-vehicle accident outside of Regina, SK on February 10, 2015.

university and communities. Our conversation occurred at her place of work on December 3, 2011.

Bill Dobbs (pseudonym). Bill Dobbs is a secondary teacher in a large Western Canadian city with a background in physics and mathematics. He is also a Master Gardener and qualified permaculture designer. He works in a very large, urban high school where there is a significant enrolment of Aboriginal students. His school board partners with community Elders who spend time at the school. Bill and students at the school have developed and run a permaculture program which includes a substantial school garden. He works alongside Elders, teachers, and students in a number of science and non-science courses to identify how the permaculture program might support teaching and learning. I first met Bill during a visit to his school. I spoke with him because the commitments he has come to understand through his study of permaculture seem to provide a meeting place where Western and Indigenous ways of knowing, being, and doing have the potential to circulate together. Our conversation occurred in a restaurant on January 31, 2012.

Ken Ealey. Ken Ealey is a former science teacher and consultant with the Edmonton Catholic School Board. He is Métis. For the last several years, Ken has worked on the First Nations, Métis, and Inuit portfolio at AE and concurrently pursued a PhD. His research interests are similar to my own. I met Ken through NAEP, when he attended one of our professional development workshops in Montréal, QC and Winnipeg, MB. He and I have remained in touch over the years and have had many discussions regarding science teaching and learning, First Nations, Métis, and Inuit perspectives and science, and the participation of Aboriginal young people in the sciences. I spoke with him because of our ongoing discussions and similar interests. Our conversation occurred at a café in Edmonton, AB on February 1, 2012.

Frank Elliott. Frank Elliott holds a doctorate from the Faculty of Education at UA. Frank has been a science educator for more than 30 years, and has also done research in biochemistry. I first heard of Frank when he was a science teacher at Amiskwaciy Academy, a school in Edmonton that provides education in an FNMI context. I came to know him once I began my own studies at UA. His current teaching occurs largely in the context of UA's Aboriginal Teacher Education Program (ATEP).

Tracy Onuczko (see page 68) suggested I speak with Frank because of his work at Amiskwaciy and ATEP, and the congruence of his research with my own. Our conversation occurred at UA on January 26, 2012.

Peter Garrow. Peter Garrow is a former teacher, administrator, and policy maker from the Mohawk Territory of Akwesáhsne which includes land in the provinces of ON, QC, and the state of New York. Before entering semi-retirement, Peter was the Director of Education, Jurisdiction, Governance, and Languages for the Assembly of First Nations (AFN). He continues to consult and advise tribal authorities on issues related to his AFN portfolio. I met Peter through NAEP when he was Director of Education for the Akwesáhsne Mohawk Board of Education (AMBE). I asked to speak with him because of his vast experience, his understanding of Indigenous education on a national and international scale, and the work that occurred in science education at AMBE while he was its Director. Our conversation occurred by Skype on April 13, 2012.

Randy Herrmann. Randy Herrmann is a Métis engineer from Manitoba (MB), and the Director of the Engineering Access Program (ENGAP) at the University of Manitoba in Winnipeg. ENGAP provides academic, financial, social and spiritual support for self-identified Aboriginal students who wish to pursue degrees in engineering. The program also undertakes community outreach and work with teachers similar to that of NAEP/MPES. Along with administrative, recruitment, and outreach duties, Randy teaches high school physics for ENGAP students who require review and upgrading for entry into first year university courses. I met Randy early in my tenure at NAEP and have worked with him closely on a number of projects over the years. I chose to speak with him because of his work with teachers and his broad understanding of mathematics and science education in both on- and off-reserve schools in several Canadian jurisdictions. Our conversation occurred on December 3, 2011.

Greg Henkleman. Greg Henkleman is an award-winning biology teacher at a large secondary school in Edmonton, AB. I met him when we were colleagues in the graduate program in secondary education at UA. Since the requirement to integrate Aboriginal perspectives in science curricula first appeared in AB, he has made attempts to work with Elders and other Aboriginal community members in the courses he teaches. Greg has a particular penchant for Charles Darwin's theory of evolution. I asked to speak

with him as a means of thinking through research conversations and reading where ideas about evolution and revolution arose. In the course of our conversation we also discussed how he is coming to understand what it means to engage with Aboriginal perspectives in science curricula. Our conversation occurred at UA on January 28, 2012.

Haley King (pseudonym). Haley King is a secondary science teacher in a large, urban school in Western Canada where a good number of Aboriginal students are enrolled. She has taught mathematics, general science, chemistry, biology, and physics at the senior high school level for over 15 years. I met Haley through a mutual friend, and know her primarily on a personal level. As such, I know she grew up in a rural setting that she returns to regularly when visiting family. I asked to speak with Haley because, as far as I know, she has little or no background or connections to First Nations, Métis, or Inuit people, peoples or communities that might support how she is coming to understand integration of Aboriginal perspectives in science curricula. Our conversation occurred over tea in her home on March 26, 2012.

Jim Kreuger. Jim Kreuger is a program consultant for the Nunavut (NU) Department of Education. For many years he was a science teacher in Baker Lake, NU, where he raised his children and continues to live during the school year. Jim founded and coordinates the Kivalliq Science Educator's Community (KSEC), an organization that supports science teaching and learning in the Kivalliq region[81] of NU through professional development, land-based science-culture camps, science Olympiads, territorial science fairs and other programming. I met Jim through NAEP, and have worked with him on a number of occasions in different parts of Canada. I spoke with Jim because, as a non-Inuit who has spent many years in NU, he has extended experience of living his life in the *inter esse*. Our conversation occurred over tea at a hotel in Winnipeg on December 3, 2011.

Caroline Laflamme. Caroline Laflamme is an elementary school teacher and parent of a teenage daughter. She lives and teaches in a small, upper middle class community near Toronto, ON. Her students are (as far as she knows) non-Aboriginal children from the same community. Caroline completed her education degree in Montréal

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[81] Kivalliq is the southernmost region in NU and includes the communities of Arviat, Baker Lake, Chesterfield Inlet, Coral Harbour, Rankin Inlet, Repulse Bay and Whale Cove. Baker Lake is the furthest inland community.

and has been teaching for more than twenty years in ON. An award-winning educator, she has taught students in most elementary grades, but now mainly teaches young people in grades 5 and 6. She and I attended the same small, girls' private high school in downtown Montréal. I choose to speak with Caroline because of her extended experience in provincial schools. In addition, I spoke with here because, as far as I know, she has little or no background or connections to First Nations, Métis, or Inuit people, peoples or communities that might support how she is coming to understand integration of Aboriginal perspectives in science curricula. Neither does she have a background in any of the sciences past high school. Our conversation occurred by Skype on April 9, 2012.

Jules Lavallée. Jules Lavallée is a Métis Elder originally from St. Laurent, MB, who now lives in Winnipeg. He has worked in and headed up a number of First Nations and Métis institutions in the city during his career. He has also taught courses regarding Aboriginal perspectives and ways of knowing at the University of Manitoba and Red River College. Currently, Jules serves as an Elder at a number of Winnipeg public schools, often visiting classrooms to work with students and teachers. He also counsels people at the Circle of Life Thunderbird House in Winnipeg and at his sweat lodge outside the city. Randy Herrmann (see page 65) arranged my meeting with Jules, with whom he has worked with on other occasions. Randy joined us for a good part of the conversation which occurred at Thunderbird House on December 3, 2011.

Darren McKee. Darren McKee is originally from the interlake region of MB. He is Anishnaabe. He has worked in SK for many years as a teacher, school administrator, Superintendent and Director of Education in First Nations schools. I first met Darren through a mutual colleague and friend. We have since worked (and played) together on a variety of projects related to mathematics, science, and Aboriginal perspectives. Currently, he is the Executive Director of the Saskatchewan School Boards Association. Prior to this position he was an Assistant Deputy Minister in the provincial Ministry of Education. I spoke with Darren because of his various roles in education, his work at the Ministry in the period when SK was renewing science curricula, and his broad understanding of education contexts across Canada. Our conversation occurred at the University of Winnipeg on December 2, 2011.

Tracy Onuczko. Tracy Onuczko is a PhD candidate in Secondary Education at UA. She has taught high school (biology, general science, and special education) in AB for the last decade. Tracy's research for her M.Ed. (Blood, 2010) focused on issues and challenges faced by non-Aboriginal biology teachers as they consider integration of Aboriginal perspectives. I met Tracy in a course during my first year at UA when she was beginning her Master's degree. She has since become a good friend and research partner.[82] When the direction of my research became clear near the beginning of 2010, Tracy was one of the first people I knew I wanted to speak with. Our conversation occurred at UA on November 22, 2011.

Sherry Taylor. Sherry Taylor is a semi-retired teacher and curriculum developer from AB now living in BC. She currently consults for the Critical Learning Consortium as its Western representative. Early in her career, Sherry worked in the Sunchild and O'Chiese First Nations as a forest fire lookout. Ken Ealey suggested I speak with Sherry because of her work as project lead on the (now shelved) program of study renewal for elementary science in AB which involved significant outreach to and consultation with First Nations, Métis, and Inuit people, peoples, and communities. Our conversation occurred by Skype on April 4, 2012.

Such descriptions do little to bring out the generosity, kindness, caring, and humour that was shared within the conversations that occurred. Neither do the descriptions do justice to the ongoingness of the conversations and relationships, some of which began almost two decades ago and persist, others that have continued subsequent to the dates listed above. Many of the conversations have been clarified, deepened and extended by email, additional words in passing, and more in-depth, collaborative work. Some of the people I spoke with have shifted their thinking significantly since the dated conversations above. The conversations are thus acts of living with. Nearly all of them occurred over tea.

I must also acknowledge that as news got out into the world about the project I was pursuing for my dissertation, other people I know in various parts of North America reached out to me without wishing formally to be included in the research. Because

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[82] The conversation with Tracy* that I refer to within this writing took place well before we began a research collaboration.

listening and sharing are part of being a "good little sister", I have respected their wishes in this regard, and thank them for guidance that clarified intentions, interpretations, and challenges with respect to integration of Indigenous perspectives in K-12 science education both generally and in specific places. As there is no way to unhear what they shared, these people circulate within my current work, as they have for years.

Practice: Indigenous teaching and learning gardens

My research proposal was explicit about the dissertation's focus on policy and conversation as locations from which evidence might emerge. At the same time, given my experience in places where Indigenous and Western ways of knowing, being, and doing circulate together, I recognized that I was engaging in a process embedded in and emergent from a web of relations, some of which I was unaware of at the time.[83] I thought perhaps this emergence might manifest as invitations to take part in newly implemented programs, to review supporting documents[84], to talk to K-12 students, etc. As it turned out, the emergence manifested in as an instance of doing and being in my own practice.

The Indigenous Teaching and Learning Gardens in the Faculty of Education at UA grew concurrently and alongside the research for my dissertation. The Gardens came about when members of the Faculty community were asked to make suggestions regarding potential ways for reclaiming unused outdoor space in the Faculty. I suggested that, since the Faculty had no teaching and learning gardens, we might use the spaces to this end, and that creating the gardens as a place for plants indigenous to AB and the

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[83] It is certain that I am still unaware of some of the relationships at play with regard to my inquiry, however, in the process of doing the research I have exposed more of the relations than were evident to me at the time of my proposal.

[84] People did give or refer me to a significant number of supporting programs and documents. For example, Steven Daniel* sent me copies of the textbooks (Campbell et al., 2009; Campbell, Freeman, Richardson, & Wunderlich, 2012; Campbell, MacLulich, Wheelock, Williams, & Wunderlich, 2008) for the Northwest Territories Experiential Science 10-20-30 courses (DECE, 2006), and multiple AB-based contacts (e.g. N. Blood*; F. Elliott*) referred me to the online resource, *Walking together: First Nations, Inuit and Métis perspectives in curriculum* (AE, 2012). While I have spent some time with these resources, they do not inform this inquiry in a significant manner. There are, however, a number of further research questions that might be considered in their examination, and to my knowledge little academic work has specifically explored resources intended to support integration of Indigenous perspectives in K-12 curricula (science or otherwise).

prairies would provide a means for initiating conversations and explorations around integration in science curricula (and potentially other) courses. Since the suggestion, I have been coordinating the Gardens project along with Florence Glanfield and Tracy Onuczko.

The Gardens are a result of Elders, undergraduate and graduate students, faculty members, and staff[85] working collaboratively to consider how such a place might serve as a location in which the Faculty community might meaningfully engage with Indigenous perspectives in science (and other) curricula. The garden sites are open for teaching, learning, and research to all members of the Faculty community. Since the project's start in Summer 2011, seven sections of three different science curriculum courses– representing approximately 170 students in elementary and secondary education–have been directly involved in research in the Gardens in some manner[86].

As the Gardens grew from an idea to real places, it became clear that they were in ongoing conversation with the other elements of my dissertation inquiry. In consultation with Florence Glanfield and the departmental Research Ethics Board representative I was given permission to include research from the Gardens in my dissertation. Given that the Gardens engage in the same messy play as my dissertation, the data collected there has been broad and includes: fields note, classroom observations, pre- and post-course surveys, course work, talking circles, and photographs.

As will become evident in Chapter 14, the Gardens actually came into being well before the question of reclaiming unused space arose. They existed in my imagination–or perhaps my dreams–as some kind of strange attractor around which my explorations of policy, my struggle to do research in the *inter esse*, and my colleagues tensions with what integration might look like in K-12 science curricula circulated. As they came into a more

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[85] Early advice and direction for the project was provided by Dustin Bajer from Jasper Place High School. Staff involvement in the Gardens extends beyond the Faculty to cooperation with a number of units in university Facilities and Operations. The ground-based site is a collaborative effort with Sustain SU, an initiative of the UA's Student Union. Relationships with K-12 schools in and around Edmonton are also beginning to emerge.

[86] Instructors in other science-related courses (at both the graduate and undergraduate levels) have asked members of the core project team to present on the Gardens in their courses. Instructors for a number of undergraduate courses in other subject areas (e.g. second languages and language arts) and special topics graduate courses have gone to the Gardens as part of their teaching and learning.

physical existence, they provided a place where I had the opportunity to engage directly with doing and being with respect to integration of Indigenous perspectives in science curricula. More importantly, they provided a place where the ideas at play in the analysis of policy and conversations with the people who have informed this research, found a fertile place to plant themselves and grow. As such the Gardens are an instance of practice that have allowed me to better consider this inquiry as a whole instead of individual parts. It was in this chaos and complexity that I was finally able to step back and see the beauty of the whole and get a better understanding of what I have engaged in through this inquiry.

Redux [adjective] : brought back; from Latin, reducere to lead back, returning. (Redux, 2015)

Part I Redux: Playing with Structure/The Structure at Play and a Thought About Hope

I wrote in my proposal that because this work is a small part of a much larger living exploration I have had in process for over to two decades, I have some difficulties with its structuring and ordering. In the multi-layered endeavour that has emerged, the structuring has become even more of a struggle. There is no question for me that I sit with the work as a whole; I can focus in on specific aspects of it, but always while holding onto the broader context in which it exists and the ways in which any one aspect is connected and related to other parts of the whole. It is woven together, and while each individual thread is important and beautiful, they have been quite insistent on maintaining their mutually supporting relationships within the whole throughout the writing process; dividing this work into ordered parts and chapters has been a challenge. While there is order and labels, in all places it is *inter esse*, already begun somewhere else–yesterday, today, or tomorrow, back twenty years ago at NAEP, in courses I have taken, taught and will teach, perhaps generations before I was born. I write a piece in methodology and from somewhere over in the (only somewhat theoretical) framework something calls out "What about me? That's what I said", with echoes of "Me too", "Me too" from threads in other parts of the writing, seemingly distant in time and space from whatever I am trying to focus on in the moment. To honour the conversations, I leave what I am working on and attend to the callings. The writing is not/has not been linear, it is interwoven, interconnected, and interrelated.

In its first iteration, the dissertation followed a more traditional path where a framework preceded methodology preceded findings, etc. Given that I was well into the process before the methodology emerged as a finding of the research, that the framework was present but inarticulable for much of the writing, the first draft was adequate but rang false in my own reading of it. It imposed a linearity on the process that did not really exist, it ignored some of the relationships from which this work emerges and in which it is immersed, and it did not adequately reflect the recursive methodology that has been so important to developing understanding. There was little *māramatanga*/effulgent coherence in the piece–no joy, no excitement, no wonder to the work as a whole, despite

the fact that there had been joy, excitement, and wonder in doing the work. It made me very uncomfortable, in part because in trying to fit into what I perceived as an expected format[87] I felt forced into language with regard to findings that indicated significantly more certainty, authority, and judgement than I felt, or feel. I was not working out from the middle, but starting with the corners and edges. I was not tracking Coyote, but sticking him in a cage where he became way more tame and only a coyote (Hermes, 2005).

The answer to structuring emerged from methodology (Chapter 12), which–while still remaining a nameless no-thing–I have come to think of as chasing Coyote's tail *AND* the mapping of recursive equations that describe complex phenomena active in the world; a doing and being active in the world, or at least, in this inquiry. Recursive equations are extremely sensitive to initial conditions–the relationships in which they are immersed and from which they emerge. At the very beginning, as with all equations, there is not much to see, perhaps only a dot that provides insufficient information as to what is being tracked or mapped. Even early iterations of their mapping, may provide an incomplete sense of pattern that seems piecemeal and unconnected, until a more general sense of pattern becomes apparent. The whole may be somewhat difficult to visualize until quite late in the process, but it does eventually emerge–as long as whole here is recognized as a poor descriptor, because the process, the mapping of recursive equations could, by definition, continue *ad infinitum*. The relationships from which the mapping emerges and in which it is immersed are always at play (even when you cannot see them, as in the dot with which I begin Part I). In this way, such mappings of recursive equations are ideal puzzles for me, always working their way out from the middle, caught up in the flux, the *inter esse*, the messiness–never finding the edges. So the structure of the piece is now quite different from what I had initially considered, and I am more able to engage in the act of living with it.

The story I have chosen to tell is about the whole. It is about what is at play in integrating Indigenous perspectives in K-12 science curricula, what is potential in sitting with the difficulties and coming to understand what it means to engage with Indigenous

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[87] Again, what I had been told in my courses regarding dissertations was quite insistent and very loud in terms of how it tried to structure student thinking about what a dissertation is and might be.

ways of knowing, being, and doing in K-12 science curricula and academic inquiry. It is about the knowing that comes from doing and being. Because readers cannot experience the doing and being that were so vital to this inquiry, in what follows, I have attempted to re/create in the experience of reading something similar to the various and multiple acts of living with that have informed this inquiry. This choice means that I ask readers to hold on to and engage with many ideas and images that may be unfamiliar and poorly defined, ideas and images that may shift and transform through the reading. It means I intentionally disrupt the writing. It also means I ask readers to engage with a certain amount of discomfort, a certain amount of "watching until it becomes clear to you" (Atleo, 2008, p. 221).

Given this choice, I am also choosing not to summarize chapters as a way of providing readers with a map for reading the work (although I do provide summaries in Appendix C). Instead, I provide an overview of the each of the four parts that structure the work as a whole, to provide an indication of how they act within the inquiry. Throughout the parts, I track relationship, process, and place, and ultimately find the first two immersed in and emergent from the third.

Part I: The Whole World in a Dot,
in which I Consider a Place for Beginning in the Middle

Part I is/has been and extended introduction to the work. It focuses on beginning to expose some of the relationships active in the work in order to provide an initial framing for what follows. I call the part "The whole world in a dot", because although it is just a beginning, the whole is potential in it. The part includes an introduction to what is at play in the whole and a background to the manner in which the questions emerged. It also examines the difficulties and slipperiness of the questions under consideration given the messiness of engaging in an inquiry that examines a shift in process, the world in flux.

Part II: Initial Conditions and Early Iterations,

in which I Let All My Relations Out to Play and Become Decidedly Uncomfortable

Part II focuses on expanding beyond Part I, to contextualize the work with respect to all my relations. I call the part "Initial conditions and early iterations", because while the relationships, commitments, and sensibilities I describe within it are all related, how those relationships would play out as a whole within the dissertation, was unclear to me. I had to sit with the relationships, commitments, and sensibilities, and significant uncertainty and discomfort, watching to see until it became clear to me as I undertook the research. Part II asks readers to hold on to and engage with many ideas and images–my personal relations, where I locate the research, considerations of theory, historical and current contexts to from which the inquiry emerged and in which it is immersed, and an exploration of methodology where the inarticulable and discomfort come to the fore. To close Part II, I briefly consider the difficulties, discomforts, and tensions that emerge from all my relations as described to find within them a thread about doing, and doing differently, even in the absence of knowing and the presence of the inarticulable. This thread allowed me to recognize parallels between my struggles and tensions with undertaking the research, and the struggles of educational stakeholders as they consider what it means to integrate Indigenous perspectives in K-12 science curricula.

Part III: Getting a Sense of Pattern within the Flux,

in which I Engage with Process and Remember to be Comfortable with the Discomfort by Chasing Coyote's Tail

Part III focuses on the learning emergent from acts of living with, the discomfort and uncertainty of the *inter esse*, engaging with process, being and doing. I call it the, "Getting a sense of pattern within the flux", because it was through doing and being with the research, and listening to the doings and beings of educational stakeholders that I was able to recognize the rhythm of return that has been key to findings. Part III examines educators' rhythms of returns, and my own. It is ultimately about finding a sense of

pattern by getting caught up in process and doing before understanding or knowing where the process would/will end up.

Part IV: Seeing the Beauty of the Whole,
in which I Sit in Place and Remember to Let Things Be

Part IV focuses on the learning potential in letting things be. I call it "seeing the beauty of the whole" because it is where I stop/ped struggling with what the dot of Part I might *be*, and get/got caught up in what it *is*. It is an extended ending to the dissertation that presents two instances of practice–the first from northern Canada, the second from the Indigenous Teaching and Learning Gardens–that might serve as illustrations of the potential inherent in the very conditions of engaging with Indigenous perspectives in (science) curricula, the potential of sitting with all our relations and doing something in particular places.

A Word on Conclusions

While in the end there are, no doubt, conclusions to be made, my focus is not conclusions, but learning and coming to understanding, sitting with the difficulties and doing something anyway. What the process opens up for me and the place I return to in the learning is somewhere I thought I had left behind. What readers will return to will depend on what each is ready to read, ready to see. I cannot say for certain what that will be. So while the ending does not/will not completely resolve tensions and struggles, it nonetheless attains it goal, because:

> we came together to hear what we needed to hear, and now, in knowing more we can move forward with this new knowledge and continue the conversation in new contexts. For, as we assembled, we heard new words, received new ideas, raised new questions, and now our work continues. (Doolittle et al., 2011, p. 93)

A Thought on Hope before Returning to the Middle

Nobody who knows me would ever accuse me of being a Pollyanna. I have a bit of a cynic about me. Blame the Scottishness of my upbringing. That being said, as I

undertook the research for this dissertation–speaking with people across Canada, working with pre- and in-service teachers in AB reading, and living life–one of the things which struck me about the conversations I had had, the actions I had observed, the words I had read, was that I could find hope in them. Perhaps potential is a better word.

Admittedly, in science you can have negative potential, but what I observed was trending to the positive. There were, of course, things that could be improved, things which made me roll my eyes, bite my tongue or twitch a little, but what I was met with overall were people struggling to figure things out, and genuinely trying to do what they could with what was available to them and what they themselves understand. Trying to understand what it means to engage with Indigenous perspectives in science curricula-even people with whom I deliberately chose to speak because nothing in their experience (as far as I am aware) lends itself to such action and engagement were making efforts that seemed (to me) to extend beyond mere lip service to a curricular requirement.

What I found were people engaged in the activity of creation. Creating not as a straightforward process with a clear end goal, but rather as a complex, ongoing, recursive and (frequently) collaborative process; something to be wrestled with, reflected upon, attended to, and deeply considered. And–from what I observed–creating undertaken with good spirit. It frequently reminded me of advice I was given years ago by Elder Dr. Lillian McGregor at the University of Toronto, "Sometimes you just have to do it. You know, like Nike". Doing does not mean you do not make mistakes or do not need to regroup and reconsider; it does mean you start from a place of wanting to do well, are willing to regroup and reconsider, listen to people and ideas, and try again. Doing, as Manulani Meyer describes it, as essential to the development of knowing and understanding. So, what I saw and heard were people "just doing it" with good spirit right across the country. In their own spaces and places–which are different and the same–even though they might not be certain what it means to engage with Indigenous perspectives in science curricula, they were in the process of creating meaning around it. I find that hopeful.

When I finally had space to sit, to consider, and to write about the research and experience of it, it was difficult to maintain that hope. In early winter 2012, the sitting federal government engaged in public vilification of Chief Theresa Spence from

Attawapiskat for taking the desperate move of sitting quietly on an island in the Ottawa River and undertaking a hunger strike in order to ensure basic needs–water, heat, uncontaminated housing–are met for the people in her community (Harris, 2013). The same government played chicken with Indigenous leaders from across the country on the issue of whether the Prime Minister and Governor General would show up for emergency meetings around national protests emergent from the Idle No More movement (APTN National News, 2013). In summer 2013, news leaked that our sitting government had asked bureaucrats to develop briefings for incoming cabinet ministers that included a list of friends and enemies (Wingrove, 2013). The implication was not so much that enemies might be those who mean to do us deep harm, but rather those whose opinions differed from that of the government or questioned its current policies and priorities. Enemies, the mind boggles. This revelation was shortly followed by reports that in the wake of World War II the Canadian government conducted nutritional experiments on malnourished Aboriginal children attending residential schools (Weber, 2013). In the late fall of 2013 the federal government once again began attempts to unilaterally impose education reform on First Nations (Canadian Press, 2013); providing rather strong evidence in support of philosopher George Santayana's (1920) famous observation "Those who cannot remember the past are condemned to repeat it" (p. 284). And then, in February 2014, both suddenly and with some warning, my mentor and great friend, the person who brought me to this work and to whom I feel I am most responsible, Corinne Mount Pleasant-Jetté, began her journey home. Among her last words to me were, "I think you know me better than almost anyone else, so you better damn well keep it up, cause I gotta go now".

It was hard to write in the face of such events and disclosures; even, harder to write hopefully. But I clung to the hope I had found in the relationships, processes, and places of my inquiry; and in the moments where the world intruded too much, I did not write, but found ways to reconnect to the hope. I sat and spoke with the people and places who sustain me, spent time with the young people to whom I have dedicated this work, and went for many walks so I could remember how and where I might listen deeply and (maybe) hear the land speak. Some times it took a while, but every time, I refound hope; reworked, reconsidered, looking a little battered, but still living and breathing.

I have a colleague who likes to remind people that hope was in Pandora's box along with all of the other evils of the world. I am also aware of Peter Taubman's (2000) position that hope in education can lead to a future-based orientation, and the desire for control and improved outcomes that marginalize the mindful presence required for acknowledging the complexity of becoming and deep reflection on the relationships between theory and practice/ideas and action. The hope I have experienced, however, is present, generative, creative; it is all about becoming and birthing ideas through action. Perhaps it should be called something different, not for what it is, but for how it acts, how it allows for the new, how it opens up possibilities, what it puts into play in the world, the patterns it sustains in the flux. Whatever we call it, I have chosen to focus on hope in this work, not to ignore the things that attempt to distract us and render us unhopeful, but, in fact, to deny them that power.

Existing in relationship triggers everything*: with people, with ideas, with the natural world.* (Meyer, 2008, p. 221, emphasis in original)

[Coyote to Raven as they consider Indigenizing environmental education]
raven … this is how mainstream research works   dividing   categorizing
breaking   into smaller units what are not actual units of anything that exist
anywhere but in the (de)constructed theoretical and/or proprio-conceptual spaces
and the postsumed knowledge arising from those spaces which becomes normalized
further fragmenting fragments then gluing them together disparately and calling it
organic or holistic or   progress. (Cole, 2012, p. 17, spacing in original)

Part II:
Initial Conditions and Early Iterations
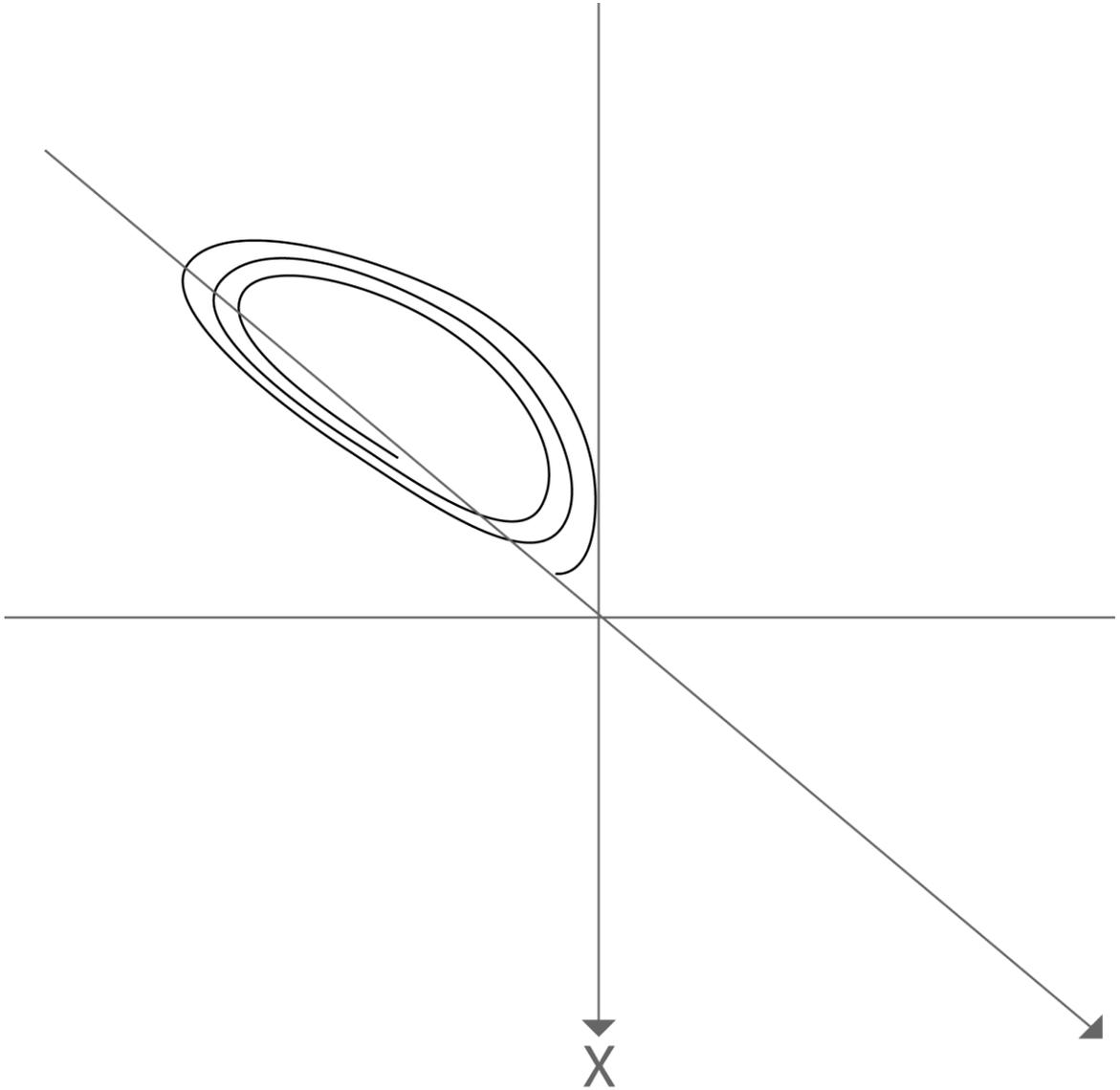
[Image credit: D. Wiseman & P. Williams]

X

In which I engage with All My Relations and Become Decidedly Uncomfortable

Shawn Wilson (2008) suggests approaches to research that honour Indigenous ways of knowing, being, and doing require means of leaving relationships intact so that they may be considered as a whole (perhaps *gestalt* is a better word; European languages are not helpful at times). In Part II, I engage with all my relations in a sense that may become clearer than the words "all", "my", "relations", or "all my relations" when the dissertation is considered as a whole. Within Part II, I bring together thinking and work by both Indigenous and Western knowledge holders[88] and my understandings/uptakes of their thinking to outline the relations that I draw on and bring to the inquiry. Chapters introduce who I am and where I come from as a means of locating the work in the *inter esse*; provide a framework that has some relationship to theory; contextualize the questions in both historical and current circumstances; explore methodology as a means of understanding what I call the inarticulable; outline the specific methodological stances from which the inquiry began. While each chapter stands on its own, they are more entangled than separate chapters and brought together by all my relations.

As a whole, Part II provides an accurate description of the sensibilities, commitments, understandings, and tensions I bring to the inquiry. At the same time, these are my relations, my starting points for research, the initial conditions and early iterations of the process in which I have engaged. They make sense to me (some of them in retrospect) because they are the elements that spoke to me and asked to be addressed "over and above [my] wanting and doing" (Gadamer, 1989, p. xxvi). For others, there may be no clear sense of what the work looks like at the end of this part. My own tensions around research are very much at play here, particularly in trying to articulate a framing and methodology for the work. The title suggests that what I am in engaged in with respect to research (and what educational stakeholders are engaged in with respect to integrating Indigenous perspectives in K-12 science curricula) is a complex process where initial conditions can have significant impact on what ultimately arises in process and place. Initial conditions and early iterations may not, at first glance, seem intricately related. They may come across as a piecemeal and poorly connected; in fact, they may appear terrible. Despite the sometimes explicit lack of connections between these

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[88] I use the term knowledge holders because not all the understandings and expertise I draw on originates with academics.

chapters, there are still hints at potential pattern, at relationships underlying the whole, at threads running through each piece, but often the tracks between them are not entirely visible or evident, not entirely articulable. As such, I work to remember what I have learned over the last two decades, that tension and discomfort can be remarkably generative if you are willing to hold on to them, to sit with them, to visit and revisit with them, and to live with them while letting go of the need to completely and utterly resolve them. And, in the midst of the unresolved tension, there is a need to do it[89] anyway.

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[89] Whatever "it" might be.

Relationality requires that you know a lot more about me before you can begin to understand my work. (Wilson, 2008, p. 12)

So when people talk about science the way they do and in isolation of who they are as a person–first of all you've got to get back and ask a very basic question: Who the hell are you? (N. Blood*)

Chapter 5: What My Relations Put into Play: Who I Am and Where I Come From as a Means of Locating the Inquiry

"Who are you and where are you from?" These are old questions, "old protocols" (Brough et al., 2006, p. 402) to be attended to at the beginning[90] (Mehl-Madrona, 2009); ways of establishing "name, lineage, and native place" (Long, 2001, p. 20), who stands with and alongside you and the location from which you speak. As I have come to understand in working alongside Indigenous people, peoples, and communities, these questions run deep; they speak to Gadamer's (1989) prejudices or prejudgements–or the understandings and commitments I bring to doing research–and go beyond them to a consideration of my place within and connections to the complex of relationships from which I simultaneously emerge and to which I return[91]. And so, I begin (yet again) in the manner I would when introducing myself at a gathering focused on Indigenous education, by telling you, both directly and in a roundabout "talking around the edges" (Allen Gunn, 2007, p. 42) way that allows things to be understood in an interpretive manner, who I am and where I come from.

Who I Am: Gifted with Learning

Where does a person begin? I was wanted (hoped for, I suppose) before my conception, perhaps even before my parents' conceptions. It is natural. We think of our children, and their children, before they ever make an appearance, before we get to know who they are. I think this may be (in part) what Elders mean when they say a child's education begins before birth; they are conceived of before being conceived. We cannot know who they will be, but we do know the potential. It behooves us not to screw up that potential in any way. It is not our potential to screw up.

Now, in early (I hope) mid-age, I carry stories with me from six generations–four before mine, and one after. Genetically, I carry countless more; chemically, I am the stuff of planets and stars; and [physically, at the smallest levels imaginable, I am mere probabilities of existence that reorganize themselves from moment to moment to make the potential perceptible and, in as much as that is real, real. All of our children are

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[90] Or as close to the beginning as can be managed when one returns to it over and over again.
[91] This is one of those instances where I have been taught by example on multiple occasions in multiple places.

mere probabilities, all of them are potential.] If we[92] think this way, if we feel a deep connection to all life (to all creation), what does it mean to educate our children? To help them be? To support them in becoming? What does it mean to know their potential? To honour it? To ensure a space for it within creation? Within this place? (Wiseman, 2010c, p. 1)

My name is Dawn Wiseman. I am the daughter, and first child, of Gordon Wiseman and Barbara Lipski, and eldest grandchild on both sides of my family. I was born in Kirkcaldy, Scotland around six in the evening on a day near the winter solstice. I have no middle name. When my father went to register my birth, all the names he and my mother had discussed and agreed on prior to my arrival deserted him. He described[93] it as drawing an utter blank; not a sensation with which was he was familiar at the time. And so, partly in frustration, partly out of embarrassment, partly to get the process completed, the third time the clerk asked "And the child's name?" he blurted out the first thing that entered his head, "Dawn … Dawn Wiseman." It just came to him, my very rational father, in that instant. So I came into the world in the darkness of a northern winter evening, but was named for the return of morning light. It is a nice balance, and a good way to begin.

Over the last few years, as I have pursued my doctoral work, I have been asked over and over again, and in many different ways, who I am. It is a question I have some difficulty answering, not because I have no sense of self or what I am doing, but because as I am so many people, and constantly becoming more. I am a Canadian/Montrealer/Québecoise/Scottish, granddaughter, daughter, sister, wife, aunt, cousin, godmother, friend, engineer, writer, teacher, and, and, and … . And yet these

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[92] The "we" here is certainly me, and a number of like-minded people I know. When I write though, I feel I am in conversation with some unknown (yet vaguely family/iar) person. So, the "we" is also, perhaps, a challenge to the reader; a challenge that invites them into a thought experiment, to consider the possibilities, implications, and complexities of assuming the perspective described. It says "You may not think this way, but what if you did? What might that mean? What might it look like?"

[93] I use the past tense of the verb "to describe" not because my father has passed on, but because he suffered a severe stroke about 10 years ago. Strokes are strange events, they rob a person of some capacities and leave others in tact. My father has not been able to speak for a decade, and thus can no longer describe the circumstances of my naming. Nonetheless his ability to understand has not been impacted, he remains remarkably deft in seeing and making connections between ideas. Getting at those connections is a bit of a challenge, often frustrating and uncomfortable for everyone. Communicating with him has been a ten-year exploration of trying to understand the inarticulable.

labels tell you so little about me. In the context of a faculty of education, I am fond of pointing out that I call myself teacher not through a claim based on the letters "B.Ed.", but by virtue of being named teacher by a Métis Elder from northern AB in 2007. I have great respect for the B.Ed., but in the places where I work and the people with whom I work the naming is more fitting.

I suspect that at some point in the doctoral work I was supposed to identify as a researcher. But, although I *do* research, researcher is a label with which I have some significant tension. It does not sit well with me and it has too many negative connotations for the people with whom and the places in which I work. As Māori scholar Linda Tuhiwai Smith (1999) writes, "From the vantage point of the colonized … the term 'research' is inextricably linked to European imperialism and colonialism. The word itself … is probably one of the dirtiest words in the indigenous world's vocabulary" (p. 1). While I deliberately work to reposition and change those connotations, I am unable to experience Linda Smith's life and living, and so I choose to take her position seriously and reposition myself by choosing a different label. So, I am a learner, or to phrase it more actively, someone who finds life and living in learning. I position myself this way because I have been gifted with learning since before I was born, in those moments when I was only potential; and it is a great gift. Let me tell you about my relations.

Both my grandfathers were refugees who ended up in the United Kingdom around World War II. My paternal grandfather, Alexander Wiseman, was an economic refugee from Newfoundland who had been raised primarily in foster homes due to his family's extreme poverty. His schooling was minimal, and he was unable to read or write until he was older than I am now. He joined the Newfoundland Overseas Forestry Unit in the late 1930s and traveled to Scotland to harvest wood for the war effort. This job paid two pounds sterling a week; one pound to the forester, and the other to his family back in Newfoundland. My maternal grandfather, Waclaw Lipski, was a political refugee who escaped Poland when Stalin and Hitler split the country in two. His father, a veterinarian in the Polish cavalry, disappeared one night in Stalin's purges of the Polish forces. His mother and sister were deported to a camp in Siberia where his sister eventually died; my

great grandmother survived[94], but did not know her son was still alive until the 1960s. My grandfather walked across Europe, getting arrested for vagrancy in Spain before being deported to Scotland where there was a growing Polish community in exile. He had been headed to university in Poland, but his education was interrupted by the war and he never returned to school.

In Scotland, my grandfathers joined the war effort and met my grandmothers. My paternal grandmother, May Gordon, was the youngest of five children raised by her widowed father. She and her two sisters all graduated from high school at a time when that was not the norm for young women of their social class[95]. Education was very important to my great-grandfather, Malloch Gordon[96], a cobbler. He believed that no matter what happened in life, knowledge and understanding could never be taken away from you[97]. My grandmother took on his commitment to education and would eventually pass that understanding along to three more generations[98]. My maternal grandmother, Ann Fisher, was the youngest of three daughters. Her mother died when she was four. Her father, a coal miner, remarried and had five more children. At the age of twelve, my grandmother, like her older sisters, was put out to service. She became a first-floor maid in a university residence in St. Andrew's.[99]

Education and learning were hugely important to all my grandparents. They saw the processes not only as a means of acquiring knowledge, but also of escape from poverty. Their children all had post-secondary education. My father grew up in a rural,

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[94] My great grandmother, Wanda, was a serious survivor. She outlived both my grandfather, her son, and my mother, her granddaughter.

[95] The class system in the United Kingdom being extremely entrenched in the early parts of the 20th century.

[96] My grandmother named her two sons for her father. My father, Gordon, and his younger brother, Malloch.

[97] This conviction arose out of a long and complex history, which I am only coming to know. In the 18th century, the Scots (although not all of them) attempted to restore the Scottish throne (which had been merged with the English throne after the death of Elizabeth I) through the Jacobite Risings that intended to repatriate the Stuart kings from France. The last Rising failed, ending in a bloody slaughter of Scottish clansmen by English troops in the Highlands. In the aftermath of the Risings, the English imprisoned many men, and deported significant numbers to the colonies (mostly North America) in return for their sworn fealty to the English throne. They also forbid the use of Gaelic or the wearing of the tartan in order to break the clan system and people's connection to their cultural identity (especially in the Highlands).

[98] My great grandfather was also well known locally as a joker. My grandmother also took on this aspect of his being and passed it along to three more generations.

[99] Ironically, the university my father would eventually attend.

multi-generational home next to his grandfather's cobbler shop, and later next to his father's barber shop, and received a degree in theoretical physics and applied mathematics. He became an actuary. My mother spent the first five years of her life in a flat with no internal plumbing or electricity, and received a degree in industrial chemistry. She was the first woman to work in the linoleum factory where she had her first job. Together they left Scotland (with me), and came to Canada, and specifically Montréal, in the late 1960s. Despite the fact that the Québec school system was an enigma to them, there was always a clear expectation in our house (and in the homes of my grandparents) that education did not end until a bachelor's degree had at least been attempted. That expectation was so clear and so present in my life[100] that, until I was well into my first degree, it never occurred to me other people's experiences might be different. Education, or lack thereof, had influenced my ancestral past, defined my ever changing present, and was to provide for the future.

Sitting with the Difficulties: Finding Relationships in the Places Between

… my entire upbringing, culture, teachers, experiences and lots of other things (some that I cannot explain) came together to allow me to form a relationship with these ideas. (Wilson, 2008. p. 22)

Like Aoki (2005d) I have often felt somewhat defined by the tensions in my life; an immigrant to Canada, an Anglophone in Québec, a women in engineering, a white person working in an Aboriginal world, an engineer pursuing an Arts degree and, now, a Québecoise in Alberta, as well as a non-classroom teacher in a Faculty of Education. Like Aoki, I have experienced belonging yet not belonging on trips to Scotland, my country of birth, with family and cultural recognitions that make a place I lived for only 18 months familiar, yet the only place I can hear my own accent. Like him, I have come to a certain comfort with the neither/nor, [the both/and], the sitting in between; [what Mi'kmaq Elder Albert Marshall describes as *Etuaptmumk* or] two-eyed seeing (Bartlett, Marshall, Marshall, & Iwama, 2010)… [a concept] so reminiscent of [Aoki's] (2005d) thought to keep "the rose and the sakura in view simultaneously" (p. 347). (Wiseman, 2009b, p. 3)

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[100] It was equally clear in the lives of my brother and cousins to the point where when one of my cousins decided that university was not for him, he was terrified of telling my grandmother.

As a pasty, white woman who works with Indigenous people, peoples, and communities, I have been asked how it is that I have come here, how it is that I am comfortable (or at least able to sit[101]) in the place(s) of tension, of difficulty, of potential, of uncertainty between different[102] ways of knowing, being, and doing. Since entering my doctoral program, since being given the gift of time to reflect away from the busy-ness of what I do, I have come to realize that this place of in-between, the *inter esse,* is where I was born, where I grew up, where I have always been, and where I will (seemingly) always be.

Although formal education was and is highly valued in my family, there has never been a sense that learning only occurs in school, or that school learning is adequate by itself in helping us become. When I look back on my life, the most consistent messages I have received about what is important and how to be in the world came from my family (both immediate and extended). My childhood was full of gentle (and sometimes more imperative) directions to watch, to see, to listen, to feel, to do, and to think. It was, and continues to be, direction to act in a considered manner–to sit with the difficulties–instead of reacting. It was, and continues to be, a learning of not just what to know about the world, but how to be and act in it. By sitting with their own difficulties, through their own–not necessarily positive–experiences of difference, the people in my family taught me to be open and accepting of it, to honour people for who they are and where they come from, to embrace contradiction and uncertainty, and to consider whatever life offers (good, bad, and indifferent) as lessons to be learned. I watched my parents, as immigrants to Canada, embody a coming-to-know in which they reconciled, shifted and/or changed their knowing, being, and doing in the world, all the while holding on to a quiet Scottish commitment to pass along in-kind the understandings, kindnesses, and generosities people shared with them. My parents worked hard to extend this understanding to the realities of their new place in the shifting diversity of Montréal. Growing up, I was surrounded first by Scottish immigrants to Canada, then by immigrants from other remnants of empire and the rest of the world, and eventually by people whose

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[101] As I hope I have begin to make clear, sometimes it is not comfortable at all.

[102] I deliberately say *different* in this sentence in an attempt to break down dualities between constructs such as *Indigenous* and *Western* that mask the complexities and diversity that exist within each of these collective terms. At the same time, I will fall back on them soon enough because of the limits of English.

relationships to this place run deeper than anyone else's. There was always extra food, always extra seats at the table–you could never be sure who was coming to dinner. Now, in the homes of my generation, when we sit down to share stories and break bread, the people, food, spiritual beliefs, and languages around the table reflect the diversity of the place in which we live.

The members of my family were also the first ones to introduce me to the world, and support my penchant to explore it. From them I learned about the seasons for planting and picking and fishing and preserving. From their directions to watch, to see, to listen, to feel, to do, and to think, I learned that tadpoles' rear legs and ripening wild strawberries appear around the same time of year (at least in the places in and around Montréal), that salmon can hear well so salmon fishing is a quiet event, that the best shortbread comes from kneading dough only to the point that it starts to feel buttery, that skipping a stone across a lake requires a particular physical and meditative stance.[103] I was the little kid who would sit for hours watching a squirrel make a nest, or slowly building a pile of sand so I could catch the moment it started to collapse.

As much as I loved school, I very much missed this kind of being and doing in the world in my learning, especially in science lessons, which were always simultaneously exciting and dissatisfyingly incomplete for me. I kept waiting for someone to put all the things I was learning back together, to put them into relationship the way they seemed to exist outside the walls of the school. It was an inarticulable and unsettling episteme/phronesis tension originating long before I was aware those words existed. I thought that the missing connections would be somehow become clear when we finally got past the point of the teacher saying "You don't need to know this yet." I thought if I just waited long enough the expected relationship would appear.

To a certain extent perhaps it did when I studied engineering. I remember how I struggled–mathematically and conceptually–with coriolis acceleration (acceleration with respect to a rotating frame of reference) which adds considerable difficulty to Newton's second law of motion[104]. As much as coriolis acceleration made me feel the world was not quite as solid as previously portrayed, it provided a tantalizing hint that things were

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[103] And the right-shaped stone.
[104] Straight lines are always so much easier, but rarely as interesting.

very interconnected. I realized that there must be relationship in coriolis acceleration because there would be no way to know that a frame of reference is rotating unless I am positioned relative to it in a manner that allows me to perceive the movement[105]. I found a hidden skeletal framing for relationship[106] in engineering, much like a triangular truss bridge that transfers loads from wind, rain, water, its own weight and moving cars into the Earth without making the means of that transfer evident–except to someone who knows how to read or track it.

While I first met Corinne when I was an undergraduate in engineering, it was only when we began working together that our relationship grew. Since her tricky question about summer camps for Aboriginal young people–the gift that opened up the potential to see the world differently–like my parents coming to know place in Canada, I have had to try and figure out this new place in which I have found myself. I have had to sit with the difficulties I have encountered between Western and Indigenous ways of knowing, being, and doing. As in my earlier learning, I have had some excellent and patient teachers. Like my parents, in this new place, I have reconciled, shifted, and/or changed my ways of knowing, being, and doing. It is an ongoing process, but then again, it always has been. Like my parents I still hold on to a quiet Scottish commitment to pass along in-kind the understandings, kindnesses, and generosities people have shared with me. I have found that this return and giving back is also a lesson from my Indigenous teachers. And so, here, in the middle, the in-between, the *inter esse* I have found the relationship I have been looking for. I have found my place. And while the *inter esse* is not always comfortable–it asks things of me on an ongoing basis–I have discovered that it is a place where it is possible to sit with the difficulties, allow them to be, and learn how to become comfortable with the discomfort.

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[105] My engineering colleagues accused me of artsy tendencies. I have since come to realize that this sort of philosophical musing is actually quite prevalent among certain engineering professors, but it is not given much time in undergraduate programs because there is just not enough time in an engineering undergraduate program.

[106] Or at least, a particular kind of relationship.

The *Inter Esse*: Considering Relationships between Physical and Metaphorical Places

Locating myself and my inquiry in the metaphorical *inter esse* is some ways is challenging to my inquiry given the importance of "place, land and territory" (Hampton, 1995, p. 40) to Indigenous people, peoples, and communities and their ways of knowing, being, and doing. I am coming to understand place conceived in this manner as *Land*, capitalized and italicized as per Zinga and Styres (2013) to indicate an identifiable geographical location where animate earth, air, and water come together with all the beings (human and other-than-human) who exist and have existed in physical, emotional, intellectual, and spiritual relationships with and within that place. This is *Land* that is "storied" (Donald, 2009, p. 129), *Land* that speaks (Basso, 1996), *Land* that can be listened to (Hogan, 2000), *Land* as first teacher and pedagogy (Zinga & Styres, 2011), *Land* that has birthed countless generations and accepted them back in death as a part of itself (Wilson, 2001). I have been told by Dwayne Donald that in AB the *Land* speaks Blackfoot and Cree, it is still learning English; I assume the *Land* in and around Montréal speaks Mohawk and, perhaps, Algonquin, and struggles with the tensions between English and French[107]. Considering these ideas and coming to understand[108] them requires a way and place for me simultaneously to remain connected to who I am, and where I live, *AND* remain open and listen for and to different ways of knowing, being, and doing.

Many people in my position consider Homi Bhabha's (Bhabha & Rutherford, 1990) hybridity/third space as a metaphorical place in which considerations of difference might "enable other positions to emerge" (p. 210). There is much to recommend in Bhabha's exploration of difference including ideas that seem to echo Deleuzian conceptions of multiplicity (Aoki, 2005c) as opposed to binaries, and culture as a concept that acts (Wallin, 2010) as opposed to culture as its "*contents*" (Bhabha & Rutherford, 1990, p. 209, emphasis in original). However, Bhabha's third space, while useful, is

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[107] As most of us who live in Montréal do.
[108] In as much as understanding is possible.

placeless, and in fact acts to "displace the histories that constitute it" (p. 210) thus stripping those[109] that enter it from all their relations.

In his work in Alaska, Jerry Lipka (Lipka et al., 2005) also uses the term third space to describe the coming together of Western and Yu'pik ways of knowing, being, and doing in mathematics teaching and learning. He draws on the term as it is taken up by Gutièrrez, Rymes, and Larson (1995) who in turn build from Bourdieu's (1977) concept of habitus. Habitus suggests people (as individuals and collectives) are both bound up and emergent from a complex of relationships that include, but are not limited to class, education, culture, and family. Bourdieu refers to habitus as a "generative principle of regulated improvisation" (p. 78), that is it can shift to admit or give rise to the new but does not strip away the relations of knowing, being, and doing from which it has emerged. The sense of third space emergent from habitus similarly leaves intact the ways of knowing, being, and doing that enter the space. In fact, for Gutièrrez et al. (1995), differences between ways of knowing, being, and doing, are key to a generative tension which opens up "and maintains the third space" (p. 467).

The manner in which Gutièrrez et al. approach the third space is more comfortable to me, as it speaks to my experience in engineering where tension is often used in specific places to physically open things up and create space. There is also something familiar in Lipka et al.'s (2005) uptake of third space in the ways I tend to engage pre- and in-service teachers in engaging with Indigenous perspectives in science teaching and learning. There is a deliberateness to this third space which resonates with the idea of planning lessons or preparing to teach, and it is thus useful. As Guitèrrez et al. point out, this third space "breathe[s] life into a classroom" (p. 467); my concern is that it appears to assume there is no life in the classroom to start.

I thus choose instead to consider the metaphorical space in which I find myself as the *inter esse*, as described by Jardine (1998b), "a being in the middle of things" (p. 7), a place that is deeply connected, deeply interested, and deeply invested in life and living. In this metaphorical place, where I am from in a physical sense forms a part of who I am and grounds me in everything I do. So, Montréal, and the areas around it, which nourish

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[109] I deliberately leave the pronoun vague so that it may be considered to include people, ideas, conceptions, etc.

me in mind, body, heart, and spirit, and to which I fully expect to give back when I pass on, is always there, always with me whether I am at home, in AB, or elsewhere. In the *inter esse*, I can also open up to find myself in the company of people and the places they are from; people who are attempting to look beyond the confines of the world defined solely via Western ways of knowing, being, and doing. I am tremendously grateful for their company and my relationships with them.

A Brief Word Regarding Some Thinking I Bring into the *Inter Esse*: Prejudices and Prejudgements

My experience of the last two decades have made me who I am and deeply informs my work. I have been and continue to be generously supported by Indigenous friends, family, and colleagues too numerous to mention[110] in coming to understand. It is an ongoing process; but then again, it always has been. Given the historical and ongoing impacts of colonial policies, I try[111] to privilege their voices and perspectives in my work. I am at heart an activist[112], so the personal is political, theory is practice, knowing, being, doing are intimately related. In my work with Corinne, this approach was rarely if ever questioned. Because I have learned that in the *inter esse* it is important to listen, question, and listen again (Belczewski, 2009) when I have something to say, suggest, or question, it is considered and engaged, even in cases where I am clearly out of my depth. I have found since returning to university where many of my colleagues do not share my understandings, experiences, and relationships with Indigenous people, peoples, and communities that there are many questions asked of me but sometimes little or no consideration or engagement by the people asking the questions. I have been asked why I want to undo or dismiss science. And so, I have found there is a need to be explicit and upfront about all of the understandings, commitments, and limitations I bring to this work.

Despite my attempts to sit with the difficulties and allow Indigenous and Western ways of knowing, being, and doing to circulate together, I do not reject Western

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[110] Although readers will meet many of them in this work.
[111] And sometimes fail.
[112] Before my mother passed on she would tell people I came into the world deeply concerned with issues of equity and justice. One of our nephews seems to be similarly afflicted.

approaches to knowing, being, and doing wholesale; to do so would be to lose myself and where I come from; to disentangle myself from all my relations. I love the intellectual fields that are collectively referred to as the sciences and mathematics; they have spoken to me for as long as I can remember, although perhaps not always in school settings. I get caught up in and awestruck by the small-, medium- and large-scale of happenings in the sciences. In the curriculum and instruction course I have taught, I wax poetic about the beauty of the relationship between mass and volume, what we name density,[113] and the elegance of the mathematical formula that describes that relationship.[114] I can spend hours watching, listening, smelling, touching, discovering the pleasures and wonders of sitting in a garden with newly-sprouted tobacco, sweetgrass, and sage.[115] I physically long for an extremely high-speed, high-resolution, high-frame rate camera which would allow me to see plants in the garden move on a scale my own eyes are unable to distinguish; to film grains of pollen on a bee's leg; to document the dance of a spider building a web. Not solely for study, but for sharing with those who come to learn about the teaching of science in my courses–to say to them "Look at what goes on, look at the interactions, look at the beauty of how it all goes together. Let's teach that". I try to remember always that these things must be returned to their relations, writ large and complex so that they may act in the world, but sometimes I am carried away by the "fecundity of the individual case" (Gadamer, 1989, p. 34).

I have been trained and indoctrinated well in Western approaches and assumptions regarding the production of knowledge through engineering and other university programs. I fail to see how certain things, such as drug trials or building bridges, might be done significantly differently, although I understand that these activities need to be questioned often and considered in contexts that extend beyond risk-benefit or profit-loss. I try, but often fail, to accept the stories Elders share as they are; the

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[113] Inquiry-based teaching in the sciences suggests that naming a concept comes only after the exploration of relationships at play, so that learners can grasp what is going on and how the relationships act in the world, instead of defaulting to memorizing a word which may carry no meaning in the absence of the relationships it is intended to represent (Everett & Moyer, 2007).
[114] As far as I can tell, so far not one of the students in these courses has heard the poetry in exploring density.
[115] This is how I learned of the communal *AND* meditative quality of bundling sage, but also how I learned that touching tobacco is bad idea as it protects itself with a sticky, caustic substance that can cause skin and eye irritation.

depth of my analytical training makes it difficult to not "read" them as allegories or without interpretation. I accept that these failures are of my own imagination, a limitation of my upbringing and education rather than an indication that there are no other equally valid ways of pursuing them; and I continue to try and become more imaginative. In the trying I sometimes get glimpses–small, momentary, but spectacularly lucid–into how the world might be from another perspective[116]. In this work these attempts have led me to track, listen for/to, and have conversations with Coyote.

Within the context of the work I do in the academy, while I can be critical, I reject critique[117] and critical theory as an end in academic work; using theory to point to manifestations of oppressive power without challenging and undermining that power through action strikes me as unethical. My interest is always in action based on collaboration with and in response to community-articulated priorities.

Finally, with regard to this particular piece of research, I am no distant observer. While I entered into it prepared to hear things I did not already know or think, and to account for them within the final work, I come to the questions I have asked believing that engaging with Indigenous perspectives in science curricula–and more deeply finding ways of strengthening and healing relationships between Aboriginal and non-Aboriginal people, peoples and communities in Canada–is important for all people and children in Canada no matter who they are and where they come from. I believe that the developing challenges in environment, health, economy etc. we[118] face over the coming years will not and cannot be met if Western ways of knowing, being, and doing do not open up to and learn from Indigenous ways of knowing, being, and doing. All of our children need

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[116] Not that the perspective is singular.

[117] With respect to critique, it seems to me that often the conventions of academic writing and dissemination do not leave adequate place for the explanation or exploration of intention. As an example, I have some tensions with Glen Aikenhead's (1997, 1998a, 1998b) foundational work with respect to science education and Indigenous students. In particular, I have difficulty with his notions of borders and border crossing. Having had the opportunity to correspond with him, and ask questions about his position, I have a better sense of what his intentions are in the uptake of borders and border crossing. While our conversations have not completely eliminated my tensions, better understanding his intentions has made me realize our approaches are not as diametrically opposed as they may initially seem. I realize that this kind of personal conversation is not possible in all instances. I also realize that the kind of conversation I have been able to have with Glen is facilitated by our pre-existing relationship.

[118] The "we" in this case is pointed at human beings, although it is "ultimately" the broader "we" described in Chapter 6.

to learn to hear the land speak, to understand what it teaches, to find their places as part of it, and to remember to give back to it. All people, all beings, in Canada (the human and the other-than-human) are bound together in deep relationships[119], and it is well passed time our education systems reflected this reality.

Thoughts Before Moving On

Corinne once told me that my work has the potential to make people uncomfortable[120]–Western people, Indigenous people, people–because it is neither one thing nor the other. My experience provides evidence she was right. I wonder though, how my work could be anything but something located in the *inter esse*, bound up in and emergent from all my relations. I suppose I might ignore what I have learned over nearly half a lifetime, but then perpetuate some of the worst of colonial habits. I might also disavow where I come from, but then forget who I am. Part of the beauty in getting older lies in more self-awareness of and self-assurance in who you are, and realizing discomfort can be fruitful for learning.

This is who I am and where I come from.

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[119] What I initially wrote here is that all people in Canada are Treaty people. Cynthia Chambers (2012) underlines treaties undertaken between Indigenous and settler peoples in the period after contact were intended to be living, breathing "conversations starters" (p. 28) that provided means for dealing with evolving relationships and for newcomers (Europeans and more recently people from other parts of the world) to learn about the land "what sustains us all" (p. 30) in partnership with Aboriginal people, peoples, and communities. Donald (2013a) also emphasizes that treaties remain active in contemporary Canadian contexts and provide the possibility for an "ethic of relationality" (p. viii) between Aboriginal and settler peoples in Canada. Thus, my statement that all residents of Canada are Treaty people. However, there are areas of the country–for example, large parts of BC–where treaties still do not exist, and so the statement is perhaps too broad and risks oversimplifying the complexity of the living situation. At the same time, in places where treaties were agreed to between First Nations and the Crown, provinces such as Saskatchewan are establishing treaty instruction for all students K-12.

[120] In truth, she used a term much less polite than uncomfortable.

Hao'e k 'ike he'enalu i ka hokua o ka 'ale–show your knowledge of surfing on the back side of a wave. Thus one knows. It's not about how well you can quote theory; it's whether those ideas affect how you act. (Meyer, 2008, p. 221, emphasis added)

Chapter 6: Relationship, Process, and Place at Play:
Framing Inquiry in *Māramatanga*/Effulgent Coherence

Having laid out some of the more personal relationships that have brought me to inquiry in the *inter esse*, I once again bump up against some of the challenges to undertaking research in a place where Indigenous and Western ways of knowing, being, and doing circulate together. As already noted, such inquiry does not solely focus on the questions being asked, but also on decolonizing research (Denzin, 2005; Smith, 1999) (see Chapter 3). In attending to such multiplicity, complex conversations (Pinar, 2004)[121] emerge that put into sharp relief practices normalized, accepted, and largely taken-for-granted within the academy. So, for instance, from within the *inter esse*, I cannot just leap into describing a theoretical framework for inquiry because accepted understanding of theory, contested though it may be (Anfara & Mertz, 2006), does not necessarily account for considerations which arise in the process, places, and relationships of my particular inquiry.[122] In practice, what this difficulty means is that I have to engage with the intention of ideas such as theory, theoretical framework, methodology, etc. to consider how they are related and how they act within research.

In this chapter, I cautiously articulate a framing for my inquiry. I begin by considering the idea and intention of theory and theoretical framing, alongside cautions regarding the dangers of theory in research. Given the warnings, I look to work by

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[121] I remain uncertain whether complex conversations are the same as Pinar's (2004) complicated conversations or a close relative of them. I have this sense there is something different about complex conversation, but at this time the difference remains inarticulable for me. Once, in discussing Indigenous education with a group of mathematics educators, they told me that what I was saying sounded much like constructivism. I understood the connection they were making because I made a similar one within my Masters work (Wiseman, 2002). The only answer I had for the educators at the time was something along the lines of "Yes, but constructivism isn't enough". I could now–many years and much learning later–expand on my response to them considerably, but I find myself in a similarly wordless situation with respect to complex versus complicated conversations. As I cannot yet adequately lay out the differences, I reference Pinar because my wording echoes his and people will recognize it. In addition, there are strong connections between what I mean by complex conversations and his complicated conversations that are "historical, political, racial, gendered, phenomenological, autobiographical, aesthetic, theological, and international" (p. 188). Nonetheless, I am left with the discomfort of understanding even that breadth of description "isn't enough".

[122] I will explore some of these difficulties in more depth in relation to methodology, but they could similarly apply here.

Indigenous thinkers as a means of balancing theory and engaging in healthier practice. As a means of being directed by and seeking direction within an articulation of a framing that is only somewhat theoretical, I then return to very early parts of my inquiry to explain how relationship, process, and place emerged as entities at play in my research, and how they directed my thinking (Hampton, 1995) to movement, action, and doing. I then examine relationship, process, and place individually to clarify the manner in which I am directed by them and close the chapter with some considerations of how they act in concert.

Considering Theory

As a scholar within the academy, theory is one of my relations. Sometimes it is an uneasy relationship that I would rather forgo; at other times, it is a relationship in which I can lose myself, getting stuck in my head for hours, conversing with ideas and people who are not there. While the second type of relationship is more gratifying, I am uncertain that either is healthy. I have some difficulty with the theory for reasons similar to those identified by Blumer (1954) over 60 years ago; I have observed researchers twist, stretch, and bend the world to fit theory rather than consider that perhaps theory itself needs some twisting, stretching, or bending[123] to fit the world. Still, I understand that within the context of academic inquiry, engagement with theory as hypothesis, explanation, or framework (Anfara & Mertz, 2006; Kawulich, 2009) can serve as a means of tracking or creating relationships across different parts of a research project or "among phenomena that may seem unrelated" (Kawulich, 2009, p. 37).

In attempts to make healthier theoretical choices, I considered what Blumer terms "sensitizing concepts" (p. 7); ideas that provide a "general sense of reference and guidance in approaching empirical instances… [in a way that suggests not] what to see, [but rather] … directions along which to look" (p. 7). Blumer acknowledges that in the social sciences the focus of research is "people, groups, institutions, practices … [each with] a distinctive, particular or unique character [that] lies in a context of a similar distinctive character" (p. 8). As I read Blumer, distinct, individual instances relate to broader instances as sensitizing concepts relate to broader theory, as hermeneutic parts

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[123] Or just to be thrown away all together.

and wholes. In recognizing that "we do not cleave aside what gives each instance its peculiar character … [but rather] accept, develop and use the distinctive expression in order to detect and study the common" (p. 9), Blumer seems to foreshadow Gadamer's (1989) "fecundity of the individual case" (p. 34), where the details of specific instances tell us something about larger phenomena via kinship, family/iar ties, and relationships (Jardine, 2006a).

While Blumer was radical for his time[124], his distinctive, individual instances are in many ways still empirical objects in an empirically objective world; who he (or anyone) is as a researcher has little impact on research and the theory applied or emergent from it. In contrast, Gadamer echoes old questions, "old protocols" (Brough et al., 2006, p. 402) that Indigenous peoples have not forgotten: who a researcher is and where s/he comes from–the preconceptions and prejudices, or complex of relationships, s/he brings to research and the contexts from which they emerge–are important. In fact, they are essential to furthering understanding as they are the things against which the new, the different, the as-yet-to-be understood bump up and make us take notice. In their explorations of the role of theory within research, both Anfara and Mertz (2006) and Kawulich (2009) draw on Silver's uptake of "theory as a unique way of perceiving reality, an expression of someone's profound insight into some aspect of nature, and a fresh and different perception of an aspect of the world" (Anfara & Mertz, 2006, p. xiv). This kind of fecundity and distinctiveness in research is embodied in the researcher, and thus emerges in the sensitizing concepts, related theories, methodologies etc. a particular researcher (or group of researchers) brings to any inquiry.

Sitting with Blumer's sensitizing concepts, Gadamer's prejudices/prejudgements, and Silver's understanding of personal perception and insight, I can begin to nurture a relationship with theory which might sit better with me, the places in which, and the people with whom I work. At the same time, I am aware that even this cautious and open relationship with theory might prove difficult in the *inter esse* where different ways of knowing, being, and doing circulate together.

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[124] Blumer accepted that his proposition regarding sensitizing concepts was likely to be dismissed by his fellow social scientists at the time he wrote.

Theory as an Entity that Acts and Also For Action

I find a caution to this approach in the work of Dean Bavington (2010). A professor in the Department of Geography at Memorial University of Newfoundland, Bavington grew up in one of the province's island outports and learned to fish cod at an early age (Cayley, 2009). Bavington's research focuses on the history of cod fisheries of the Grand Banks. He points to late 19th century work by German fisheries biologist, Friedrich Heincke, as key in changing the sensitizing concept applied to the study of fish and fishing from species to populations. According to Bavington, the change[125] homogenized understandings of cod[126]-in-the-North-Atlantic, grouping them all together as North Atlantic cod[127]. The shift has allowed researchers, and others, to discount–among other things–local understandings about cod, the importance of in-shore cod and their relationship with off-shore cod, variations in timing, size, and path of seasonal migrations, and ultimately led to the collapse of the fishery. His research underlines that sensitizing concepts and the manner in which they are applied have important implications in a living world; in other words, theory is not solely theoretical–it acts.

In Jean Anyon's (1994) commitment to research and researching that supports movement towards a "more humanitarian, more equitable society" (p. 117), she privileges theory with the potential to act. In her estimation, theory must be useful; that is, it must provide applicable means of moving towards a goal, and affecting change.

> The precepts of theory must be, quite literally, capable of enactment. Moreover, and this point is significant, if theory and practice are to be integrated, then practice itself ought to be a primary resource from which these theoretical recommendations are drawn. (pp. 117-118)

For Anyon, theory acts, and in order to support what she wants to do with research, theory must also allow for action. In considering the shift in social science research practice away from Enlightenment theories[128] towards post-theories[129], she asks if "theories which contradict fundamental precepts of their own design constitute a

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[125] Along with improvements in fishing technologies which changed the relationship between fish and fishermen from hunted and hunters to resource and harvesters (Bavington, 2010).

[126] And other fish species.

[127] It is a perhaps a case of shutting opportunities down instead of opening them up (Kovach, 2005, 2009).

[128] Such as a Marxism and various feminisms.

[129] Such as post-structuralism and post-modernism.

reliable guide to emancipatory practice?" (p. 121). Her concerns arise in relation to what she reads as fundamental contradictions in or tensions in alignment within the constitution of post-theories. For example, she notes that while post-theories warn against elements of Enlightenment theories such as the meta-narrative of "universal Truth" (p. 122), post-theories themselves embrace meta-narrative. That is, they do not deconstruct metanarrative, as much as deconstruct "universal Truth" replacing it with another meta-narrative of, in the example given, "the certainty of uncertainty" (p. 122), and thus contradict their own intentions.

I take the cautions offered by Bavington and Anyon to heart. The choice of a framing theory for inquiry is not an apolitical act. It seems to me in her struggle with Enlightenment and post-theories Anyon points to Bateson's (1972) idea of the double-bind, which Bowers (2002, 2010) describes succinctly as drawing on the set of assumptions that created a problem in order to solve it. In fact, various Elders I spoke with as part of this inquiry (N. Blood*; P. Garrow*; J. Lavallee*) shared multiple stories about the importance of acting differently and being creative as a means of rethinking and reworking relationships between Indigenous and settler peoples. As Narcisse Blood* said, "The worst thing to do is nothing, and just go with the same, eh. … You know, status quo". Given that advice, I turned my attention to Indigenous thinkers, and their thoughts on theory, to try and move beyond the status quo.

Māramatanga/Effulgent Coherence

In considering the role of theory in scholarship, Manulani Meyer (2013b) shares the teachings of Hawai'ian seer Hale Makua to explain how overemphasis and reliance on theory can create an imbalance that favours Western/colonial thinking from which most academic theory emerges. She does not make judgements about theory and its usefulness, but rather suggests that theory must be balanced by and respond to application and action in and emergent from place. In Hawai'ian she names this approach *māramatanga*, and translates it to English as effulgent coherence, where effulgent means "shining brightly; radiant" or "emanating joy or goodness" (Effulgent, 2014). The term in English is deceptive because Meyer's use of it is not so much descriptive but active. Given the challenges of translation, Meyer offers a number of examples of what she

means by it: "practicing the teachings and ideas that I am teaching so as to live the ideas I believe in"; "all principles touch every aspect of your practice[130]. … You can't be saying one thing and doing another. You can't just be saying something and not doing anything. You've got to be both." In this way, there must be an intentional striving for and attending to alignment among knowing, being, and doing.

It is tempting to read the sentence "You've got to be both" as missing a word–perhaps "doing" between "be" and "both"–in order to align it with the seeming actions inherent in the previous sentences[131]. As it stands, it reads more like an ontological stance that suggests a scholar should embody ("be") both what they say and what they do. And in fact, as I am coming to understand, this may be an appropriate interpretation. Perhaps more illustrative of my meaning is the following piece that Donald (2003) shares from a conversation with Bernard Tallman, an Elder from the Kainai Community on the Blood Reserve of southern AB.

> *Initiative. The elder would sit, "Okki, amoyi ahkootsiitapiiyoop." We'll use the circle. Here we'll visualize. We'll visualize what I'm gonna be doing in the future. I'm gonna think about how I'm gonna go about it. Then there's gonna be movement. Then we'll see it. That's initiative. "Sapataniip nikiitsipoowasin Us sapahlaaniip." We didn't just talk about it. We're being initiative.* (emphasis in original, p. 140)

Here too, there is an alignment of intention with action. Here too, the structure of the last sentence is unusual in English; there is an active ontological quality to "initiative" brought about by the words "are being" and connecting the act of "initiative" to the subject "we". It could be construed as a grammatical/semantic error made by someone whose first language is not English; but it shares a similar construction with Meyer's "You've got to be both". As I understand it, neither sentence is missing words or grammatically/semantically wrong; instead, the wording in each case is a deliberate choice intended to provide as accurate an articulation as possible in English[132] of the

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[130] It seems to me that in this statement Meyer is–in a different manner–getting at a point similar to Anyon's (1994) point about the problems of "theories which contradict fundamental precepts of their own design" (p. 121).

[131] In a complementary manner the phrases "be saying" and "[be] doing" in the previous sentences could be read as embodied/ontological action.

[132] In her exploration of research from an Anishinaabe perspective, Absolon (2011) explains the challenge of working in English this way, "Sometimes english (sic) in its grammatically correct

relationships among knowing, being, and doing that exists in a number of Indigenous peoples' conceptions of the world[133]. In these conceptions, there is a cyclical relationship at play where being and doing precede knowing. Once the cycle is understood it can lead to an embodied understanding that is reflected in how a person (or entity) acts and is in the world[134]. As Meyer explains it:

> See what happens with English[135], we actually are unaware that knowledge and knowing–we actually mistake them. We think that knowing is the same idea as knowledge. It isn't. We actually think understanding is a flimsy idea of just taking a test and remembering the ideas quickly, but it's actually the application of ideas. It's the application of an idea that is knowing[136].

Meyer works hard to get at *māramatanga/*effulgent coherence practicing the teachings and ideas that [she is] teaching so as to live the ideas she believes in and in that work the whole of her being is reflected in and aligns with who she is when engages in academic research (and vice versa). *Māramatanga/*effulgent coherence does not just allow for action as Anyon sees usefulness in theory, it requires that the researcher act in order to come to understanding. With respect to the manner in which research is framed, I thus understand *māramatanga/*effulgent coherence to imply the need to not only account for, consider, and engage with theory on an intellectual level, but also to take it, work with it, and act in the world in a manner consistent with what that theory or the sensitizing concepts therein infer; the need to remain aware, in a sense deeper than the cognizant, of the livingness in which we engage in research because ignorance of such livingness has the potential to lead to dire results for us and/or some our relations, such as the collapse of fisheries.

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form does not convey or enact my intentions, and I must apply english (sic) words in new ways to help the reader view through a different lens" (p. 21).

[133] Certainly Hawai'ian and Blackfoot; what I know of Mohawk and Mi'kmaw seem similar.

[134] While they do not use the word *māramatanga*, the manner in which Cajete (1994, 2001) and Basso (1996) describe Tewa and Apache community Elders seems to indicate such embodied understanding.

[135] The same can likely be said of most noun-based languages, again, I will expand on these thoughts as the dissertation unfolds.

[136] In this explanation I better appreciate why Meyer's (2003) early academic work engages so much with hermeneutics. I think she may have been struggling to articulate *māramatanga* in English and found ideas that resonate with it in Gadamer's (1989) understanding as "a work of *application*" (p. 325, emphasis in original).

Māramatanga a Hawai'ian word that likely lives best on the islands of the Pacific, where the sun shines brightly and the wind blows in repeating daily and annual patterns that impact the ways in which people live their lives. At the same time, it is also incredibly helpful to my thinking in the Canadian context where integration of Indigenous perspectives in K-12 science curricula asks that we consider how Indigenous and Western ways of knowing being and doing might circulate together in teaching and learning. I borrow the term with the proviso there is perhaps a better word or articulation for it in more local languages. To maintain the tension I have with its use, I refer to it throughout as *māramatanga/*effulgent coherence. The double word is perhaps unwieldy, but it reminds me on an ongoing of the tension of choosing to work in the *inter esse*.

Returning to Very Early Parts of the Inquiry as a Means of Tracking

Understanding the dislocatedness of *māramatanga* to the places of my inquiry, I looked for ways to track it more locally, and returned to early part of my research. In winter 2011, I met with the members of my supervising committee to share with them a working concept map (see Figure 2) for my dissertation proposal. That initial mapping of thinking involved four intricately interconnected big ideas emergent from and informing to an early articulation of my primary question. Distinct from the four big ideas, but connected to them all, were three words: relationship, process, and place.
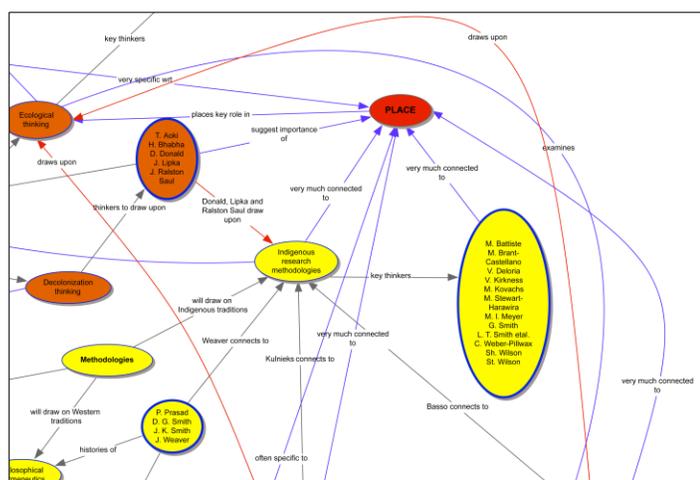
Figure 2. Concept mapping detail.
An excerpt from the initial concept mapping of my proposal indicating connections to place.

As I told the members of my committee, I did not know how to classify these terms, but did know they were ideas underlying the whole, and so had to be attended to throughout the research. I suggested they might be something like sensitizing concepts, but that I was not completely comfortable with that naming. We discussed them as perhaps circulating sensibilities at play, means of acknowledging motion embedded in the research, or active nodes in the research that might nonetheless remain nameless[137] as a collective. The notions of play, movement, and action moved to the fore in the process of doing the research because relationship, process, and place are not taken up solely (or even primarily) as representations of particular ideas or sets of ideas. While I attend to their representations, I am caught up in them as entities acting in the work that might allow me to track or track to *māramatanga/*effulgent coherence.

Relationship, process, and place have traveled alongside me[138] and insisted on their own presence and voice in the conversations I have been having with people, places, and documents of various kinds. Eber Hampton (1995) describes a similar situation when he came to realize that his doctoral work was framed by the six directions he had come to know as a young man in the Chickasaw Nation. Once the framing made itself known, he still hesitated to think through his work in this manner because he worried he would "be misunderstood as using the six directions as model rather than allowing it to direct me" (p. 16). While I cannot claim the deep spiritual relationship imbued by ceremony that Hampton shares with the six directions, like him, I recognize relationship, process, and place as a "way of thinking… [that] is bigger than anything I might say" (p. 16). Hampton (1995) writes that his uptake of the six directions "help me to understand … by stimulat[ing] my thoughts and feelings rather than being contained in my words" (p. 16). I find this description is also true of my uptake of relationship, process, and place. They are what I attended to, what I track/have tracked in attempting frame the inquiry.

Relationship, process, and place act in this work as principles that have touched every aspect of the practice, as means of engaging in and responding to the livingness and

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[137] Even in coming to the research the inarticulable was at play.
[138] Or more likely they have already in place waiting for me to notice them.

play of my inquiry. They are present in this writing from the first page to the last[139], that is, they are already active in the work. I suspect the manner in which they are taken up and act is truly sensible only by considering the dissertation as a whole; that there is some *māramatanga/*effulgent coherence in their interrelationships. In what follows, I provide some context and clarification for each term and how they directed me in the inquiry. My consideration of relationship, process, and place do not follow a similar format because where I have already started to consider the manner in which place acts within my work (see Chapter 5), I have been less explicit about relationship and process. Relationship is thus taken up in some depth. Process is introduced quite briefly, but can be read through more thoroughly in relation to methodology in Chapter 12. Finally, place is returned to, clarified, and expanded upon in relationship to place-based learning and language.

Relationship

> [The] fundamental insight [of Aboriginal holy people and philosophers] was that all existence was connected and that the whole enmeshed the being with its inclusiveness. (Ermine, 1995, p. 103)

> I waited and waited through my own schooling for someone to put it back into relationship. I waited for an "Aha" moment that never came. Then I began my work with Aboriginal peoples and found relationship in everything. Aha! Parts of me that had felt like badly fitting shoes suddenly were the most comfortable pieces. Things made sense in ways they could not have made sense previously. (Wiseman, 2010c, p. 3)

Tewa science educator and curriculum scholar Greg Cajete (2001) explains that most Indigenous communities/nations have an equivalent to the Tewa saying which translates to English as "we are all kernels on the same cob" (p. 629). In Mi'kmaw, it is *Msit No'kmaq* or "all my relations"; in Lakota, it is *mitakuye oyasin* or "we are all related" (Cajete, 2006a, p. 56)[140]. My understanding is that the Lakota "we" should be

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[139] If we are to consider this piece ordered in any manner.

[140] Cole (1998) critiques Cajete's work as given over to new ageism, "filled with saccharine clichés" (p. 104), and–as I read it–too conciliatory to non-Indigenous points of view. There is perhaps some truth to his assessment from the perspective of critical theory and/or related political positions calling for long overdue change in relations between Indigenous and settler peoples in colonized nations. Having had the opportunity to meet Cajete, to sit and talk with him on a number of occasions, I know he is deeply committed to bringing about change that benefits his Nation and its young people. He is incredibly generous with his time and wisdom, and seems to believe that change occurs–in part–through the development of mutually respectful relationships. He is a teacher, and takes time to try and explain Indigenous ways of knowing,

broadly interpreted; it includes all things that in Western ways of knowing, being, and doing would be classified as living and non-living/biotic and abiotic. So along with animals (both the human and the other-than-human) and plants, "we" includes the air, the water, the rocks, and the soil. It includes the planet as a whole, and extends out from it to include everything in the universe. It applies at the individual level, where a person is a relationship of intellect, physicality, spirit and emotion[141]; at the social level, in families, in classrooms, or other communities; and, at the extreme micro or macro levels, in the interplay of proteins in a cell, or the dance of stars in a galaxy. It is quite the encompassing "we". The depth of relationship and interconnection implicit in "we" suggests that any action has the potential to impact all of creation, and so even in situations where an action appears to have little impact beyond ourselves, there is a responsibility to weigh impacts and tread lightly. As such, relationship conceived in this manner tasks us all with ethical action in everything we do.

Cajete underlines that the understanding of relationship contained in "all our relations" is both explicit and tacit[142] in Indigenous ways of knowing, being, and doing, and thus in Indigenous approaches to education. He suggests that in Western ways of knowing, being, and doing, and thus Western approaches to education, that abstract subjects from one another and often from lived experience, such deep understanding of relationship and its accompanying ethics has been largely forgotten[143]. He is not alone in

being, and doing in ways that settler people might begin to understand. I have found his work helpful in opening conversations with students and colleagues. My experience with him, thus strongly suggests that while "we are all kernels in the same cob", "all my relations" or "we are all related" may seem like trite sayings, he understands them as what Haudenosaunee Elders might call "one of our Instructions" (Shenandoah, 2001a, p. 13).

[141] Or mind, body, spirit, and heart.

[142] For Cajete *tacit* appears similar to Polyani's (1969) sense of the word which implies embodied knowing, or knowing that is in some ways inarticulable because it revolves around doing.

[143] Cajete (1999b) strongly implies that such conceptions of relationship once existed in Western ways of knowing, being, and doing, but have been forgotten in the logicial-rationalism of Newtonian-Cartesian conceptions of the world. Moreover he suggests Western forgetting has been a somewhat deliberate, or at least predictable, outcome of breaking "cycles of remembering" (p. 197). In contrast he writes that Indigenous peoples "remember to remember" (p. 197) relationships through language, stories, art, and ceremony. Donald (2009) similarly acknowledges that "Indigenous peoples today [do not] hold exclusive copyright on this [relational and interconnected] view of the world" (p. 439). While Donald locates the source of forgetting in the "homogenizing processes of modernity and colonialism" (p. 440), these processes are closely related to Newtonian-Cartesian logical-rationalism in their attempts to separate, enclose, and abstract rather than to relate, open up, and create.

this critique. The practice of fragmenting and abstracting as opposed to considering things in the wholeness of their relations is a significant and recurring theme in work by Indigenous scholars (Battiste & Henderson, 2000; Bowers, 2012; Donald, 2009; Ermine, 1995; Little Bear, 2000; MacIvor, 1995) as they challenge the dominance of Western ways of knowing, being, and doing across various fields and attempt open up the academy to all our relations.

I work to take up relationship in the manner of the expansive "we". It reminds me of the need for balance and the consideration/questioning of actions. For example, something as simple as picking up an empty shell on a beach while on vacation has consequences of which I can potentially never be aware. At the same time, my understanding of relationship is also influenced by thinking emergent since the mid-20th century that attempts to consider systems, if not as wholes, at least with respect to their complex of relations. Davis (2004) suggests that as reactions to the modernist neglect for context, ecology and complexity thinking are two branches of thought emerging from the same roots. They both focus on relationship, the intertwining and co-dependencies of phenomena, the more-than-human world, interconnectedness and interactions within and between nested systems, collective emergence/self-organization, and a universe constantly created and recreated in an unfolding flux. Ecology and complexity diverge in more subtle ways; complexity taking on the more detached stance associated with the sciences to examine processes rather than meanings; ecology reasserting the role of consciousness to focus on meaning, ethical action, and spiritual entanglement.

Within educational approaches that draw on complexity and/or ecological thinking, Cajete (1999a, 2006b) senses some remembering[144] of relationship, and suggests the potential for meeting places of understanding[145] between Western and Indigenous ways of knowing, being, and doing. Davis, Sumara, and Luce-Kapler (2000) reciprocate the acknowledgement. They stress Cajete has been instrumental in identifying and criticizing Western concepts of knowing as a "dispassionate academic exercise" (p. 11), and opening up the idea of knowing as "about who you are and what you are doing" which "unfolds within interlaced sets of political, social and environmental conditions"

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[144] In other work (Wiseman, 2009a), I have wondered if complexity and/or ecological approaches are "echoed rememberings of ideas Indigenous peoples have not forgotten" (p. 4).
[145] Arrived at via different paths.

(p. 11). In this uptake, epistemology emerges from ontology in specific contexts, and subsequently maps back onto it. Knowing and being here are neither independent nor conflatable, but similar to what Davis and Sumara (2006) refer to as vital simultaneities, "events or phenomena that exist or operate at the same time" (p. 153). These events/phenomena are concurrently bound together in a relationship through which they are constantly and "simultaneously redefined in relation to one another" (p. 155). The dynamic, changing nature–the flux–of the relationship renders it somewhat post-modern, but not in a way that gives over to rampant relativism.

Doll (1993) suggests that post-modernism emerged, in part, from the sciences and early 20th-century work of Einstein on relativity and Heisenberg on uncertainty that established a "megaparadigmatic" (p. 3) shift in Western thinking that is still largely unresolved. The shift has challenged all the assumptions of modernism–linearity, solidity, cause-effect relationships etc.–and has thus touched every discipline. Capra (1996) also points to the work of Einstein and Heisenberg as instrumental in the loss of the modernist metaphor of a strong (certain and fixed) foundation upon which one builds, to a new metaphor of continually expanding network or web in which things must be viewed in relationship to each other in order to have meaning. From this perspective, I suggest it is only the concept or idea that is without relationship which can be interpreted in any manner. Concepts or ideas which are strongly connected by relationship to other concepts or ideas, become not fixed but embedded (or stabilized) in those mutually defining relationships and from these relationships emerge. While I tend to think of this kind of relationship in terms of the space truss diagrams I came to know through engineering, this type of relationship is also deeply ecological in the sense of Naess (1973), who posits that a whole is much more than the sum of its parts, but in which we must understand the parts in order to begin to grasp the totality of the whole[146]. This type of relationship is also reminiscent of Meyer's (2008) suggestion that it is only by coming to understand the specificity of different people or peoples "That will bring us to a common knowing" (p. 220). Here epistemology and ontology are related, as are objectivity and subjectivity, and rampant relativism is staved off by ideas emerging out of the sciences but very much connected to the idea that "We are all related".

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[146] This stance is also tremendously hermeneutic.

Process

Indigenous scholars from North America (e.g. Battiste & Henderson, 2000; Donald, 2009; Ermine, 1995; Hampton, 1995; Michell, 2005) emphasize the importance of movement, change, and renewal to Indigenous ways of knowing, being, and doing[147]. Blackfoot Elder Leroy Little Bear (2000, 2012) identifies flux or constant motion as a key underlying tenet that is visibly at play and acting in Indigenous philosophy and worldview[148]. Flux manifests in the world broadly as seasonal changes, migrations, etc., and, in more human affairs[149] as ceremonies, celebrations, and daily life with their accompanying stories, song, and ritual[150]. Little Bear points out the world viewed in this manner "emphasizes process as opposed to content" (2000, p. 78) and "focuses on the totality of the constant flux rather than on individual patterns" (p. 79). I find Little Bear's distinction particularly helpful because it reminds me that the questions with which I am engaged focus not on the content of already lived experience (van Manen, 1997) but rather on the process of tension-filled, *living* experiences that play out in an ongoing, recursive manner of creation and recreation. I therefore take up process as a way of allowing such livingness, animation, and transformation to enter the inquiry; as a way of acknowledging and engaging the flux in the world via research.

Place

In situating myself in relation to this work, I have already begun to outline some of the specificities, tensions, and possibilities of place as it is taken up in my dissertation (see Chapter 5). I want to briefly expand on this previous discussion in order to situate

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[147] A similar sense of world in motion appears to be shared by Indigenous peoples in others parts of the world. For instance, Maori scholar Makere Stewart-Harawira (2005) writes that "Maori understandings recognize creation as a process of continuous action or coming into being" (p. 37).

[148] Little Bear (2000) acknowledges the existence of local differences in emphasis and uptake of various aspects of philosophy in different Indigenous nations but suggests "there is enough similarity among North American Indian philosophies to apply the concepts broadly" (p. 77).

[149] The human and other-than-human manifestations are in many ways related to and responsive to each other.

[150] All of which play a role in ongoing renewal and recreation of the world

place in relation to place-based education,[151] and to acknowledge some tensions that emerge with respect to language.

Place-based education. Place-based education or learning emphasizes multidisciplinary engagement of students in problem solving or service related to issues emerging from local contexts (Calderon, 2014; Gruenewald, 2003a, 2008; Styres, Haig-Brown, & Blimkie, 2013). It is a broad field with significant diversity in uptake and application, but often includes a focus on experiential learning, community engagement and connection, out-of-school/outdoor experiences, intergenerational learning, and student-lead projects as a means rendering curriculum less abstract and more relevant to students' lives (Gruenwald, 2003).

While place-based learning does not preclude Indigenous ways of knowing, being, and doing, Calderon (2014) and Styres, Haig-Brown, and Blimkie (2013) strongly suggest the approach is inadequate for decolonizing and indigenizing education. It does not account for "*Land* as sentient" (Styres, Haig-Brown, & Blimkie, 2013, p. 192) and living, nor does it explicitly work to expose the manner in which settler assumptions about the world and the way it works have silenced Indigenous ways of knowing, being, and doing, and separated *Land* from all its relations. Both Calderon and Styres, Haig-Brown, and Blimkie suggest that more critical approaches to place-based education such as Greenwood's (2009) critical placed-based education or Gruenewald's (2003, 2008) critical pedagogy of place can be supportive in addressing some of these insufficiencies, particularly in relation to decolonizing goals, but conclude these approaches are still too grounded in Western ways of knowing, being, and doing to account for a significantly different understanding of place that includes "*Land* as living fundamental being" (Styres, Haig-Brown, and Blimkie, 2013, p. 192)[152]. The critique of place-based learning

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[151] The need for such a discussion in the dissertation was made clear in comments received from a reviewer on a conference proposal for the Canadian Society for the Study of Engineering (CSSE) conference in 2014. While we deliberately avoided the reference to place-based education, given the use of place in the proposal the reviewer assumed we were in fact engaging in place-based education and raised questions about the lack of engagement with literature that would situate our proposal within or in relation to place-based education. The question/assumption regarding place-based education has since come up on a number of occasions and so I take time and space to clarify my use of the term here.

[152] Sutherland and Swayze (2012) also draw on Gruenewald's work as a means of considering the importance of place in Indigenous science education. Unlike Styres, Haig-Brown, and Blimkie,

reminds me to attend to *Land* as active entity in understandings developed in different places. It also reminds me to attend to the subtle differences that can occur in seemingly similar or family/iar language/ideas/events between Indigenous and Western ways of knowing, being, and doing, because the subtle differences can have significant impacts on understanding, or the ability to develop understanding.

Language, context, placing.

> I asked [the elders], "Is a ma'iingan in a zoo a ma'iingan?" They said, "No, it is a wolf." Because ma'iingan requires a context. I can't take it out of its context without changing the meaning. Everything in English is taken out of context. *Everything taught about Indians taken out of context is really in English—or in that way of thought* (research participant, Henry, in Hermes, 2005, p. 50, emphasis in original).

Within Indigenous ways of knowing, being, and doing there is an intimate relationship between language and place (Basso, 1996; Hermes, 2005; Little Bear, 2012; Watts, 2013) that arises, as I understand it, because language is connected to and emergent from the *Land*. Watts (2013) explains the idea as "based upon the premise that land is alive and thinking and that humans and non-humans derive agency through the extensions of these thoughts" (p. 21). The implication is that without access to the language *Land* speaks it is difficult to understand certain things related to place; that certain ideas may only exist in particular languages (and places). As Hermes (2005) points out, *ma'iingan* removed from the *Land* loses its spirit and becomes merely a wolf; or conversely, anything in English is out of context in North America, because English has arisen in another place. Even attempting to account for research which occurs *somewhere* between Indigenous and Western ways of knowing, being, and doing raises issues around language. Kovach (2005) writes that "For the Indigenous researcher, incorporating Indigenous epistemology into a non-Indigenous language … is a troublesome task of criss-crossing cultural epistemologies" (p. 27). This criss-crossing is, in part, I think where the inarticulable arises, and it is important to remember that language becomes slippery and tricky in such contexts. While these and other difficulties remain in the *inter esse,* the place I have identified as my location within this research, there is no imperative to resolve tensions from this location. Instead, the tensions become

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and Calderon, Sutherland and Swayze focus on aspects of Gruenewald that are supportive of their work and not limiting factors with respect to Indigenous considerations of place.

generative and useful in identifying where something maybe occurring, even if that something is not articulable[153].

Some Final Thoughts on Framing: Entities at Play as Both Directing *AND* Direction

As Meyer says, the nature of *māramatanga*/effulgent coherence is that all principles touch every aspect of the practice; it cycles through processes, it is evident in every level of organization, it manifests as recursive fractal patterns. In this manner, it frames my inquiry; in every place it allows me to remember, acknowledge, and speak with[154] all my relations. In tracking *māramatanga*/effulgent coherence, relationship, process, and place are entities at play in the inquiry that have served both to direct me *AND* to suggest directions along which to look throughout the work. I have learned to track relationship, process, and place, to pay attention to them, to listen for their voices, to sense their pushing and pulling throughout the work. They are useful in the sense described by Anyon (1994), in that they both act *AND* allow for action.

While relationship, process, and place could be read as individual concepts, they are themselves interconnected, interrelated, and responsive to each other. I rarely encounter one without the others, and so, in instances where I lose track of relationship, process, or place, I sense I am likely missing something at play[155]. The interconnection shifts relationship, process, and place from mere sensitizing concepts to means of tracking *māramatanga*/effulgent coherence in the dissertation as well as in the practices potential and described in the conversations I have been having with people, places, and documents of various kinds as part of this inquiry.

> *A researcher assumes a responsibility that the story shared will be treated*
> *with the respect it deserves in acknowledgement of the relationship[s]*
> *from which it emerges. (Kovach, 2009, p. 97)*

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[153] Even if that something is not even a thing.

[154] Or at least listen for.

[155] It is 100% certain that I have in fact missed a number of things at play in the inquiry, but the framing in relationship, process, and place provides some means of–if not identifying what is missing–potentially being able to infer where the missing might be located.

Chapter 7: Relationships at Play:
Broad Contexts from which the Inquiry Emerges and in which it is Immersed

Shawn Wilson (2008) suggests that, given the importance of relationship/relationality, "concepts or ideas are not as important as the relationships that went into forming them" (p. 74). The relationships from which my inquiry emerges and in which it is immersed are the complex, historical (and ongoing) relationships between First Nations, Inuit, and Métis people, peoples, and communities, and settler people, peoples, and communities in Canada, along with their respective views on and approaches to education–as a primary focus–*AND* also governance, health, ways of knowing, being, and doing and, and, and … because these elements are all related. The understandings I bring to these relationships include academic, peer-reviewed description and analysis of this history, and a consideration of policy around Indigenous governance and education in Canada. At the same time, my understandings are also intricately and intimately bound up in who I am and where I come from; my own experiences of the last twenty years, and stories that family, friends, and colleagues have shared. Like Herman Michell (2005) my work "is the synthesis of the stories that have been shared with me by relatives too numerous to mention. I have absorbed these stories in oral form and constructed them within the parameters of my worldview, prior experiences, personal limitations and idiosyncratic tendencies"[156] (p. 34). So, while there is no doubt that academic work has contributed to my ongoing process of coming to understand, it has been in the experiencing of policy in place and in conversation with people, of listening and reaching out, of walks in the land, and of exploring science with Indigenous young people and their teachers, that I have begun to make some sense of what has at times seemed senseless.

This experience includes coming up against racism and the legacy of residential schools during work with Indigenous people and communities; the stories of my husband's grandfather who was enfranchised and had to leave his home in the Mohawk community of Kahnawà:ke on the day he graduated from medical school; and, my work

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[156] Like Michell (2005) I also apologize for misunderstandings and misrepresentations. They are entirely my own.

with Corinne, with whom I once attended an First Nations education conference where one of the sessions was titled (something like) "Dealing with imbeciles and unmanageables"[157]. It also includes lessons from my Indigenous family, friends, and teachers that it is possible–even after half a millennium of being treated in the worst possible manner by people who arrived from elsewhere with no knowledge of this place[158]–to cultivate a generative inner power[159] (Gadamer, 1989) that allows you to still greet these newcomers-who-do-not-understand in your own language as my brother, my sister, my relations[160], respect their "paradigm of knowledge" (Michell, 2005, p. 36) as required for balance, and trust that they will eventually come to understand. The trust does not mean that you do not become frustrated, or angry, or impatient, but it does mean that you move past those moments to a position of compassion[161]; a suffering with and amidst, borne out of a trust that understanding is possible because "We are all related".

In this chapter I describe my understandings of the broad complex of relationships–historical, economic, political, theoretical, and personal–in which my inquiry is caught up and from which it emerges. While I could consider these relationships back to before contact, the majority of the chapter is bounded in the 30-year period between 1969 and 2000, from which I argue the current context for policy regarding integration of Indigenous perspectives in curricula emerged. There is a heavy focus on policy, but it is intertwined with personal experiences and consideration of academic discussions and analysis. I begin by explaining the focus on policy, and identify the 1969 *White Paper on Indian Policy* (Chrétien, 1969) as a key site of change. I then

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[157] In reference to K-12 students.

[158] Narcisse Blood* shared that when he was growing up he frequently heard the term *Matónni mááno'tooyaa.* As he explained it means "They just arrived yesterday" in reference to settler peoples. The expression is used

> to chastise our people when they start going in the direction that's not Blackfoot and into the Western…–you know, the newcomers coming in–and starting to give too much credence to them. And that's when they would invoke that [saying] to chast[ise] … remember, they just arrived yesterday … and they don't know anything.

There is a strong implication in the saying that the lack of understanding is very much related to place.

[159] Gadamer equates such inner power with freedom.

[160] These greetings are used by some of my Indigenous family, friends and colleagues.

[161] I maintain that movements such as Idle No More are based on such compassion and understanding of relationship.

examine parallel events and conversations in science education, Indigenous education, and academic thinking through the 1980s and 1990s where ideas from multiple contexts and ways of knowing, being, and doing began to circulate together. In relation to these events, I introduce and consider the thinking of a number of scholars with regard to how ideas can hover to effect long-term transformation (Weaver, 1990) that moves beyond the status quo, and how to think about difference and multiplicity in practice. I conclude the chapter by suggesting that *Indian Control of Indian Education* (ICOIE) (National Indian Brotherhood (NIB), 1972) began a revolution that lead to the context from which integration of Indigenous perspectives in science curricula has emerged.

The Focus on Policy

While, like Kovach (2009), I believe that education is always "more than a matter of policy" (p. 160) through my experience at NAEP, I have come to understand that in Canada not much in education is far removed from policy. In general, policy has direct impact on what is taught, how it is taught, and (certainly how government perceives) why it is taught. If anything, policy and Aboriginal education are even more enmeshed and complex. Jurisdiction[162] over responsibility for the governance and funding of Aboriginal education, law defining belonging or not belonging to named categories–First Nations, Inuit, Métis, status or non-status Indian–and thus who is covered by various jurisdictions, what and how much funding is provided on a per student basis based on jurisdiction and

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[162] In Canada, K-12 education is a provincial/territorial responsibility in which the federal government has no role except an annual transfer of funds earmarked for education (and health care). First Nations education–not Aboriginal education–is however technically a federal responsibility which has largely devolved to the local level over the last half century. Where First Nations, Métis, and Inuit students attend school is tremendously varied. Growing urban populations of Indigenous students attend provincially funded schools. Even among First Nations students who live on-reserve a significant number attend provincial schools. Provincial school attendance is lower for younger children; in kindergarten 75% of First Nations students attend school on-reserve; by senior high school the same percentage attend provincial schools (Assembly of First Nations, n.d.). There are various reasons for the shift including parental choice and availability of on-reserve schools (Assembly of First Nations, 2010). Given the complexity of the situation there are significant tensions among various levels of government regarding jurisdiction, funding, and governance. In 1987, when AB adopted the *Policy Statement on Native Education* (AL, 2002a; Betkowski, 1987) then Minister of Education, Nancy Betkowski, was clear that "that the policy and the funds involved do not infringe on the federal responsibility for the education of native people on reserves" (Betkowski, 1987). It has been my experience that this type of statement regarding division of responsibilities is expected in public fora around Aboriginal education in order to both acknowledge and mitigate jurisdictional tensions.

categorization of students, who can name themselves as belonging to a First Nations, Inuit, or Métis community and claim relationship to their family's history and land, responsibility for developing and delivering education, and growing urban populations of Indigenous people are only some of the issues at play.[163]

Both the situation as lived and my stance on relationality[164] suggest I must consider policy and the discussions that have taken place in the fuzzy places around–and connected to–policy, such as public consultations, Royal Commissions, and various agreements in place, as it relates to the context of my research. I use the term *fuzzy* here almost in the mathematical sense where it indicates approximation and uncertainty rather than fixedness and exactness. I use the term *fuzzy places* to indicate indeterminate locations that sit between, or in the overlap of, different places; that may be characterized by elements of multiple places and thus are difficult to define. I use fuzzy places to contrast with borders which are clear delimitations between one place and another. Borders are a key term within the discourse regarding Aboriginal education in Canada (e.g. Aikenhead, 1998a, 1998b) that I will consider later within this chapter. There is some relationship between fuzzy places and the *inter esse,* although they are not exactly the same, in that the fuzzy places do not necessarily account for different ways of knowing, being, and doing circulating together.[165] Fuzzy places are important for a number of reasons. First, fuzzy places have the potential to "take us beyond the 'them and us' (colonizer/colonized) position commonly found in colonial discourse" (McKinley, 2007, p. 201).[166] Second, the ideas that impact and inform policy in Canada

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[163] People I know and am related to are personally impacted by the way these issues are defined in policy. The issues are not abstract potentials to me, but things active in the world that have real and lasting impact on how people lead their lives.

[164] Gadamer (1989) uses the term "historically effective consciousness" (p. 355) to, as I read it, indicate a deep understanding of the multiple relationships that contribute to who you are and where you come from; the traditions in which a person is immersed and from which they emerge. In his view, such traditions are not stagnant, they act, and they provide a means for recognizing and engaging with (or building relationships with) the new. Tradition thus provides a "readiness for experience" (p. 355), and to be unaware of tradition, or to forget who you are and where you come from, limits the potential for experience.

[165] Perhaps the easiest way to illustrate the difference I see between fuzzy places and the *inter esse* is to use a logical construction: The *inter esse* is a fuzzy place, but not all fuzzy places are located in the *inter esse*.

[166] McKinley is a Māori scholar who has spent a significant amount of time examining science education.

arise in the fuzzy places; intersections between the public, the media, academia, and federal, provincial, and local bureaucracies[167] (Weaver, 1990). Third, policy is fuzzy in that it may or may not be formally articulated but "is what any government [or other institution] decides to do or not do" (Abele, Dittburner, & Graham, 2000, p. 3).

How I Think About Policy

Broadly, I understand policy as described above by Abele et al. (2000). In their focus on doing they echo Anyon's (1994) thoughts regarding useful theory, to strongly suggest there is some requirement for enactment, engagement with, or operationalization of the ideas presented as policy. For Abele et al., a beautifully written document with in-depth analysis of why ideas are important is meaningless if it just remains words on paper. They imply that policy comes into and maintains its being via relationship in practice. In their view, it seems, policy requires *māramatanga*/effulgent coherence, a breathing of life into words and intention. Abele et al.'s conception of policy works well for me as a starting point because they intimate what I have come to understand over the course of my career, that policy is tricky; a multiplicity. It is text that can be responded to, *AND* discourse that frames the possibilities for response, *AND* process that acts. In thinking about policy, Coyote always seems rather close by.

Within the context of education, like Haig-Brown (2008), I broaden my definition of policy to include programs of study and related resource documents/reports; concrete implementations of government priorities and visions regarding what young people need to know and the re/creation, re/production, and/or re/visioning of society. In their exploration of First Nations education policy in Canada, Paquette and Fallon (2010) draw on work undertaken for the Ministère de l'Éducation du Québec where clear links between the sociocultural paradigms of a society and the educational paradigms it embodies through such policy are evidenced. Through my work with Corinne[168], I saw these ideas at play when I was involved (both directly and peripherally) in a number of conversations that took place between 1993 and 2009 with respect to policy and

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[167] Within which I include First Nations, Inuit and Métis governance structures.
[168] And my location growing up as an Anglophone in Québec.

Aboriginal peoples/education in Canada[169]. My experience of school in Québec and with Aboriginal people, peoples, and communities provides strong evidence that such documents are used by government to forward particular positions and priorities (e.g. Woods, 2014). In addition, as I have already noted (see Chapter 2), there is evidence (Ball, 1993; Barrett & Pedretti, 2006; Hart, 2002) that teachers often have little engagement or familiarity with broad policy statements and principles that inform the development of programs of study and so, for many classroom teachers these more specific documents serve as their only insight into government vision and policy.

My understanding also includes treaties as living means of framing relationships between Aboriginal and settler peoples in Canada that should be active in policy. I recognize that "Friendship/Alliance Treaties" (2012, p. 9), such as the Two-Row Wampum[170] (McGregor, 2011; Mount Pleasant-Jetté, 1998; Ransom & Ettenger, 2001) have existed between Indigenous and settler peoples since contact,[171] and that "education was one of the elements of primacy as a Treaty entitlement, [that] confirm First Nations jurisdiction over education for their peoples" (2012, p. 9). I further recognize that Treaty

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[169] These conversations were numerous and included the following. The Royal Commission on Aboriginal Peoples (RCAP) (Dussault et al., 1996), within which Corinne contributed research related to First Nations, Métis, and Inuit employment and labour market equity/participation. Balancing Choices: Opportunities in Science and Technology for Aboriginal People, a national conference that took place in Winnipeg, MB in April 1999. Corinne chaired this gathering. I facilitated a session on K-12 science and mathematics education. The Minister's Working Group on Aboriginal Education (Jeffrey & Mount Pleasant-Jetté, 2002), a national consultation for which Corinne served as Co-Chair. Discussions leading up to the Canada-Aboriginal Peoples Roundtable (Patterson, 2006) which took place in Ottawa in April 2004; and, direct conversations with educational policy makers at the Assembly of First Nations (AFN), what is now Aboriginal Affairs and Northern Development Canada (AANDC), as well as various provincial governments, school boards, and Aboriginal education authorities.

[170] In the 1980s members of the Haudenosaunee nations described the Two-Row Wampum to the House Special Committee on Indian Self-Government as

> a bed of white wampum [shells] which symbolizes the purity of the agreement. There are two rows of purple, and those rows have the spirit of your ancestors and mine. There are three beads of wampum separating the two rows, and they symbolize peace, friendship and respect.
> These two [purple] rows will symbolize two paths or two vessels, traveling down the same river together. One, a birch bark canoe, will be for the Indian people, their laws, their customs, and their ways. The other, a ship, will be for the white people, and their laws, their customs and their ways. We shall travel the river together, side by side, but in our own boat. Neither of us will try to steer the other's vessel. (Penner, 1983 in Mount Pleasant-Jetté, 1998, p. 251)

[171] And between Indigenous peoples since before contact.

making processes and the obligations therein were undertaken by the British Crown[172] and then by the Government of Canada[173]. In particular, I recognize that the Indian Act of 1876 reflects the Constitutional responsibility for Indians and lands reserved for Indians, that treaty rights are further recognized in the *Canadian Constitution Act of 1982*, Section 35.1, which affirms the existing Aboriginal and treaty rights of the Aboriginal peoples of Canada (S. Carr-Stewart, personal communication, January 5, 2016). These rights are further acknowledged and affirmed in Section 25 of the *Canadian Charter of Rights and Freedoms* (Battiste, 1995). Despite the existence of these agreements and treaty obligations, I understand that the policies of settler peoples and the Canadian government with respect to First Nations, Inuit and Métis peoples have been, over the time since contact, largely genocidal (Truth and Reconciliation Commission of Canada, 2015), assimilationist, or–at best–ignorant and indifferent. I recognize also that policies emerging from the Crown and Government of Canada with respect to education of First Nations, Inuit and Métis peoples have seriously, severely, and (usually) negatively impacted people, peoples and their communities; they were "assimilation through educative means" (Kovach, 2009, p. 159) and bent on separating (even very young) children from their homes, lives and languages, whether the schooling took place in segregated residential schools or integrated provincial schools. Much has been written about the policies and their impacts (e.g. Dussault et al., 1996; Fournier & Crey, 1997; Haig-Brown, 1998; Regan, 2010), their full exploration would constitute a dissertation in itself. In order to limit the extent of my exploration of policy to the specific context of my research, I begin with a particular juncture in Aboriginal policy in Canada, the Trudeau government *White Paper* of 1969 (Chrétien, 1969).

The *White Paper* and *Indian Control of Indian Education* (ICOIE)

The *White Paper* (Chrétien, 1969), although including provisions to honour "Indian[174]" languages and knowledge, to transfer control of Indian lands to Indian people, and welcome Indians as "full, free and non-discriminatory" (p. 5) participants in

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[172] And other European governance entities.
[173] Sometimes in bad faith and under coercive circumstances.
[174] *Indian* is a term defined by the Indian Act and refers to First Nations people who hold status under the act.

Canadian society, was a continuation of government assimilationist policy whereby federal services and supports for Indian people would be dismantled over a five-year period, the *Indian Act* would be repealed, and the federal government would unilaterally withdraw "from its historic, and even treaty entrenched, fiduciary responsibilities to First Nations" (Paquette and Fallon, 2010, p. 76). The document generated an unprecedented, collective response from First Nations groups in Canada, in which they asserted the very power the *White Paper* stated[175] they did not have.

In 1972, the National Indian Brotherhood[176] (precursor to the AFN) presented its response to the *White Paper*[177]. *ICOIE* was a comprehensive document that addressed early childhood through post-secondary education, vocational training of adults, teacher education, the need for educational facilities and services, and locally run, locally controlled schools. It essentially "singled out education as the platform on which to formulate detailed resistance" (Paquette & Fallon, 2010, p. 77) to existing government policy and outlined "philosophy, goals, principles and directions" (NIB, 1972, p. iii) for the education of First Nations children in Canada. It insisted that such education be grounded in the desires, traditions, languages and values of First Nations communities and parents (Kirkness, 1999) while simultaneously providing the "training necessary for making a good living in modern society" (NIB, 1973, p. 3). In this last point, I read the document as acknowledging the place of Aboriginal peoples in Canada in the *inter esse*.

While the ideas embodied in *ICOIE* were adopted as policy drivers by the federal government in 1973 (Battiste, 1995; Kirkness, 1999; Paquette & Fallon, 2010), I would argue that the struggle to implement its tenets is ongoing. Still, its central thinking has appeared in discussions and policy documents regarding First Nations, Inuit, and Métis education ever since (e.g. Dussault et al., 1996; Jeffrey & Mount Pleasant-Jetté, 2002; Longboat, 2012).[178] The document has thus been instrumental in the devolution of

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[175] "To be an Indian is to lack power" (Chrétien, 1969, p. 2).

[176] Which was formed largely in response to the *White Paper* (Kovach, 2009).

[177] It was also a response to a report on education from the House of Commons Standing Committee on Indian Affairs which indicated huge gaps in all areas of education for First Nations students (Kirkness, 1999).

[178] One of the first places where the ideas outlined in *ICOIE* became manifest was the *James Bay and Northern Quebec Agreement* (Ciaccia, 1975), a tripartite agreement between the Governments of Québec and Canada and the James Bay Cree. This was (and is) a comprehensive agreement touching on all aspects of Cree life including the move from seasonal camps to more

educational funding from the federal government to local jurisdictions, and other changes such as the establishment of Aboriginal teacher education programs in faculties of education across Canada (Battiste, 1995), Aboriginal Head Start programs (e.g. Chabot, n.d.; Pence, Rodriguez de France, Greenwood, & Pacini-Ketchabaw, 2007; Prochner, 2004), and language resurgence in places such as the Mohawk territory of Kahnawà:ke (Jacobs, 1998) in Québec and several of Nova Scotia's Mi'kmaw communities (Battiste, 1987). Contemporary treaties, such as the *Nisga'a Final Agreement* (Gosnell, Leeson, Wright, Stewart, & Clark, 1999), and other recent agreements focused solely on education, such as the ones undertaken between the province of Nova Scotia, the federal government, and the thirteen communities of the Mi'kmaw Kina'matnewey (Government of Nova Scotia & Mi'kmaw Kina'matnewey, 2008; "Mi'kmaq Education Act," 1998) also integrate ideas originating in *ICOIE*. At the same time, its tenets have not been without their challenges.

Paquette and Fallon (2010) suggest that interpretations of meaning around the language of the document (by both governments and Indigenous groups) have led to considerable difficulty and, in some ways, allowed the federal government to technically meet its obligations with respect to Aboriginal education while simultaneously morally abandoning them. For instance, they underline that the equation of Indian control with local control is particularly onerous for small First Nations communities which do not experience the economies of scale associated with larger school systems, and therefore cannot afford the expenses associated with developing and maintaining local curricula and language learning or a school. Many small communities continue to send their young people to provincial schools, a service which they often find lacking (Dussault et al., 1996) but for which they must pay[179]. Kirkness (1999) also suggests that the concept of local control has been taken too literally by some First Nations communities that have kept locally developed programs of study, supporting materials, teaching and learning

permanent settlements. In terms of K-12 education it transferred responsibility for the schooling of Cree children in the communities covered by the agreement from the federal and Québec governments to the newly established Cree School Board, and ensured a place for Cree language in education.

[179] Usually a dollar amount more than the funding per student transferred to the community for education, although there is some debate around this issue (Mendelson, 2008). Underfunding of education for First Nations students is an ongoing issue on a national level (Assembly of First Nations, 2011; Clibbon, 2013)

resources etc. local and not shared lessons learned with other communities. She points to another challenge based in legislation, or rather lack thereof. Given the stipulations of the *Indian Act*, the Minister of (what is now) Aboriginal Affairs and Northern Development Canada (AANDC) has no actual authority to transfer control of schools to bands or local Aboriginal-run school boards[180]. All the Ministry can legally do is transfer funds for services through various Treasury Board authorities, resulting in an odd dual control of band-operated (but not entirely controlled) schools[181]. A third challenge is the definition of "Indian" or Aboriginal education, as agreements such as those considered above usually include stipulations that the education Aboriginal young people receive in community schools, while locally defined, is equivalent to that offered by provincial schools. For example, the *Nisga'a Final Agreement* (Gosnell, Leeson, Wright, Stewart, & Clark, 1999) states,

> 100. Nisga'a Lisims Government may make laws in respect of pre-school to grade 12 education on Nisga'a Lands of Nisga'a citizens, including the teaching of Nisga'à language and culture, provided that those laws include provisions for:
>
> 1. curriculum, examination, and other standards that permit transfers of students between school systems at a similar level of achievement and permit admission of students to the provincial post-secondary education systems. (p. 176)

Challenges of meaning, interpretation and intent run deep here[182]. So, while the implementation of *ICOIE* brought about changes such as improved retention, attendance,

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[180] Although it does allow for transfer of control to religious/charitable organizations, provinces and territories (Kirkness, 1999).
[181] This is not as significant an issue in Nunavut, the Northwest Territories, or the Yukon because as territories they administer their own schools.
[182] The challenges is ongoing. In 2014, the current federal government drafted a proposed *First Nations Education Act* (FNEA) (AANDC, 2014) aimed, in part, on addressing chronic education funding shortfalls for First Nations students. While the AFN signed on to a revised version of FNEA proposed in early 2014, local First Nation communities, councils, and governing bodies were significantly more concerned about the manner in which the Act is being publicly presented, and details of the Act which had not been forthcoming. For instance, there had been some indication by the sitting Minister of Aboriginal Affairs and Northern Development Canada that funding would only follow reform measures and evidence of improved student achievement in on-reserve schools (Curtis, 2014), that raised concerns FNEA would nullify many of the gains made since 1969. In addition, communities had significant questions about the manner in which

and graduation rates of Aboriginal students by the mid-1980s (Kirkness,1999), there was still much to be addressed[183]. Looking back on that defining period, Kirkness writes that while *ICOIE* supported Aboriginal people, peoples, and communities in

> articulat[ing] what we believe to be Aboriginal education. [It also] reversed our traditional holistic psychology to one wherein we are going from the parts to the whole. In other words, the most common approach under *Indian Control of Indian Education* today is to interject parts of our culture into the curriculum rather than having culture as the basis of our curriculum. (p. 7)

My Own Coming to Know at a Particular Juncture

Both Shawn Wilson (2008) and Abele et al. (2000) suggest that, in Canada, the period from 1990-2000 represents a particular juncture in opening up government policy and post-secondary research to Aboriginal voices, largely in response to significant public manifestations[184] of tension and disagreement between Aboriginal and settler peoples and communities[185]. It was a period Corinne described as "having the floor, and knowing you cannot let the moment pass, even if the reason for its existence is regrettable" (August 6, 2011). It was in this period of change that my involvement in Indigenous science education began.

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guarantees around language and culture as an integral part of learning were addressed in the Act (Piller, 2014). While the government indicated willingness to negotiate provisions of the proposed FNEA, there was suggestion that the Act in combination with other concurrent legislation impacting First Nations, Métis and Inuit people, peoples and communities was (and is) ultimately, like the *White Paper* (Chrétien, 1969), intended to assimilate Aboriginal people and dismantle existing Treaty rights and obligations. Dissensus around FNEA was so pronounced that AFN National Chief Shawn Atleo, who supported the legislation, resigned.

[183] Kirkness (1999) reads significant tensions in *ICOIE* as a response to the *White Paper*. I sense her tensions are related to the double bind, as she underlines the difficulty of drawing on the set of assumptions that created a problem in order to solve it.

[184] I use the term *manifestation* here in both the English sense of becoming manifest, and the French sense of protest, expression, and gathering together of people.

[185] The events include the 1990 Oka Crisis, that began in the Mohawk Territory of Kanesetake, north of Montréal, as a protest over the neighbouring town of Oka's use of land on contested territory. It spread to Kahnawà:ke, south of Montréal, where in solidarity with Kanesetake, community members blocked access to the Mercier Bridge, one of the major connections between Montréal and the south shore of the St. Lawrence River. Canadian Forces were called in by then Premier Robert Bourassa, significantly escalating the situation from a protest to a crisis that continued for several months.

As I was learning about science education, about Aboriginal peoples[186], about Aboriginal education, I was involved in both policy and more academic discussions. This second set of conversations[187] primarily focused on science, technology, engineering, and mathematics as they pertained to Aboriginal community-identified needs in terms of employment, infrastructure, health, and education[188]. Given the interconnected and interdependent nature and jurisdictional complexity of these discussions, I found myself at conferences and consultations with academics, educators, Elders, local, provincial, territorial and federal bureaucrats, parents, and just about anyone else who might be identified as a stakeholder in Indigenous[189] education (including K-12 students). While the focus at these gatherings was First Nations, Inuit, and Métis students and their experiences of STEM education (in both community and provincial schools), the participants were both Aboriginal and non-Aboriginal; a (mostly) motivated group who (usually) had a clear appreciation for the reasons[190] and need to approach STEM education from both Indigenous and Western perspectives[191]. As we sat with each other,

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[186] My schools had been very much silent about Aboriginal people, peoples, and communities, despite the fact that my high school was one of the private schools in Montreal where families from Kahnawà:ke consistently sent (and send) their daughters.

[187] Never far removed from policy.

[188] Education was often the most immediate part of the conversation because it serves as a gatekeeper for entry into the other elements under discussion.

[189] These meetings often included Indigenous peoples from outside of Canada– particularly Australia, New Zealand, and the United States–where similar relationships between Indigenous and settler peoples are at play.

[190] Mostly, because the status qui was clearly not working for Aboriginal young people.

[191] For the most part, the educational documents which have emerged from Aboriginal organizations in Canada (e.g. Callele, 2010; Indian Chiefs of Alberta, 1970; NIB, 1972) as well as the public documents based on consultation and research with Aboriginal peoples (e.g. Dussault, et al., 1996; Jeffrey & Mount Pleasant-Jetté, 2002), state and restate very clearly that Aboriginal peoples desire education that includes both Western and Indigenous ways of knowing, being, and doing. At the same time, I acknowledge that the conversations in which I have taken part are usually with people who come from that position. On rare occasions, I have heard members of Aboriginal communities suggest that Western education is toxic for their children and to be avoided. On a few other occasions, I have heard similar sentiments expressed specifically with respect to mathematics and science. Here the primary argument seems to be that mathematics and science are so based in and emergent from Western ways of knowing, being, and doing–and particularly the tenets of Cartesian-Newtonian logical-rationalism–as to be unredeemable. A secondary argument regarding the strong connection between mathematics and science as economic drivers and thus a conduit for education as economically driven also exists. These voices appear to be a minority of voices, but they do exist.

and tried to understand each other, it became clearer and clearer[192] that the conversations were not so much about subject matter content. Instead, they were frank discussions about differences and tensions between Western and Indigenous perspectives around pedagogy and philosophy of education. Almost without fail, at some point in the proceedings, as we got deep into conversation, someone would say, "But this is a better way to teach all of our kids"; and so, as Kirkness (1999) writes, the sense that an "Indian philosophy of education is in many ways more valid and universal than the one which prevails in educational circles today" (p. 4) hovered over our conversations.

In referring to Indian philosophy, Kirkness does not mean to suggest that there is a singular Aboriginal philosophy of education within Canada, nor more broadly a singular Indigenous philosophy of education worldwide. She acknowledges the importance of local philosophies to local education. She is, however, suggesting that there is something common enough among Indigenous philosophies, and particularly philosophies of Indigenous peoples in North America, to articulate a philosophy of education that contrasts with the Western philosophy of education that underlies most programs of study in education[193] in Canada. While what I have come/am still coming to understand with regard to what Kirkness means by *Indian philosophy of education* has developed through practice and the act of living with, I remain grateful to Greg Cajete for being one of the first Indigenous scholars to articulate an explanation in writing[194].

Using Aztec traditions as an illustrative example, Cajete writes (1994, 2001) of the primary impetus of education from Indigenous perspectives[195] as supporting young people in finding face, heart, and foundation; unique qualities of self, passion, vocation, and the ability to express who they are in order to become complete people. It is a process that, like school curricula, has key content: the ways of life and worldviews of the

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[192] Mostly to those of us who are not Aboriginal; everyone else already knew.

[193] Speaking about philosophy more broadly, Little Bear (2000) similarly states "there is enough similarity among North American Indian philosophies to apply the concepts broadly" (p. 77).

[194] Cajete's (1994, 1999a, 2000) early work was key within my Masters thesis (Wiseman, 2002) in terms of support for articulating things/events/understandings I had experienced at NAEP but could not always put into words.

[195] Cajete is Tewa. He understands the difficulties, dangers, and limits inherent in making global statements with respect to Indigenous peoples and their beliefs. At the same time, on the advice of his community Elders, he has undertaken a career-long study of Indigenous understandings of education and science, which began because he was teaching high school science to Indigenous students from multiple nations.

community in question. It is taught by example, occurs over a lifetime, and is embodied in community Elders. Learners (regardless of age) are supported in their engagement with the content, and are encouraged to what Greene (1978) would call "wide-awakeness" (p. 156), a deep awareness of what is going on around them, what they themselves are doing, and how these things interact. Learning in this manner is what Tadodaho Chief Leon Shenandoah, former spiritual leader of the Haudensosaunee, calls "becoming 'a human being'" (2001, p. xi). In retrospect, I recognize the discussions around pedagogy and philosophy from the gatherings in which I was involved as focused on supporting young people in their efforts of becoming–becoming complete, becoming awake, becoming human.

Provinces and Territories Consider Aboriginal Education Policy

Abele et al. (2000) write that the changes brought about by *ICOIE* (and subsequent policies that drew on and expanded the ideas therein), combined with large and growing populations of urban Aboriginal students, led provinces and territories to begin to consider Aboriginal education as early as the mid-1980s. SK and AB led provincial engagement with Aboriginal education, focusing on the need to address gaps (relative to the non-Aboriginal school population) in attendance, retention, and achievement, as well as concerns of Aboriginal parents and community members regarding the fit of school content and methods for their children.

In 1987, AB introduced the *Policy Statement on Native Education* (AL, 2002a, 2002b; Betkowski, 1987) that focused on better attending to the 23,000 Aboriginal students in provincially run schools at the time. The policy earmarked annual, multi-year funding for Aboriginal education projects and resource development initiated at the community-level, and was instrumental in the development of Aboriginal language and culture courses offered K-12 (AL, 2002a). Of particular note, the policy included a statement indicating that non-Aboriginal students were not excluded from the projects and resources developed: "Alberta Education supports education programs and services which provide enhanced opportunities for all Alberta students to develop an understanding and appreciation of Native histories, cultures and lifestyles" (in AL, 2002b, p. 2). While this statement does not seem to have been broadly taken up in

practice in the period the policy was active[196], the idea that all students might be better served by learning from the ways of knowing, being, and doing of Aboriginal people, peoples and communities began to hover.

While also recognizing the need to improve the educational experience of Aboriginal students in school, SK's *Indian and Métis Policy from Kindergarten to Grade 12* (Saskatchewan Education Training and Employment, 1989) was broader[197] than AB's. SK outlined a plan for beginning to shift the entire provincial education system so that Aboriginal and Western ways of knowing, being, and doing were present as a "part of *all* subject areas" and "for the benefit of *all* students" (p. 2, emphasis added)[198]. The policy acknowledged that such a shift required full participation of Aboriginal people, peoples, and communities at all levels and in all processes related to education including development of programs of study, teaching and learning resources, further policy etc. It also recognized that implementation required significant shifts not just at the K-12 level but in pre- and in-service teacher education, and so these ideas began to hover.

Other provinces and territories followed suit[199]. Like AB and SK, they included provisions in their documents stipulating that: Aboriginal peoples be involved in the design, planning, and delivery of education, Aboriginal children may have worldviews that differ from those of other students, and educational programs should reflect those worldviews in order to support the success of Aboriginal young people in school (e.g. Manitoba Education (ME), 2004; Warren, 1998). Over time, the tenets included in these documents have led to initiatives such as: BC Aboriginal Education Enhancement Agreements, individual agreements between local Aboriginal communities, the school

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[196] Initiatives under the policy appear to have run from 1987 to 1994 (AL, 2002a).

[197] SK's policy also addressed all schools in the province whether they were provincially-run or locally-run, community-based schools.

[198] From the early 1990s, some SK science programs of study (Saskatchewan Education, 1992a, 1992b, 1992c) contained explicit reference to Aboriginal perspectives as one of the principles guiding "the development of curricula as well as instruction in the classroom" (Saskatchewan Education, 1992b, p. 6).

[199] In 1995, MB issued a province-wide "request that all schools … incorporate Aboriginal Perspectives into all curricula" (ME, n.d., para. 1). NT published *Dene Kede: Education from a Dene Perspective* and *Inuuqatigiit: The Curriculum from the Inuit Perspective* (Appendix B) (DECE, 1996) in the 1990s. While they are listed as curriculum documents by the Northwest Territories DECE (2013a), as Steven Daniel* explains they "are foundation documents that allow teachers to integrate Inuit and/or Dene teachings and philosophy into the science (or other) curriculum".

boards which serve them and the provincial government (British Columbia Ministry of Education (BCME), n.d.; School District #23 Central Okanagan, 2006); Edmonton Catholic School Board's Rainbow Spirit project which supported classroom teacher engagement with Aboriginal content and perspectives (AL, 2002c; K. Ealey*); and the opening of school board-run, culture-based Aboriginal schools such as Children of the Earth High School (Winnipeg, MB), Oskāyak High School (Saskatoon, SK) and Amiskwaciy Academy (Edmonton, AB).

Science Education and Young People:
Considerations with Respect to Some Foundational Work in the Field

In terms of K-12 education, the work Corinne and I undertook at NAEP and MPES was focused on science[200], and also very much focused on First Nations, Métis, and Inuit young people[201]. When our program started in the 1990s, federal requirements for equity hiring, growing concerns regarding Aboriginal employment across the country, massive infrastructure needs in Aboriginal communities, resource and technology requirements arising from land claims agreements and contemporary treaties (along with other factors already described), were focusing attention not just on K-12 education of Aboriginal students, but specifically on mathematics and science education as particularly challenging locations with low enrolment and achievement levels for Aboriginal students (MacIvor, 1995). This attention resulted in development of a body of research with regard to Indigenous student experiences of science education[202].

In the Canadian context[203], Glen Aikenhead's career focus on science education in Aboriginal contexts has been very influential. Drawing on work by Geertz on culture and Snow on cultural divides, Aikenhead (1996, 1997, 1998b) suggests the tensions between

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[200] Due to our own backgrounds and the faculty in which we were located.

[201] We made no distinction between young people classified as Status or non-Status.

[202] In Chapter 2, I have already noted that, taken as a whole, the research points to tensions between Indigenous and Western epistemological and ontological assumptions regarding the world and the ways it works/is experienced as fundamental challenges and barriers to the participation of Indigenous students in science courses in schools and later careers.

[203] Aikenhead's work is respected and influential internationally. In, 2014 he received the Distinguished Contributions to Science Education through Research Award from the National Association of Research in Science Teaching (National Association of Research in Science Teaching, 2015).

Indigenous and Western epistemological and ontological understandings of the world and the way it works manifest as difficult border crossings for Aboriginal students in school. He posits school science as a subculture of Western science, and Western science as a subculture of Western culture[204]. Like any culture, Western science and school science come with their own traditions, languages, and practices (emergent from and immersed in underlying epistemological and ontological assumptions). He positions the teaching of science as "an attempt at transmitting a scientific subculture to students" (Aikenhead, 1998b, p. 87) where they must learn to cross the border between school culture and the culture of school science. Aikenhead says negotiating the border can be difficult for Western students for whom school science is a new experience, but may be more challenging for Indigenous students who–as entrants into an institution based on ontological and epistemological assumptions that can differ significantly from their own– are engaged in not just one but multiple border crossings. Because evidence indicates that unconscious switching of science teachers "between their Eurocentric science culture and students' everyday commonsense culture" (G. Aikenhead, December 11, 2013) leads to student misunderstandings and misconceptions about science, Aikenhead (2001) recommends science teachers take on the role of "culture brokers" (p. 339) who work with students to identify borders and facilitate negotiation of them. I have found Aikenhead's work on border crossing helpful in isolating and identifying processes which might be at work as Aboriginal students (and others[205]) attempt to negotiate spaces in which different ways of knowing, being, and doing circulate together[206]. However, it seems less productive in exposing the complex web of relationships of which those processes are but one part and in which they are embedded.

Cajete would likely not disagree with Aikenhead, but takes a broader view of the processes which are occurring in Western and school science to suggest that it is these processes and the assumptions underlying them that impact Indigenous (and all other) students' experiences of school science[207]. Examining E. O. Wilson's concept of biophilia, or affinity for nature, Cajete (1999b) contends that instead of nurturing young

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[204] Again, I in no way suggest that Western culture is in anyway unified, uniform, or unitary.
[205] In my experience, pre-service teachers also find Aikenhead helpful as they learn to think about the integration of Aboriginal perspectives in science.
[206] But only one is acknowledged.
[207] As well as school more broadly, and life in general.

people's curiosity and wonder about the world and introducing them to it through relationship, schools and curricula–in every subject area, but particularly science–re/produce biophobia, or fear of the natural world, by abstracting content from living experience, people from nature, and learning from community; in a sense abstracting all relationship and subjectivity from experience and focusing solely on a (false) objective view. My experience of working with pre-service teachers suggests there is something to this assertion. In taking students out of the classroom and into the Edmonton River Valley, I have found a good number of them significantly resistant to touching anything or moving off well-worn paths[208]. High School teacher Greg Henkleman* reports a similar experience in attempting to undertake field studies with urban high school students. He says, "many of them just don't have a visceral connection to nature" and are thus afraid of it[209].

Cajete (2006b) says this hidden biophobic curriculum leads students to perceive themselves not as a "microcosm of the macrocosm" (p. 249), but instead as distinctly separate and apart from the rest of creation, and thus able to control it only through knowledge and expertise; control of nature being one of the key, but largely unconscious, "epistemological underpinnings" (Cajete, 1999c, p. 190) of Western institutions. In his view, the concept of control runs throughout the curriculum, but is most obviously manifest in the teaching of science from a Western perspective which he acknowledges as "the single most powerful paradigm of modern Western culture" (Cajete, 1999a, p. 188).

While both Aikenhead and Cajete are concerned with student experience in and relationship to science learning, Cajete returns relationships created in classrooms to the larger context of being in the world[210]. He argues that in its commitment to objectivity,

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[208] In my experience, people tend to assume that in taking students outside and into the River Valley we focus on biological sciences. While relationships with biology are relatively easy to make outdoors, we speak just as much about chemistry and physics as biology, and in fact often move into considerations of engineering, mathematics, art, and language, and, and, and … .

[209] Louv (2010) offers the term "nature-deficit disorder" (p. 26) to describe what he reads as significant negative impacts on the health and well-being (physical, emotional, intellectual, and spiritual) of young people who learn in the isolation of a walled classroom.

[210] Within academic work "being in the world" is often taken up in relation to Heidegger's (1962) *Being and Time* in which I understand he rejects the Cartesian split between subject and object in favour of a primarily ontological positioning of human consciousness (Apostolidou, 2012). I am aware that Heidegger's work also closely informs Gadamer's (1989) conception of hermeneutics,

Western science–and by extension school science–does not creatively participate in the world but abstracts and fragments it in order to talk about and study it. He says these commitments result in a school science where the world is a representation of which students may have knowledge, but cannot touch and act in, and thus can never really know. Cajete (1999b) links the realization of this potential to our current ecological predicament[211]; it seems that the mindset required to bring about the collapse of fisheries is nurtured from an early age. At the same time, Cajete suggests that engagement with Indigenous ways of knowing, being, and doing in schools and school science offers a way to think education back into relationship and knowing.

Difference is not Easy: Multiplicity and the Potential for Relationship

Neither Aikenhead nor Cajete take the position that science or school science should be abandoned. In their own ways, they are each attempting to work toward some manner in which Indigenous *AND* Western ways of knowing, being, and doing in their contradictions and complementarities might inform and be acknowledged in teaching and learning. They are both attempting to deal with difference. Difference can be uneasy; that is, it can both cause discomfort (dis-ease), *AND* be difficult to negotiate (not easy).

In my own conversations with high school students, pre- and in-service teachers, and others about having Western and Indigenous ways of knowing, being, and doing circulate together in science and science curricula, when specific instances of difference arise–such as whether a person is part of the system being studied or not–I notice how they can become suddenly at a loss for words, uneasy. They may wave their hands in the air, shake their heads, grimace, as they search for some inarticulable explanation. Davis (2008) refers to such occurrences as "Huh?!" (p. 81) moments; instances of

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and certain uptakes of phenomenology (Dowling, 2007). While Heidegger's ontological bias (Apostolidou, 2012) suggests potential kinship or a meeting place for conversations with Indigenous ways of knowing, being, and doing, I am not familiar enough with his work to consider the nuances of these relationships. I use the term "being in the world" in this instance, because it is as good as descriptor as I can think of to describe the active, living ontology which I understand from Cajete and my Indigenous family, friends, and relations.

[211] A similar position is offered by Bateson (in Macy, 2008) who takes the position that a fundamental misunderstanding of self as individual instead of self as relationship between individual and environment "is basic to the planetary ecological crisis in which we find ourselves" (p. 335).

turbidity rather than clarity; inconsistency rather than coherence; jarring breaks rather than tidy connections. *Huhs* are those instances when you realize that something is amiss … in which a rule or interpretation that has always seemed to work suddenly comes up short–and not because the interpretation is wrong. (pp. 81-82)

I read Huh?! moments as signals of being in the *inter esse,* where the complex and dynamic nature of living in the world[212] becomes evident and caught up in the multiplicity that might imply. While Davis's description of Huh?! moments does not explicitly draw on Bateson's consideration of the double bind, it seems to share some kinship with it. The double bind occurs when a person receives contradictory or paradoxical messages and must figure out how to act within the contradiction. Difference is not easy.

In his consideration of multiplicity in classrooms, Aoki (2005c) draws on Deleuze's ideas about difference and multiplicity to make distinctions between difference in degree and difference in kind. Differences in degree are about more or less, better or worse, hierarchies; this apple is bigger than that apple. Western science is particularly well-suited to identifying differences of degree[213]. Differences in kind are literally that, apples and oranges[214], Western and Indigenous; things, ideas, concepts which are individually internally consistent, but not necessarily compatible or comparable to each other; not better or worse, not more or less, just different; and often complementary. Allowing differences in kind together to circulate in the same space can present as Huh?! moments or double binds. Deleuze engaged with Bateson's ideas around the double bind in his consideration of difference (Bell, 2006) to suggest there were two approaches for acting within the seeming paradox; either/or, or both/and. Either/or tends towards the destruction of the paradox either through the collapse of one element into the other, or through the inability to bring any meaning to either element (p. 105).

I read Aikenhead as dealing with multiplicity through an either/or approach, where border crossings indicate stark and often difficult-to-negotiate boundaries between differences in kind. Part of my tension with his work has been the seeming rigidness and

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[212] Or at least a world.
[213] I would assert that it is getting better at working with differences in kind.
[214] In the mathematical sense that they can neither be added to nor taken away from each other.

impermeability of the borders he describes[215]. I understand that his intention is to have teachers clarify epistemological locations for students–and particularly Aboriginal students–so that as young people who are still coming to understand they can begin to figure out how they might negotiate different ways of knowing, being, and doing while remaining true to who they are. Given the long-term impacts of colonial educational policies and school practices on Aboriginal people, peoples and communities, such explorations are vital[216]. I experience tensions around the apparent either/or approach to border crossings as it seems to leave little room for complex conversations in the *inter esse* where there can be "an intermingling of many things" (McKinley, 2005, p. 201), brought about by hundreds of years of contact between Indigenous and settler peoples. I thus worry that border crossings reproduce "colonial frontier logics" (Donald, 2009, p. 7) which maintain separation and division between Aboriginal and settler peoples rather than opening a space where ethical relationships might grown and develop. As Bell (2006) points out in his discussion of Deleuze and Bateson, either/or leaves little room for a creative response to the double bind[217]. But again, I acknowledge difference is not

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[215] And I grant that school science is often presented as difficult.

[216] I find some of my tensions diminished through conversations with Aikenhead (December 11-12, 2013) about more recent work with Herman Michell (Aikenhead & Michell, 2011). While he still suggests that teachers needs to be clear about their epistemological locations in order to avoid student confusion, the manner in which both teachers as learners and students makes sense of the border crossing may, in fact, open up the fuzzy places. In this negotiation, Aikenhead (2008) points to incarnations of third space metaphors with a preference for Vickers' (2007) "camping spots" (p. 592) which she describes as places for dialogue within and between communities. Vickers' camping spots seem similar to what I have called "meeting places".

[217] I am not saying that Aikenhead's work is uncreative. It is in fact useful in the sense Anyon (1994) looks for in theory. Teachers in community have developed wonderful lessons using the Aikenhead's approach as a model (Aikenhead, 2001; "Rekindling traditions: Cross-cultural science and technology units project," 2005). He and his work have also been instrumental in developing SK's programs of study for science (see for example SME, 2011a, 2011e), which I read as more complete and comprehensive in terms of creating space for engagement with Aboriginal ways of knowing, being, and doing than programs of study in nearly any Canadian jurisdiction. I am, however, saying such a position is only one approach and that such an approach might miss or preclude the emergence of certain responses in avoiding the messiness of engaging with the both/and. Whether what is missed or precluded is important to teaching and learning in science, to ways of knowing, being, and doing within the Canadian context remains open to conversation.

easy, that Aikenhead's (1997, 1998a, 1998b, 2001) work is foundational, and that it is his way of coming to understand[218].

In my own attempts to consider the apparent[219] Huh?! or double bind, the complexity and multiplicity presented by attempting to place Western and Indigenous ways of knowing, being, and doing together in science teaching and learning, I lean towards the both/and of dwelling with and amidst a "life … constantly in flux" (Aoki, 2005c, p. 205). While Aoki underlines Deleuze's position that differences in kind "resist integration" (p. 207), he, like Bell, says there is also room between differences in kind for creation, emergence, growth, and "new conventions that can reopen lines of communications" (p. 99) and perhaps lead to an "ethical relationality [which] is centred on an ecological understanding of the world" (Donald, 2009, p. 438). While the theory supports my leanings, I do not come to the leanings via theory, but rather through experience. That experience suggests despite the fundamental tensions between Western and Indigenous ways of knowing, being, and doing, the tensions, rather than destroying a space by collapsing or pulling it apart (Bell, 2006), can work together to open it up in ways fruitful and generative for teaching and learning. The space acknowledges the difference between ways of knowing, being, and doing but allows relationships to build between them in places where they can meet to have conversations. And these conversations are what Deleuze says counts in multiplicity, "not … the elements, but what is there in between, the between, a site of relations which are not separable from each other. Every multiplicity grows in the middle" (in Aoki, 2005c, p. 205).

Growing in the Middle: *The Common Framework for Science Learning Outcomes*

Growing in the middle of the conversations, consultations, local agreements, and changes with respect to Aboriginal education in Canada that occurred through the 1970s, 80s and 90s, were concurrent changes in science education. From 1979-1984, the

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[218] Glen is also very open to conversation about this work. He is in every sense a generous and supporting teacher.

[219] I write "apparent" because while within Western research Huhs?! and/or double binds seem like apt descriptors of the multiplicities at play, there may be other ways to consider the dynamics from Indigenous perspectives. I do not have a word or words for what this might be. I do not even have the sense of something inarticulable (see Chapter 3) at play. Nonetheless, I acknowledge these other ways may exist.

(former) Science Council of Canada (SCC) undertook an extensive examination of science education across the country and concluded that the situation was untenable (Blades, 2000; Milford, Jagger, Yore, & Anderson, 2010). Status quo approaches to science teaching and learning at the time were resulting in a significant number of students who became less interested in science the longer they studied it in school (Blades, 2000). To address what was seen as a national crisis, SCC challenged provinces and individual educators to consider and implement new science education programs that focused on the relationships between science, technology, and society (STS) (Blades, 2000; Milford et al., 2010). As such, STS was a primary focus when the Council of Ministers of Education, Canada (CMEC[220]) turned its attention to science education in the early 1990s (Hart, 2002).

The resulting *Common framework for science learning, K-12: Pan-Canadian protocol on school curriculum*[221] (CMEC, 1997) represents a collaborative effort between provinces[222] and territories to articulate harmonized goals and content for science teaching and learning at the primary and secondary levels. The *Framework* has been highly influential in the development and implementation of subsequent science programs of study in Canada (Aikenhead, 2006; Hart, 2002), resulting in a congruence and coherence in science programming across the country that does not necessarily exist in other K-12 subject areas. The four foundations for the *Framework* are (1) science, technology, society, and the environment[223] (STSE), (2) skills required for engaging in scientific inquiry, technological problem solving and STSE decision making, (3) conceptual understandings in life science, physical science, Earth and space science, and (4) attitudes that reflect and support responsible application of skills and understandings.

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[220] Although education is a provincial jurisdiction in Canada, there is an understanding amongst the provinces and territories that there are areas of mutual, national interest and potential cooperation with regard to the teaching and learning of young people. The CMEC was established in 1967 as a locus for discussions and actions around these areas (CMEC, n.d.).

[221] Hereinafter referred to as the *Framework*.

[222] Québec did not participate in the development.

[223] STS is taken up in science programs of study across jurisdictions, while the environment (E) appears only in some. AB, for example, only includes STS in its science curricula (e.g. AE 2005). Hart (2002) reports that a significant number of teachers believe the addition of environment represents an opening up of science to questions of values that they are uncertain belong in the teaching and learning of science and feel unprepared to address. Tensions around values are also identified by Kanu (2011) and Deer (2013) as one of the elements pre- and in-service teachers can struggle with in the integration of Aboriginal perspectives.

Luke (2013) writes that such broadly applied policies push:

for interoperability and equity of exchange [between jurisdictions and nations], but in so doing, … simply exclude … debates and learning about civics, civility, language, and culture; about diverse and common cultural touchstones; and about learning to live together–and it altogether ignores Indigenous lessons about the stewardship of cultures, the land, and the planet. (p. 375)

Critiques of the *Framework* identify many of these same points. They focus on the variation of the role played by teachers in different jurisdictions in the *Framework's* development (Hart, 2002), the potential for the document to marginalize environmental education (Sammel & Zandvliet, 2003), as well as its grounding in Western worldviews and absence of any explicit reference to First Nations, Métis and/or Inuit ways of knowing, being, and doing (Aikenhead, 2006; Blades 2000). With respect to these last two points, the *Framework* does acknowledge that there are "*values* inherent" (p. 10) in the practice of science related to the social and environmental locations of the practice, and that science (and learning) occur within "socio-cultural context[s]" (p. 7). However, as Aikenhead (2006) underlines, the values, contexts, and culture, both hidden and more explicit, within the document are very much Western, very much "embedded in the predominant Euro-Canadian culture" (pp. 387-388).

I agree that the *Framework*'s silence in relation to Canada's Aboriginal people, peoples, and communities is problematic. At the same time, I maintain that the positioning of STSE as the "driving force" (p. 9) of the *Framework*, along with the broad uptake of the document's tenets in subsequent provincial/territorial science curricula across the country (Milford et al., 2010) have had a crucial role in putting into play the integration of Indigenous perspectives in science curricula[224]. As described in the *Framework* , STSE consists of three dimensions, the first of which is the nature of science and technology, where it is acknowledged that both science and technology are humanly constructed activities based on the contributions of people "from many societies" and "all cultures of the world" (p. 9). Nature of science essentially opens up questions about what science is or might be, and who gets to consider the questions. In

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[224] The *Framework* has not put integration in science curricula into play in and of itself, but co-temperously with and in relation to conversations etc. that were occurring with respect to Aboriginal education in the same period.

his review of science education on the continent of Africa, Jegede (1997) identifies a commitment to STS as key in opening up science education to questions of culture and values, and subsequent inclusion of or engagement with local understandings and ways of knowing, being, and doing within science curricula. In the Canadian context, in the provinces and territories where integration of Indigenous perspectives in K-12 science curricula has been mandated, every science program of study where Indigenous perspectives are in some way explicitly taken up, also contains explicit reference to STSE[225]. In instances where explicit mentions of STSE are absent in the science programs of study, there is also an absence of Indigenous perspectives, as in the case of senior academic science programs of study in BC (BCME, 2006a, 2006b, 2006d)[226].

So, while the *Framework* contains no explicit reference to or acknowledgement of First Nations, Métis and/or Inuit perspectives/worldviews, I take the position that its privileging of STSE has been key in providing a place in which the idea of Aboriginal ways of knowing, being, and doing could begin to hover over science education.

Ideas Hovering Over the Same Place

Anthropologist Sally Weaver spent a career examining the relationship between policy and Aboriginal peoples in Canada (Abler, 1993). Slightly before her death in 1993, Weaver (1990) published a paper predicting the upcoming decade would see the opening up of policy in relation to Aboriginal peoples noted by Shawn Wilson (2008) and Abele et al. (2000). In her paper, Weaver underlines the power of ideas, and specifically the power of ideas to affect policy and political change. While she locates the origins of ideas in human actors–bureaucrats, Ministers, advisory groups, journalists, and academics–she suggests some ideas, no matter how outlandish they first appear, take on a life of their own, and

> 'hover' over the policy field, thereby continuing to provide alternatives to the conventional policy approach used in government. The persistence of certain ideas can be seen when they reappear in different policies within the same policy field (p. 9-10)

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[225] There are instances where STSE is explicitly mentioned and Indigenous perspectives are not (ME, 2013).

[226] British Columbia's primary resource document for integration, *Shared Lessons: Integrating BC Aboriginal Content K-10* (AEEB, 2006), is explicit about the grade limitations for integration in its title.

in an ongoing manner. This persistence she likens to Kuhn's (1962) model of scientific paradigm shifts, where two (or more) internally consistent but mutually exclusive scientific models (models of different kinds) exist cotemperously and cause tensions in the scientific community that are not easily resolved. Kuhn refers to these shifts as revolutions.

The persistence of ideas could equally be likened to complexity models where ideas have the ability to jump from lower levels of organization, like individual people, to higher levels of organization, like bureaucracies, taking on a life that is quite separate[227] from the context in which the ideas were originally conceived (Davis & Sumara, 2006). It could also be likened to Deleuze and Guattari's (1976) use of the biological notion of rhizomes, that are often hidden but pop up over and over again in seemingly unconnected places. The persistence might also be a sign that Coyote picked up these ideas and has been running around with them in all sorts of places, but has not been able to figure out where to put them down safely or who else might pick them up. The point being, it is often difficult to identify how ideas hover, but it is possible to find traces or tracks they are at work. Weaver suggests that within policy, traces of a paradigm shift in process would include "erratic policy experiments, unfocussed initiatives, and false starts until the new model of thinking settles into acceptance"[228] (p. 10).

A Shift in Progress, a Change at Play, the World in Flux: Revolution

I propose that the ideas collectively presented in *ICOIE* sparked the beginnings of a paradigm shift that have manifested with respect to education for Aboriginal students, and, more recently, with respect to education for (nearly) all students in Canada, not just because the ideas in *ICOIE* are about education, but rather because they are also about

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[227] But still related to.

[228] While I think the process Weaver identifies is in play, I am not yet convinced it is settled. Graham, Dittburner, and Abele (1996) write that the policy relationship between the Canadian federal government and Aboriginal peoples has a tendency to fall into a model of either soliloquy–where the government unilaterally imposes (or attempts to impose) decisions–or dialogue–where policy is developed through cooperation and consultation between the government and Aboriginal people, peoples, and communities. It seems that the recently defeated Conservation federal government preferred soliloquy, but was being resisted in ways Weaver suggests indicate the shift is still in process. This resistance took the form of movements such as Idle No More, but also actions such as the refusal of federal judges to impose (what are widely considered unjust) surcharges on persons found guilty of minor crimes (Fine, 2013).

relationships and multiplicity. In acknowledging the location of contemporary Aboriginal peoples in the *inter esse*, the authors of *ICOIE* also suggested there was a need for the other residents of Canada to enter this space:

> The gap between our people and those who have chosen, often gladly, to join us as residents of this beautiful and bountiful country, is vast when it comes to mutual understanding and appreciation of differences. To overcome this, it is essential that Canadian children of every racial origin have the opportunity during their school days to learn about the history, customs and culture of this country's original inhabitants and first citizens. We propose that education authorities, especially those in Ministries of Education, should provide for this in the curricula and texts which are chosen for use in Canadian schools. (p. 2)

In the educational policy changes taking place up to the turn of the last century, (most) provincial/territorial governments could only go as far as acknowledging that Aboriginal students existed in the *inter esse,* and there was some willingness and recognition of a necessity to adjust/adapt/develop programs to address that dual/multiple place of being. Nonetheless, the ideas that there is something to "Indian philosophy of education" (Kirkness, 1999, p. 4), that there is value to all young people in Canada developing understandings of "Native histories, cultures and lifestyles" (AL, 2002b, p. 2), and that science as taken up in schools might be open to ways of knowing, being and doing beyond the Western hovered over policy conversations throughout the late 1980s and 1990s, and began to circulate in the same space as ideas emergent from *ICOIE.* Together they have led to what might described as a growing sense of *māramatanga*/effulgent coherence or a "revolution" (D. McKee*); the emergence of the current context of integration.

We are convinced that you mean to do us Good by your Proposal [to educate our young men]; and we thank you heartily. But you, who are wise, must know that different Nations have different Conceptions of things and you will therefore not take it amiss if our ideas of this kind of Education happen not to be the same as yours … We are … not the less oblig'd by your kind Offer, tho' we decline accepting it; and to show our grateful Sense of it, if the Gentlemen of Virginia will send us a Dozen of their Sons, we will take Care of their Education, instruct them in all we know, and make Men of them. (Chief Red Jacket of the Haudenosaunee at a treaty signing in 1744 from Drake in Brant Castellano, Davis, & Lahache, 2000, p. xii)

Coyote, Naapi, Raven and a few of their colleagues invite Hermes to a consultation meeting (probably in Winnipeg or Ottawa). After a sunrise ceremony and the usual introductions, they move into a windowless room. Coyote consults with his colleagues, nods, turns to Hermes and says, "We've been paying attention to your work. It shows promise. As you know, we've been doing this for a while and have more experience locally. We're working on a new project that might be right up your alley. We'd like to bring you on board, teach you a few things, see how they work out". (Excerpt research journal, July 10, 2013)

Chapter 8: What is at Play in the Contemporary Context of Integration

Integration is not a new proposal. It arose in the 1950s as an assimilative federal policy aimed at moving Aboriginal students from residential schools and into provincial schools (Kovach, 2009). *ICOIE,* however, troubled the idea of integration and its intentions.

> Integration is a broad concept of human development which provides for growth through mingling the best elements of a wide range of human differences. Integrated educational programs must respect the reality of racial and cultural differences by providing a curriculum which blends the best from the Indian and the non-Indian traditions.
>
> Integration viewed as a one-way process is not integration, and will fail. In the past, it has been the Indian student who was asked to integrate: to give up his identity, to adopt new values and a new way of life. This restricted interpretation of integration must be radically altered if future education programs are to benefit Indian children.
>
> The success of integration hinges on these factors: parents, teachers, pupils (both Indian and of other races) and curriculum. (NIB, 1972, p. 25)

The possibility of integration as a two-way process important to all students in Canada has thus hovered over policy for a long time. As suggested by the NIB, successful two-way integration requires shifts and re/alignment across the educational system, and among a wide range of educational stakeholders. Such broad-based change did not arise in response to the government policy documents and directives of 1980s and 1990s (as described in Chapter 7), although it was invited. According to Darren McKee*, real change could only come about through revolution,

> You really need to have a revolutionary shift and then allow evolution to manage that shift. In my mind, it's the teacher talking about things like "I *have* to do this". The revolution is, yes, [ministries of education are] going to force people to do it. The evolution is then they will understand–or come to understand–that it was a great choice to do it, but not everybody does that at the beginning of the process.

While the policy and programs of study that mandate integration of Indigenous perspectives in K-12 curricula certainly seemed revolutionary and sudden to my class colleagues (as described in Chapter 2), the evolution of the shift is on going. To date, implementation has largely focused on revision of programs of study and development of teaching content (e.g. Aboriginal Education Provincial Advisory Committee, 2008;

Aboriginal Policy Branch, 2008). There has been, and continues to be, professional development opportunities for teachers regarding integration of Indigenous perspectives.[229] Ministries of education in consultation and/or collaboration with First Nations, Métis, and Inuit people, peoples and communities have developed on-line multi-media and text-based resources to support pre- and in-service teachers' developing understandings with respect to integration of Indigenous perspectives (e.g. Aboriginal Education Enhancements Branch (AEEB), 2006; AE, 2012; Manitoba Education and Youth (MEY), 2003a). In 2010, the Association of Deans of Canadian Education signed an *Accord on Indigenous Education* (Archibald, Lundy, Reynolds, & Williams, 2010) that, in part, lays out the role of faculties of education in promoting "comprehensive teacher candidate and faculty programs that create meaningful opportunities for learning about and practicing Indigenous pedagogies and ways of knowing" (p. 6), but also recognizes the goals of the accord as a new and ongoing project. In provinces[230] where integration is mandated, curriculum and instruction departments in faculties of education seem to be seeking out faculty candidates with experience and expertise related to Indigenous education in all subject areas. In general, there are signs of change and re/alignment across the education system in response to the mandates that the NIB suggested would be required for two-way integration. At the same time, slightly over a decade from the adoption of the earliest policies, the revolution is still evolving.

This chapter serves as both a review of policy that examines what educators are responding to in terms of integrating Indigenous perspectives in science curricula, and a review of literature that positions my dissertation with respect to the emerging field of research around integration in Canada[231]. Most of the research regarding integration of Indigenous perspectives in K-12 curricula in Canada focuses on the experiences and perceptions of educational stakeholders. The research does not tend to pay significant attention to policy/programs of study other than to acknowledge them as a source for the

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[229] Although in some jurisdictions professional development considered outside of science as a subject area can be difficult for science teachers to access because of school or school board restrictions regarding the use of professional development funding (H. King*).
[230] There are currently no universities in the territories. Post-secondary institutions in these jurisdictions tend to award degrees through partnerships with universities in southern Canada.
[231] As noted in Chapter 4, given that the two cases are evolving entities, every effort has been made to remain current with literature and policy changes through December 2013, more recent changes are not necessarily accounted for in this chapter.

shift in process (e.g. Blood, 2010; Kanu, 2011)[232]. Yet, the teachers I met in my courses, and many of the educational stakeholders I had conversations with as part of this inquiry, spoke about policy and science programs of study as the impetus for change in their practice and a source of subsequent struggle, discomfort, and tension around that change.

As such, in the first part of this chapter I examine more closely broad policy documents with respect to integration of Indigenous perspectives in K-12 curricula and science programs of study. I outline the commitments made by provincial/territorial governments in broad policy, and how such commitments seem to frame relationships with Aboriginal people, peoples, and communities as either consultative or collaborative (G. Aikenhead, August 21, 2014). I then provide examples of tensions in alignment between commitments laid out in broad policy and science programs of study that might prove challenging for educators who are trying to interpret and understand integration in science curricula, to suggest that collaborative framings of relationships provide a framing where *māramatanga*/effulgent coherence is potential. In the second part of the chapter, I explore and outline the emerging body research regarding integration of Indigenous perspectives in K-12 curricula in Canada. I conclude the chapter by suggesting that, in relation to integration, some jurisdiction's broad policy and certain scholars' approaches to research assume the need to do something significantly different than the status quo. In these cases, what policies open up and results of research suggest is that *integration* as a descriptor of process somehow becomes inadequate to what is at play. My own commitments in both research and practice are allied with work that attempts to break from the status quo.

Integration: Policy

In reviewing policy, I examined documents from each of the eight jurisdictions that have mandated integration of Indigenous perspectives in K-12 curricula (see Appendix B). Here, I return to my understanding of policy as tricky (as discussed in Chapter 7)–text that can be responded to, discourse that frames the possibilities for response, process that acts (Ball, 1993)–something to be interpreted. I consider the policy

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[232] There is recent research that specifically examines the manner in which Indigenous perspectives are taken up within policy/programs of study (Kim & Dionne, 2014), but this work does not tend to focus much on educators.

and programs of study in relation to research by Hart (2002) and Barrett and Pedretti (2006)[233] regarding tensions in alignment that can occur in moving from policy to programs of study, from curriculum as plan to curriculum as lived (Aoki, 2005f). All the places in-between where Coyote can pick up something and walk away with it, or leave behind unexpected gifts.

Hart (2002) indicates that K-12 science educators in Canada respect the authority of policy frameworks, but have little attachment to the processes by which policy is developed and comes to manifest within programs of study. He notes that K-12 science educators are also aware of their responsibility for enacting policy as it is presented in programs of study but,

> Because [curricular] reform is complex and can produce few concrete examples of what reformed classrooms might *look like*, the alignment of teachers' core beliefs with a curriculum's conceptual framework is crucial to enactment/implementation. (p. 1243, emphasis added)

Given this position, the statement that inspired my dissertation–"I don't even know what this *looks like*"–might be read as an indication of tensions in alignment between the core beliefs of educators[234] who have come through schools and universities grounded in "colonial frontier logics" (Donald, 2009, p. 7), and programs of study in which the conceptual framework now stipulates consideration of both Indigenous and Western ways of knowing, being, and doing[235]. So, in terms of curricular policy reforms with the potential to generate such tension with core beliefs–such as integration of Indigenous perspectives–it would seem prudent for programs of study and supporting documents to be somewhat explicit regarding change in order to support interpretation and understanding of how and why Indigenous perspectives might be integrated. Such explicitness seems particularly important given that Barrett and Pedretti (2006) identify programs of study as the location for most educators' understandings of policy. Barrett and Pedretti echo Hart's (2002) position on policy and add that changes to programs of study can themselves be contradictory and challenging for teachers to interpret. For example, in examining ON science programs of study with respect to STSE, they note how the front matter positions STSE as a means and location for engaging with critical

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[233] Both Hart (2002) and Barrett and Pedretti (2006) consider policy in relation to STSE.
[234] The majority of whom are "white, [and]… of European heritage" (Johnston et al., 2009, p. 2).
[235] It might also be read as a form of resistance.

thinking and science literacy, whereas the expectations outlined in content "are prescriptive" (p. 240) and leave little space for such engagement. The difficulties identified by Hart and Barrett and Pedretti are also present in science programs of study with respect to integration of Indigenous perspectives. It seems to me that what Hart and Barrett and Pedretti point to as tensions in alignment might also be read as a lack of *māramatanga*/effulgent coherence within and between policy documents and programs of study. That is they point to changes where it becomes difficult for all principles to touch on every aspect of the practice because the change involves a change in principle that is challenging to negotiate in terms of practice.

In the sections that follow I draw on elements of my review of policy and programs of study (see Appendix B for a full list of documents), alongside conversations with some of the educational stakeholders who informed this writing[236], in order to clarify what they appear to be responding to and trying to interpret in their attempts to integrate Indigenous perspectives in science curricula. In addition, I consider how policy and science programs of study can support these attempts or be a source of significant tension.

Broad policy

In each of the provinces and territories that have mandated integration of Indigenous perspectives in K-12 curricula, broad policy (see Appendix B) is relatively explicit regarding the commitments being made. There are significant similarities across broad policies regarding integration of Indigenous perspectives in curricula. For instance, all of the documents acknowledge and discuss the importance of Aboriginal languages as locations of knowledge and understanding, and their place within provincial/territorial schools. All of the documents also in some way echo the position of the NIB (1972) that the change with regard to integration in K-12 curricula is substantial and has broad impact in terms of structure and programming across the education system and for all educational stakeholders[237]. Within the similarities, however, are differences often

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[236] People who agreed to be participants in the research, as well as Glen Aikenhead with whom I have had several discussions over the course of writing.

[237] Although there is little or no explicit provision for including student voice amongst the various stakeholders involved in the implementation process except in NT (DECE, 2013b).

specific to place. So, for example, while ON (Ontario Ministry of Education (OME), 2007b) lays out detailed steps for specific stakeholders–the Ministry of Education, school boards, schools–in terms of meeting its policy goals with respect to integration, BC (AEEB, 2006; BCME, n.d.; School District #23 Central Okanagan, 2014) is less explicit in this regard. In what follows I summarize and clarify some key points arising from broad policy with respect to integration of Indigenous perspectives in K-12 curricula.

Treaty rights and the place of Aboriginal peoples. All jurisdictions include some discussion of the unique place of First Nations, Métis, and/or Inuit peoples within the context of Canada and the role of treaties in establishing the relationships between Aboriginal and settler peoples. While the approaches differ, in the discussion and recognition of treaties provinces and territories acknowledge that their jurisdiction is limited to provincial/territorial schools, although some of the documents do mention partnering with Aboriginal community-administered schools (Department of Education Culture and Employment, 2013b; Saskatchewan Learning (SL), 2003).

The discussion and recognition of treaties and the relationships they establish also differentiate the mandates regarding integration of Indigenous perspectives from those of multiculturalism. AB (AL, 2002b) provides a particularly strong statement in this regard:

> First Nations, Métis and Inuit people *are not* special interest groups in Canada. They are unique constitutional and governance entities, whose place in Canada *is unlike* that of any other people because of their original occupancy of Canada, their treaty rights, and Section 35 of the Constitution Act, 1982 that recognizes and affirms the "existing aboriginal and treaty rights of the aboriginal peoples of Canada". (p. 4, emphasis added)

The distinction is important. While Johnston et al., (2009) indicate there can be some ambivalence among educators with respect to the manner in which multiculturalism plays out in schools, they are very much aware of Canada's ("Canadian Multiculturalism Act", 1988) official stance on multiculturalism. Verna St. Denis[238] (2011) writes that familiarity with multiculturalism can lead educators to subsume "Aboriginal curricular content and perspectives" (p. 306) within it and then silence them. As such, statements that clarify integration of Indigenous perspectives as distinct from those of

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[238] Dr. St. Denis is a professor in the College of Education at the University of Saskatchewan. She is Cree and Métis from Beardy's and Okemasis First Nation, SK.

multiculturalism are important.

All subject areas K-12. Most broad policy documents somehow state the changes will be applied across curricula for all subject matter, kindergarten through grade 12. The outlier in this regard is British Columbia (AEEB, 2006) which limits the integration of Indigenous perspectives from kindergarten to grade 10 (as discussed in Chapter 7).

Aboriginal students, all students, all our relations. Within most of the broad policy statements there is explicit discussion regarding enhancing the educational experience for Aboriginal students in provincial/territorial schools as a means of improving their educational success and later life outcomes, such as labour market participation (AL, 2002b; DECE, 2011; ME, 2004, 2008; OME, 2007b; SL, 2003; School District #23 Central Okanagan, 2006, 2014). In some jurisdictions, such improvements are taken up in terms of over all (emotional, physical, spiritual, and intellectual) well-being of Aboriginal (and sometimes other) students and/or reference to building strong Aboriginal identities through participation in the school system (First Nations Programs and Partnership Unit, 2013; Nunavut Department of Education (NDE), 2007; OME, 2007b; SL, 2003; School District #23 Central Okanagan, 2006, 2014). There are differences in the ways such commitments are worded. For instance, ON (OME, 2007b) underlines the necessity for Aboriginal students to "see themselves and their cultures in the curriculum and the school community" (p. 6) in order for them to engage in and feel welcome in school, whereas NU underlines "the responsibility of educators to ensure graduates have a strong sense of [individual and collective] Inuit identity and clear knowledge of their unique personal strengths and skills and how to use them to serve family and community" (Picco in NDE, 2007, p. 7). These approaches represent different foci for integration or engagement with Aboriginal perspectives in curricula, with one (OME, 2007b) focusing on First Nations, Métis, and Inuit young people fitting into the school system and the other (NDE, 2007) having the school system support Inuit and other NU young people in becoming more complete human beings who are supported by and contribute to life in the places where they live (Cajete, 1994; Shendoah, 2001).

The broad policy documents from all jurisdictions, except the Yukon (First Nations Programs and Partnership Unit, 2013), state that integration of Aboriginal

perspectives in curricula is intended for all students[239]; another indication of integration as a two-way process. MB, for instance, (MEY, 2003a) takes the position that:

> The inclusion of Aboriginal perspectives into curricula will benefit not only Aboriginal peoples but also non-Aboriginal peoples as well. All students are denied a quality education if they are not exposed to the contributions made by all people of the development of the country in which they live. (p. 1)

In considering integration, SK (SL, 2003) goes well beyond a focus on the school system, educational stakeholders, and students. Read as a whole, the province's policy focuses on the creation of partnerships between Aboriginal and settler peoples for the current, mid-, and long-term benefit of the entire province. Integration in SK is positioned as not only for students–Aboriginal or otherwise–but also for all of the province's people, its economy, land, air, water, and other-than-human relations. The shift to integrate First Nations and Métis perspectives in Saskatchewan curricula is thus a key means via which the province plans to realize its future as a complex collective. NU's policy (NDE, 2007) presents a similar holistic approach and NT appears to be moving in a comparable direction (DECE, 2011, 2013b)

Relationships with Aboriginal people, peoples, and communities. All broad policy documents discuss the importance of reaching out to and working with Aboriginal people, peoples, and communities in the processes related to implementing integration. While statements to this effect demonstrate an overall commitment to some kind of partnership with respect to integration of Indigenous perspectives in K-12 curricula, there are some distinct differences in terms of how and where such partnerships are framed.

In some jurisdictions, such as AB (AL, 2002b) and ON (OME, 2007b), the role of Ministries of Education remains central. So, for example, while AB (AL, 2002b) is clear about the provincial commitment to continue to seek assistance and advice from stakeholder groups–including First Nations, Métis, and Inuit people, peoples, and communities–it is also clear that "Alberta Learning has primary responsibility for the implementation of the policy framework" and will consult "In instances where

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[239] For the most part, the statements about inclusion are clear and relatively upfront in the documents. In Ontario, the position that all students will somehow engage with Aboriginal perspectives in curricula does not appear until page 7 of the policy and requires some searching to identify.

community issues may require attention" (p. 10). Other jurisdictions–notably NU and SK provide a contrasting approach.

In the years leading to the creation of NU in 1999, Inuit Elders articulated a statement of values[240] intended to underlie all public policy and programs in the new territory (Arnakak, 2002; Kreuger, 2011; Tester & Irniq, 2008). They named the result *Inuit Qaujimajatuqangit* (IQ), in English "The Inuit way of doing things: the past, present and future knowledge, experience, and values of Inuit Society" (IQ Task Force in Kreuger, 2011, p. 2). IQ tenets have been written down in frameworks and documents to support public servants' and bureaucrats' understandings of how the creation and implementation of programs across all government sectors should proceed. The articulation of IQ specific to education (NDE, 2007) has involved educators and other community experts, but is lead by Elders in order to ensure that education is grounded "in the strengths of the Inuit so that their children will survive and successfully negotiate the world in which they find themselves today" (p. 22).

A similar situation seems to be at play in SK policy (SL, 2003). In taking the position that integration is about the well-being of the province as a whole, SK also articulates a set of values[241] to underlie curricula and how it is taken up in teaching and learning in every subject area. SK explicitly states that the relationships between Aboriginal and settler people, peoples, and communities required to achieve the stated goals are "qualitatively different from many traditional partnerships and public involvement initiatives. The **authentic partnerships** and *collaborative* arrangements this policy promotes will support shared management and governance" (p. 2, bold in original, italics added) characterized by mutually identified expectations, shared responsibility across processes and decision-making and for the well-being and achievement of all students, and flexibility in terms of how implementation is defined and taken up both

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[240] The values laid out in IQ are: *Inuuqatigiitsiarniq*–respecting others, relationships and caring for people; *Tunnganarniq*–fostering good spirit by being open, welcoming and inclusive; *Pijitsirniq*–serving and providing for family and community; *Aajiqatigiinniq*– decision-making through discussion and consensus; *Pilimmaksarniq*–the development of skills through practice, effort, and action: *Piliriqatigiinniq*–working together for a common cause; *Qanuqturniq*–being innovative and resourceful in seeking solutions; *Avatittinnik Kamatsiarniq*–respect and care for the land, animals, and the environment (Kreuger, 2011, pp. 2-3).
[241] The values include cooperation, equity, community, shared responsibility and respect for diversity (SL, 2003).

broadly and in more local places (p. 3). Aikenhead and Elliot (2010) document how these relationships and values were (and are being) applied in the renewal of provincial programs of study for science[242] to suggest that ongoing process of involving community Elders and knowledge holders along with field-testing of new programs of study by Aboriginal teachers has contributed to an "emerging decolonizing" (p. 321) of science education in Canada.

      Collaboration or consultation: Framing relationships at play. Glen Aikenhead (personal communication, August 21, 2014) describes the relationships between Aboriginal and settler people, peoples, and communities framed by NU and SK as collaborative, and similar relationships framed by AB and ON as consultative[243]. The difference between the two processes lies in the willingness of provincial/territorial governments to enter into relationships where ministries "relinquish some genuine authority to Indigenous Elders [and other knowledge holders] to make contributions [to curricula] and take ownership of those contributions" (G. Aikenhead, May 13, 2013). Or, in other words, the difference between collaboration and consultation lies in the willingness of provincial/territorial governments to let go of control and embrace the spirit of two-way integration suggested in *ICOIE* by developing a framework within which *māramatanga/*effulgent coherence might be potential. The commitment to

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[242] The renewal process began in 2005.

[243] Aikenhead (personal communication, August 21, 2014) suggests Manitoba is moving in the direction of collaboration. There is some evidence to support his contention in current provincial policy documents (ME, 2004, 2008; MEY 2003a), and more from personal conversations I have had with educational stakeholders in the province. As I read them, the province's science programs of study (ME, 1999a, 2000a, 2010, 2011, 2013; Manitoba Education and Training (MET), 2000a; MEY, 2003b, 2003c; Manitoba Education, Citizenship and Youth (MECY), 2005, 2006) do not yet reflect such collaboration. Given the manner in which Aikenhead (personal communication, August 21, 2014) describes collaboration, I would suggest that BC leans to collaboration, although on a more local level through Educational Enhancement Agreements in school districts with significant enrolments of Aboriginal students (e.g. School District #23 Central Okanagan, 2006, 2014). The province's science programs of study (BCME, 2005, 2006a, 2006b, 2006d, 2006e, 2006f, 2008b) and *Shared Learnings* (AEEB, 2006) document do enter into discussion of integration and Aboriginal values, but it is hard to know how much it informs classroom practice in the absence of more evidence. Informal conversations with personal contacts in the province suggest integration in large urban schools is hit or miss, particularly in science and mathematics. Given that *Shared Learnings* does not address integration beyond grade 10, there do seem to be limits to the province's commitment. The Northwest Territories also seems to be moving in the direction of collaboration in its current education renewal process (DECE, 2011, 2013b).

collaboration or consultation does seem to have some impact in terms of moving integration within science programs of study beyond curriculum content add-ons.

Programs of study

In Canada, science programs of study developed by provincial/territorial[244] ministries of education are generally divided into two sections, front matter and content. The front matter outlines philosophical and pedagogical assumptions and commitments for the teaching and learning of science. The content is then generally laid out per the *Common framework for science learning outcomes* (CMEC, 1997) as knowledge, skills, and attitudes to be taught at each grade level, usually arranged by grade level and topic, with related general and specific learning expectations/outcomes for each topic.

Where policy documents regarding integration of Indigenous perspectives in K-12 curricula (see Appendix B for a full list of documents) make relatively clear commitments to integration, the translation of that intention into science programs of study is less consistent, both within and across jurisdictions. Still, there are instances where front matter and content with respect to integration of Indigenous perspectives work to support ongoing conversations between Indigenous and Western ways of knowing, being, and doing in science curricula. These instances reflect the diversity of historical and contemporary Aboriginal people, peoples, and communities in Canada, as well as diversity in Indigenous understandings of the world and the way it works in a manner that offers parallel, alternative, or complementary understandings to Western ways of thinking about topics explored within science programs of studies. Nearly all of the science programs of study developed subsequent to provincial/territorial policies contain some reference to Aboriginal perspectives[245]. The placing of the references, the depth to and clarity with which they are present, the manner in which they represent the intentions laid out in policy, and how they deal with tensions between Indigenous and

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[244] See Appendix B for clarification on territorial programs of study.
[245] AB's program of study for elementary science (AE, 1996) was adopted in 1996. It contains no reference to First Nations, Métis, or Inuit people, peoples, or communities, or integration of Aboriginal perspectives, but predates policy (AL, 2002b) by six years. On the other hand, SK science programs of study (Saskatchewan Education, 1992a, 1992b, 1992c) that predate policy mandating integration still contain reference to perspectives and contributions of First Nations and Métis people, peoples, and communities.

Western ways of knowing, being, and doing vary considerably. Within this section I present some examples where different kinds of tensions in alignment between policy and programs of study, front matter and content might arise, as per Hart (2002) and Barrett and Pedretti (2006). I also consider how commitments to collaborations versus consultation (G. Aikenhead, August 21, 2014) seem to impact the manner in which programs of study might be understood, and thus lived in classrooms.

Shifting commitments. Perhaps the clearest example of tension in alignment between policy intentions and programs of study appears in ON. The province's policy framework (OME, 2007b) expresses a commitment to "provide a curriculum that facilitates learning about contemporary and traditional First Nation, Métis, and Inuit cultures, histories, and perspectives among all students, and that also contributes to the education of school board staff, teachers, and elected trustees" (p. 7), in part by "integrat[ing] content that reflects First Nation, Métis, and Inuit histories, cultures, and perspectives throughout the Ontario curriculum and related resources" (p. 32). However, in the front matter of ON science programs of study references to Aboriginal people appear under only two headings.

The *Program Considerations for English Language Learners* section (OME, 2007a, p. 33)[246] notes that the province's "linguistic heritage"[247] (p. 33) includes a number of Aboriginal languages, and that due to limited opportunities for formal schooling in remote communities Aboriginal students may require additional English language instruction. The *Antidiscrimination Education in the Science and Technology Program* section adds that "parents of Aboriginal students may need special outreach and encouragement in order to feel comfortable in their interactions with the school" (p. 36)[248]. Neither section seems to take up the commitments of the provincial policy. Both individually and together, the statements above strongly suggest an approach that assumes Aboriginal students (and their parents) will require special accommodation

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[246] The grade 1-8 science program of study (OME, 2007a) is used for the example. Uptake of Aboriginal perspectives in the front matter of science programs of study for other grades in Ontario (OME, 2008a, 2008b) does not vary significantly from what is presented here.
[247] The languages are not named, nor acknowledged as active living languages within the province.
[248] This statement is in no way contextualized with reference to the legacy of residential schools nor issues of trust arising from the manner in which Aboriginal students have been served poorly by provincially run schools.

within schools and potentially within science curricula. In addition, the *Program Considerations for English Language Learners* section appears to locate Aboriginal students in remote regions of the province despite census figures indicating over 60 per cent of Aboriginal people in the province live in urban areas (Ministry of Aboriginal Affairs, n.d.; Statistics Canada, 2013). While the *Antidiscrimination* section does include a statement that there are "expectations in the curriculum that require students to look at the perspectives or worldviews of Aboriginal cultures as they relate to science and technology" (p. 37), what these perspectives or worldviews might be and how they might relate to science and technology are not discussed. In addition, no philosophical or pedagogical grounding with respect to the expectations is provided. As such, when content outcomes/expectations that address or include Aboriginal perspectives appear later in the programs of study, there seems to be little or no way for teachers to understand them as anything other than isolated content add-ons that occur within the context (and vastness) of Canadian multiculturalism[249].

In some ways, the front matter for science programs of study in grades 10 through 12 in AB is more explicit with regard to integration. In a section called *Aboriginal Perspectives* (AE, 2005, p. 2)[250] it echoes the province's policy (AL, 2002b) position that Aboriginal perspectives are "incorporate[d]" (AE, 2005, p. 2) in science curricula so that all students recognize First Nations, Métis, and Inuit peoples' "understandings of the natural world" (p. 2). In addition, the section states the science programs of study designed to:

- support relational thinking by integrating learning from various disciplines of science
- develop the concept of our connectivity to the natural world and the importance of caring for the environment. (p. 2)

The emphasis on relational thinking and connectivity to the natural world (with its attendant reference to stewardship) opens up potential for some deep consideration of

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[249] While Ontario does supplement programs of study with a teaching resource (OME, 2009a) designed to support K-12 teachers with respect to integration of Aboriginal perspectives, the document is silent about the sciences at all grade levels. In grades 1-6 it focuses solely on social studies and language arts, an interpretation confirmed in my conversation with Ontario teacher, Caroline Laflamme*, "[Integration of Aboriginal perspectives] is *only* mandated as far as the social studies curriculum is concerned." As I will explore in Chapter 11, the tension in alignment causes Caroline significant discomfort.
[250] I used the Science 10 program of study (AE, 2005) for specific example.

Indigenous ways of knowing, being, and doing that can fit well alongside commitments arising from the CMEC *Framework,* such as relationships, interdependencies, and stewardship. These connections suggest there could be more going on in AB programs of study with respect to Aboriginal perspectives than token content add-ons[251]. At the same time, there is no other reference to Aboriginal perspectives in the front matter. As such, like ON (e.g. OME, 2007a), AB (AE, 2005) does not provide much explicit direction or explanation for teachers in terms of philosophical or pedagogical grounding with respect to integration of Indigenous perspectives, and thus not much upon which they can base interpretation of what follows with regard to integration in content.

Lack of explicitness. The lack of explicit philosophical or pedagogical grounding regarding integration of Indigenous perspectives in science curricula leads to instances where content outcomes/expectations seem likely to cause tensions for educators. There are multiple specific examples where this occurs across the different provinces and territories I examine (Wiseman, 2012). One example evident across multiple jurisdictions occurs with respect to the CMEC *Framework* grade 1 topic, *Needs and Characteristics of Living Things*. Most science programs of study include an outcome within the topic where students are required to distinguish between living and non-living things[252], e.g. a rabbit is living, a rock is not. This distinction is clear in Western considerations of science, but, for many Indigenous people, people, and communities, "all things have life force" (Cajete, 2000, p. 71) and are imbued with spirit, i.e. both the rabbit and rock are living. Canadian developers of science programs of study seem aware of the grade 1 topic as a location for conversations between Indigenous and Western ways of knowing, being, and doing, given the number of references to Aboriginal peoples that appear in relation to the topic (ME, 1999b; OME 2007a; Saskatchewan Ministry of Education (SME), 2011a). In ON (OME, 2007a), one of the related outcomes suggests that grade 1 teachers and students consider the question "Why do some Aboriginal people consider rocks to be living?" (p. 71). For people unfamiliar with Indigenous ways of knowing, being, and

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[251] I acknowledge that there are simultaneously tensions emergent in the language and root metaphor (Bowers, 2010) used in the section on *Aboriginal Perspectives* (AE, 2005, p. 2).
[252] MB (ME, 1999b) omits the outcome requiring students to distinguish between living and non-living, and notes "Students should not undertake any extensive classifying of things as living/non-living. This could result in confusing complications around things that were 'once living'; or maybe considered as living by different cultures" (p. 1.3).

doing, this is a challenging question[253]. Darren McKee* explains SK's approach to such

potentially tension causing challenges:

> we said that there are people who can help you with those answers and you need to seek [them out],... We call [the questions] tobacco questions in a sense because at some point there comes a time when it goes beyond the sphere, the sphere of understanding for a generalist teacher. And so, you know, those tobacco questions are about the interactions of animate and inanimate objects. You know when we talk about rocks as living things–in a Western context [they are not] that, well they're … you know they're a rock. That's where you know you need to really begin to understand and appreciate an Indigenous perspective in order to understand why we call them living things, why they are animate objects. You know, there are very many lessons associated with those pieces that you really have to immerse yourself in order to really appreciate. So it's not as simple, you know, as photocopying a lesson and understanding it, you have to experience it. And that's the difference I think. And so we … don't pretend to share and have absolute knowledge in the [program of study]. We only give folks a flavour, and begin to encourage you to become a lifelong learner around pursuing the understandings.

It is entirely possible that the question posed in the ON grade 1 science program of study

might be a beginning to lifelong learning for young students (and their teachers) with

respect to Indigenous ways of knowing, being, and doing. At the same time, there is no

reference close at hand in the text to suggest a teacher might need to consult an Elder, no

mention how to deal with tobacco questions in the classroom. Entering into such a

conversation is likely a challenge to most teachers' core beliefs that might cause

significant tension. Moreover, given how little exposure most teachers are likely to have

had to teachings that explain how rocks have spirit, I wonder how they might be expected

to engage in exploration of the question in a manner that honours the ways of knowing,

being, and doing from which the understanding emerges[254].

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[253] I have been working alongside Indigenous people, peoples, and communities for more than 20 years. Intellectually, I can somewhat grasp the idea that rocks have spirit. I can think of the ways rocks act so that the idea makes sense within the boundaries of what I understand of the world and the way it works. After all this time, I think I am beginning, and only beginning, to understand that rocks have spirit as something more than an idea, and that understanding remains largely inarticulable to me.

[254] A number of the educators with whom I had conversations indicated their tensions about having such conversations given their own lack of grounding in Indigenous ways of knowing, being, and doing (B. Dobbs*; G. Henkleman*; R. Herrmann*; H. King*; T. Onuczko*). The tensions and reticence they expressed were not so much related to tensions and contradictions between Indigenous and Western ways of knowing, being, and doing, as to their own abilities to

Death by suggestion. The previously discussed tensions are compounded by the manner in which Aboriginal perspectives appear in content. Where St. Denis (2011) points to the erasure of Aboriginal perspectives and content due to a focus on multiculturalism, in AB (as an example) there are cases where reference to Aboriginal people, peoples, and communities and/or their ways of knowing, being, and doing appear explicitly in the science programs of study but only as suggested ways in which to engage with content; what I call *death by suggestion*. In such cases, the suggestion is in some way set aside from the primary text of the program of study by some combination of parentheses, italics, or the words: "for example", "may include", "suggested activity", "suggested assessment", etc. as in:

> [Students will] explain how conventions of mathematics, nomenclature and notation provide a basis for organizing and communicating scientific theory, relationships and concepts …
> - *research plant and animal systems of classification developed by Aboriginal peoples in their cultural practices.* (AE, 2007a, p. 28, italics in original)[255]

Death by suggestion is wide spread across science programs of study in AB, BC, MB, and ON[256]. While in cases of death by suggestion many of the examples provided have the potential to lead to ongoing conversations and rich explorations, because they are only suggestions teachers who are experiencing tension around integration can opt out of using them. I thus worry that in relying on suggestion as a means of integration within science programs of study content, provincial/territorial governments can technically meet the commitments made in broad policy with respect to integration of Indigenous perspectives in K-12 science curricula while morally abandoning them (Paquette & Fallon, 2010); that reliance on suggestions as a means of integration leads to the death of it.

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adequately express and honour what they recognize as another way of understanding the world and the way it works.

[255] In AB science programs of study "examples **do not form part of the required program** but are provided as an illustration of how the outcomes might be developed. Illustrative examples are written in *italics*" (AE, 2005, p. 6, emphases in original).

[256] In AB, there are only two references to Aboriginal people, peoples, and communities and/or their ways of knowing, being, and doing that are not merely suggestions; both appear in the same unit of *Science 30* (AE, 2007d, p. 88).

Easing the tension: Creating the possibility for *māramatanga/*effulgent coherence. It is perhaps inevitable that engaging with different ways of knowing, being, and doing leads to discomfort and tension, but there are ways in which to become comfortable with the discomfort, to ease the tension (Wiseman et al., 2015). With respect to integration of Indigenous perspectives in K-12 curricula, the explicitness in programs of studies that Darren Mckee* alludes to seem to be helpful.

SK has developed science programs of study for grades 1 through 10[257] that bring Indigenous and Western ways of knowing, being and doing into conversation with each other in a number of ways[258]. Values laid out in the province's policy (SL, 2003)– commitments to self, community, process, place, relationship and social responsibility– appear explicitly in the front matter of science programs of study:

> Students develop and strengthen their personal identity as they explore connections between their own understanding of the natural and constructed world and the perspectives of others, including scientific and Indigenous perspectives. Students develop and strengthen their understanding of community as they explore ways in which science can inform individual and community decision making on issues related to the natural and constructed world. Students interact experientially with place-based local knowledge to deepen their connection to and relationship with nature. (SME, 2011c, p. 4)

The values are then woven through the document as a whole in a manner such that Indigenous and Western ways of knowing, being, and doing enter into conversations that are not solely informational but also pedagogical in that they are examples of how tensions between different ways of knowing, being, and doing can be generative and open up spaces in teaching and learning. In other words, in laying down the underlying assumptions and values for the teaching and learning of science in SK, the documents also take them up in an active manner. There is the potential in the SK documents for all principles to touch every aspect of practice.

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[257] The renewal process for science programs of study in Saskatchewan is ongoing. Programs of study for grades 11 and 12 (Saskatchewan Education, 1992a, 1992b, 1992c) have not yet been revised.

[258] Wording and headings used in Saskatchewan science programs of study in grades 1 through 10 are similar, although there are some minor adjustments and changes from the earliest program to take up integration (SME 2005) through the more recently adopted programs (e.g. SME, 2011a, 2011e). I use the program of study for grade 3 (SME, 2011c) for the examples provided.

For example, SK takes the structure for the CMEC *Framework* and expands it considerably. Foundation 2 for the province's programs of study–knowledge–includes not only life science, physical science, and earth and space science as laid out in the *Framework*, but also traditional and local knowledge often referred to as Indigenous knowledge (SME, 2011c, pp. 13-14). Within the front matter, Indigenous knowledge is described via the ICSU definition of traditional knowledge (cited on page 53), and characterized as "in dialogue" (p. 13) with Western ways of knowing, being and doing. To the learning contexts of the *Framework*–scientific inquiry, STSE decision-making, and engineering problem solving–SK adds "cultural perspectives" (p. 17) so that students can consider the ways in which different cultural knowledge systems express understandings of the world and the way it works in "systematic, rational, empirical, [and] dynamically changeable" (p. 19) manners. While the learning context is open to multiple perspectives, it emphasizes the perspectives of Euro-Canadian, First Nations and Métis people, peoples, and communities.

Aikenhead and Elliott (2010) propose that the explanation of Indigenous knowledge in SK science programs of study provides an "extraordinarily strong parallel" (p. 332) to understandings of science from the perspective espoused in the CMEC *Framework*. It thus provides means from which "alignment of teachers' core beliefs with [the] curriculum's conceptual framework" (Hart, 2002, p. 1243) might occur. Combined with the pedagogical interweaving of values and assumptions through out SK's science programs of study, I would suggest that such commonality provides a meeting place in which teachers might consider the coming together of Western and Indigenous ways of knowing, being, and doing within the context of science teaching and learning and begin to consider what it means. Further, there is little or no death by suggestion in SK science programs of study. From grades 1 through 6 there are more than 30 outcomes that explicitly reference First Nations and/or Métis perspectives. So, even where tensions exist for teachers, they have to engage with Aboriginal perspectives in science curricula alongside their students.

NU's approach is different from SK, but also explicit. Jim Kreuger* explains how such explicitness regarding IQ supports educators in NU with a means of understanding integration in science curricula in terms of pedagogy and process, not content:

I think it's a little easier for our teachers because someone has written it down and there are exemplars out there. And that's without giving into actually taking a traditional topic and bringing it into the classroom. I mean, you can, you can apply all of these [IQ] principles to something as ... you know something as unAboriginal [as] protecting an egg, like an egg drop. … So *it's not the content, it's the process.*

In our conversation, he elaborated about how IQ is active and lives in teaching and learning in NU, because "everything, by default, everything is Inuit. And even when we're playing hockey or we're at a square dance or–you know, Inuit means people–we're being people". Given the strong grounding in IQ, even though NU schools generally use programs of study from other places (see Appendix A) that have a different set of underlying histories, experiences, and values, teachers are supported in understanding how IQ and programs of study can come together with the potential to lead to rich, living explorations of learning that are perhaps neither entirely Inuit nor Western but embedded in and emergent from both ways of knowing, being, and doing. The key to getting at the richness, however, is the willingness of educators to listen to and engage with the histories, experiences, and values of the Inuit, not solely to acknowledge that Inuit histories, experiences, and values exist and are different from those of Western peoples.

Closing Thoughts on the Trickiness of Policy and Programs of Study: Consultation is to Collaboration as Integration is to [?]

Policy is tricky. Policy that attempts to bring together different ways of knowing, being, and doing, is perhaps even trickier. Within Canadian jurisdictions where policy mandates integration of Indigenous perspectives in K-12 science curricula the trickiness is evidenced in multiple ways:

- tensions in alignment between the stated intentions of broad policy and the front matter of science programs of study;
- tensions in alignment between science programs of study front matter and content outcomes/expectations;
- content outcomes/expectations that allow educators to avoid integration through death by suggestion;
- front matter and content outcomes/expectations that do not explicitly "connect teachers' core beliefs with the [program of studies] conceptual framework"

(Hart, 2002, p. 1243), or provide adequate grounding for teachers to connect to the conceptual framework.

Such trickiness seems less evident in broad policy and programs of study in jurisdictions where integration is framed as a collaborative–or perhaps two-way–process, than in those where it is framed as a consultative process. In collaborative processes, Aboriginal peoples, peoples, and communities have "genuine authority" (G. Aikenhead, March 13, 2013) to articulate and define values and priorities within science (and other) programs of study that move integration beyond curricular content add-ons, to a manner of thinking differently (DECE, 2013b, p. 5) about what curricula in general, science curricula specifically, and whole education systems might be. Where Indigenous *AND* Western ways of knowing, being, and doing are acknowledged in this manner and are allowed out to circulate and play together, broad policy and programs of study seem to become mutually informing pieces of a coherent whole that demonstrate some sense of *māramatanga*/effulgent coherence. They work together in such a way that "integration" as a descriptor of process somehow becomes inadequate to what is potential in and emergent from the coherence. Perhaps a more accurate word is just engaging, or learning, or living, or just "being people" (J. Kreuger*) perhaps it is a word in an Indigenous language specific to each of the places where collaboration occurs–such as *Inuit Qaujimanituqangit*–or a word that is as yet inarticulable. The questions arising around policy and science programs of study in jurisdictions committed to collaboration seem to become not about how to integrate Aboriginal perspectives in science curricula, but instead how science curriculum accounts for and supports the histories, experiences, and values of Aboriginal people, peoples, and communities. They seem to take up King's (2003) challenge: "Want a different ethic? Tell a different story" (p. 164).

In jurisdictions committed to collaboration with respect to integration of Indigenous perspectives in K-12 curricula there does seem to be something qualitatively different at play in terms of policy and science programs of study. Emerging research is also beginning to suggest that doing something different may be key to integration (or whatever we end up calling it).

Integration: Emerging Research

In terms of research, an identifiable field with respect to integration of Indigenous perspectives in K-12 curricula in the current Canadian context is only beginning to emerge. Some scholars (e.g. Barsh, 2000; Haig-Brown, 2008) who have worked closely with First Nations, Métis, and Inuit communities explore their own experiences to elucidate what is required to take Indigenous ways of knowing, being, and doing seriously within practice and institutions. Within education, a few studies examine perception, experiences and/or resistances of practicing teachers and/or teacher educators with respect to integration in specific disciplinary groups, such as general science (Aikenhead & Huntley, 1999)[259], biology (Blood, 2010)[260], social studies (den Heyer, 2009; Kanu, 2011) and languages arts (Kanu, 2005, 2011). More recent work explores integration within pre-service teacher programs (Deer, 2013; Styres et al., 2013; Wiseman, Glanfield, & Donald, 2012; Wiseman et al., 2015)[261]. Recent work is also beginning (Donald, 2009; Styres et al., 2013; Wiseman et al., 2015) to consider what is potential in thinking creatively, doing something different, and moving beyond the status quo. Overall, Kanu (2011) notes a need for research in the field. In this section, I summarize the research to provide a sense of the state of the field in which I am engaged/engaging.

Taking Indigenous ways of knowing, being, and doing seriously

Outside of the field of education, Barsh (2000) writes of the great potential for complementarity and mutual support between Western and Indigenous scientific understandings[262] of the world and the way it works. Like Cajete, Barsh recognizes the privileged position of Western science and the importance of building trust between

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[259] While this early work by Aikenhead and Huntley (1999) predates integration mandates, it identifies some issues which have continued to appear in post-mandate studies, and so I have included it here.

[260] Blood (2010) completed this study for her M.Ed. under her birth name, but has since started writing under her married name, Onuzcko.

[261] Aikenhead and Michell (2011) have recently published, *Bridging Cultures: Indigenous and Scientific Ways of Knowing Nature*, a book largely aimed at pre-service teachers. I have not included it in the review of research above because it largely reiterates ideas already presented and considered within the dissertation.

[262] Barsh (2000) uses the terms *Indigenous knowledge* and *Indigenous science* interchangeably.

Indigenous and settler people, peoples, and communities so that Indigenous science–as he terms it–can be taken seriously without being patronized, trivialized, or idealized. He suggests the development of trust involves recognition that both Indigenous and Western approaches to understanding the world and the way it works are limited, contemporary, and humanly developed means of engaging with and responding to the world that emerge out of specific traditions. While different traditions may lead to the use of different language and metaphor, he emphasizes that such differences do not negate deep understanding nor equate with lack of understanding about the world and the way it works–they are differences in kind, not degree. Barsh strongly encourages Western scientific practitioners to acknowledge the damage Western science has wrought on Indigenous people, peoples, and communities, to develop an appreciation for different language and metaphor, to understand local knowledge holders–such as hunters and Elders–as "active researchers and model builders" (p. 154) and to support young Indigenous people in their engagement with community ways of knowing, being, and doing.

Haig-Brown (2008) looks specifically at the Canadian education context to suggest that taking Indigenous thought seriously requires educators move beyond border crossings[263] to inhabiting "border worlds" (p. 14); less defined, more fuzzy places, similar perhaps to the *inter esse*, where Indigenous and Western ways of knowing, being, and doing circulate together. In these places she suggests Indigenous teachings[264] can engage and challenge colonialism and imperialism in their contemporary forms, which she intimates may include policies and programs of study such as those discussed in the previous section of this chapter. She is somewhat skeptical that such engagement can occur on a broad basis within current Canadian education systems because engagement requires significant commitment on the part of educators to deep consideration of and reflection on the underlying assumptions they bring into the classroom, alongside a commitment to a constant coming to understand that extends beyond the comfort of what they take for granted. Both she and Barsh underline that serious consideration of

[263] While Haig-Brown does not reference Aikenhead in this paper, given the prominence of his work in the Canadian context and her specific reference to border crossing (p. 14), I read this paper as, at least in part, responding to his work. I could be wrong.
[264] Haig-Brown equates such teachings with theory. I am inclined to agree with her argument, as she also understands theory requiring practice in order to lead to understanding.

Indigenous ways of knowing, being, and doing engage with complex, ecological understandings of relationships that acknowledge place as important to the work which occurs in and on it.

Integration and educators in various locations

A number of studies examine the perceptions, experiences, and resistances of teacher educators, and pre- and in-service teachers with respect to integration generally and in specific subject areas.

Teacher educators. With respect to university level instruction, den Heyer (2009) analyzes conversations between a small group of AB social studies teacher educators around the requirement to integrate First Nations, Métis, and Inuit perspectives in the provincial social studies programs of study. His reading of the conversations indicates that the changes raise significant questions among teacher educators regarding their own classroom practices and pedagogies. Some of the questions–such as whose expectations shape teaching practice–might occur with respect to any significant curriculum change. Other questions–such as how to effectively support pre-service teachers in negotiating some of the shocking and stark injustices suffered by First Nations, Métis, and Inuit people, people, and communities in Canada–require deep consideration. Ultimately, the study is somewhat unsatisfying because the depth of reflection due these second types of question is hinted at but not really engaged in the conversations as presented; perhaps because the paper presents only a small part of a broader inquiry.

In-service teachers. In general, research examining in-service teachers' experiences and perceptions of and resistances to integration of Indigenous perspectives in K-12 curricula seems to indicate similarities with regard to the value of and barriers to integration across subject areas and geographical locations[265] (Aikenhead and Huntley, 1999; Blood, 2010; Kanu, 2005, 2011). Within these studies in-service teachers acknowledge the importance of integration–particularly for Indigenous students; although they do not necessarily explicitly connect integration with decolonizing goals.

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[265] MB (Kanu 2005, 2011), SK (Aikenhead and Huntley, 1999), and AB (Blood, 2010).

Teachers identify a number of barriers or challenges to integration including: lack of resources and professional development (Aikenhead and Huntley, 1999; Blood, 2010; Kanu, 2005, 2011), lack of teacher knowledge with respect to Indigenous perspectives (Aikenhead & Huntley, 1999; Blood, 2010; Kanu, 2005, 2011), and tensions between school culture and Indigenous or community values (Aikenhead and Huntley, 1999; Kanu, 2005, 2011). The studies also identify barriers related to lack of knowledge about Indigenous cultures in general (Kanu, 2005), about working definitions of integration and Indigenous perspectives (Blood, 2010), or appropriate knowledge for integration in specific places (Aikenhead & Huntley, 1999). Other barriers and challenges to integration are identified only in a single study: racism among non-Indigenous school staff in Kanu (2005, 2011); and tensions around use of class time in Blood (2010).

Despite the respect teachers indicate for Indigenous perspectives in all the studies, integration of Indigenous perspectives in their practice varies considerably. Aikenhead and Huntley conclude there was only token addition of Indigenous perspectives by teachers in their study, even by Indigenous teachers. Blood and Kanu report more variation, but overall largely only content addition based on existing programs of study.

The research by Aikenhead and Huntley and Kanu involved both Indigenous and non-Indigenous teachers. While both studies suggest a range with respect to the manner in which teachers perceive identified barriers to integration based on personal background and teaching context[266], and thus how they subsequently approach and understand what it means to integrate Indigenous perspectives in curricula, it is of note that Indigenous teachers also struggle with considering and integrating Indigenous perspective in curricula. Aikenhead and Huntley provide the most illustrative examples. In their study, one Aboriginal teacher said because she was not teaching in her home community it was a challenge to know what Indigenous knowledge and understandings from the community she worked in might or should be brought into her science class. In addition, teachers in the study reported that even in First Nations communities there were tensions around bringing Indigenous and Western perspectives together in school.

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[266] In all their complexity.

Teachers tended to locate these tensions in parental connection to Christian churches[267]. In my work with educational stakeholders, the assumption is often made that integration of Indigenous perspectives in K-12 curricula does not cause tensions for Indigenous people, peoples, and communities. The examples underline, however, that in Canada all people, peoples, and communities are, to a greater or lesser extent, caught up in colonial frontier logics and the complexities brought about by the intermingling of Western and Indigenous ways of knowing, being, and doing that have come about since contact[268], and so the assumption is a poor one.

Pre-service teachers. Deer (2013) uses the barriers and challenges to integration identified by Kanu (2005) as a means of analyzing pre-service teachers' experiences and perceptions with respect to integration during a practicum following a course on integration and Indigenous perspectives. His work in some ways complexifies the challenges identified by Kanu and indicates places where student apprehension with respect to integration might be mitigated in order to lead to more positive experiences. Overall, Deer indicates that opportunities in university courses and practica, or outside of schools, that allow pre-service teachers to develop deeper relationships with Indigenous people, peoples, and communities and their ways of knowing, being, and doing lead to less apprehension and more positive experiences as pre-service teachers begin to teach.

Doing something different: Moving beyond the status quo

Studies that examine the potential of moving beyond the status quo work from an underlying assumption that the policy mandates for integration and ongoing relations between Indigenous and settler people, peoples, and communities require something fundamentally different in terms of practice. These studies examine integration in education generally (Styres et al., 2013) and in relation to specific subject areas–social studies (Donald, 2009), science and/or mathematics (Lunney Borden & Wiseman, In press; Wiseman et al., 2012; Wiseman et al., 2015)–with pre-service teachers (Styres et al., 2013) and/or in-service teachers (Donald, 2009; Wiseman et al., 2015) and/or K-12 students (Lunney Borden & Wiseman, in press). The research tends to acknowledge the

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[267] I heard a similar suggestion regarding Christian churches in First Nations communities in my conversation with Jules Lavallée*, although it did not apply directly to schools.
[268] Some people are just more aware of it than others.

tensions around and resistances, challenges, and barriers to integration and then move beyond them to consider what happens or is potential in taking Indigenous ways of knowing, being, and doing seriously (Barsh, 2000; Haig-Brown, 2008; Stewart-Harawira, 2005). As in policy based in collaboration, these studies seem to indicate that with a commitment to doing things differently space opens up in which there is the potential for all principles to touch every aspect of practice, and "integration" as a descriptor of process somehow becomes inadequate to the ideas simultaneously presented and taken up.

Donald's (2009) dissertation is a broad exploration of the ways in which "colonial frontier logics" (p. 7) maintain separation and division between Indigenous and settler peoples rather than opening and creating a space where ethical relationships between people, peoples, and communities might grow and develop. He locates colonial logics in the Western practice of physical separation between different people/s and between people/s and land by walls and forts. He explains that the practice extends back to the Romans, but has subsequently been honed and replicated across time by policy, law, education, etc. to become entrenched as metaphorical, intellectual barriers that people take for granted. In contemporary contexts, Donald notes that Indigenous scholars who "frame their ideas in isolated or exclusionary ways" (p. iii) also reify such barriers. He examines responses of pre- and in-service social studies teachers to integration of Indigenous perspectives in AB's social studies curricula, and frames their resistance to the curricular changes as instances of colonial logics at play. He argues for breaking down such entrenched barriers between people, peoples, and communities via "ethical relationality" (p. 438) that posits teaching as a means of creating spaces where people might move closer together (p. 437). "Ethical relationality" (p. 438) is different in that it does not mean to resolve difference, but rather to acknowledge we are all related and interdependent–in an expansive sense similar to that offered by Cajete. It thus makes common issues arising in difficult historical relationships and contemporary contexts, a stance that seems to be taken up in the policies regarding integration in SK and NU. To further such work, Donald offers an approach he calls "Indigenous Metissage that focuses on insights derived from contextualized and place-based interpretations of Aboriginal-Canadian relations" (p. vi).

Styres et al. (2013) offer a comprehensive consideration of how engagement with Indigenous perspectives might be taken up in new and creative manners within teacher education. Working from an understanding of *Land* (p. 190) as a sentient, living entity with which we live in relationship, they describe two initiatives at York University which invite pre-service students to explore histories, stories, cultures, and contemporary understandings with, in, and through *Land*. Styres et al.'s goal is not to render pre-service teachers expert on Indigenous perspectives so that they may subsequently teach about Indigenous perspectives, but instead to support pre-service teachers understandings of "respectful relationships" (p. 208) between Aboriginal and settler people, peoples, and communities so that, as teachers, they might subsequently engage students in K-12 classrooms in a similar manner. Styres et al. report that such approaches seem to help pre-service teachers begin to breakdown the nature/culture split–to reclaim biophilia as suggested by Cajete (1999b)–and to consider "very old pedagogies around different, innovative perspectives that help students find new ways to interact with *Land* in their own teaching" (Styres et al., 2013, p. 212, emphasis in original).

While Donald and Styres et al. present quite different possibilities there are commonalities between their work. They each assume a two-way, collaborative process that takes into account deep considerations of relationship between people, peoples, and communities, and all their relations including *Land* and place. In so doing, they both demonstrate *māramatanga/*effulgent coherence in the own practices and open up the possibility for the emergence of it in the practice of the educators with whom they work.

Some Closing Thoughts on the Field and My Own Work

My dissertation was always intended to contribute to the emerging field of research regarding integration of Indigenous perspectives in K-12 curriculum (both as plan and as lived) in the Canadian context. It was always intended to ally with work by people such as Barsh and Haig-Brown who insist that the ways of knowing, being, and doing of Indigenous people, peoples, and communities are taken seriously.

Having lived with my research for so long, I am left with little doubt that the conversations I had with educational stakeholders could be analysed in a manner that would reproduce and support the findings of Aikenhead and Huntley (1999), Blood

(2010), Deer (2013), and/or Kanu (2011). I cannot in good spirit give the impression that everything is going so well with respect to integration of Indigenous perspectives in K-12 science that the challenges, barriers, and resistances to engaging with Indigenous perspectives in K-12 curricula these researchers identify can be ignored. On the contrary, they seem active and reasonably persistent in the present[269]. While it is important to undertake such examinations in order to understand relationships at play in particular contexts, it is not my practice to focus on barriers, perceptions, and resistances. I acknowledge they exist, but I am not interested in limits other than to find ways to move beyond them. Moving beyond often requires finding ways to shift and change, to transform, to do things creatively and differently because "The worst thing to do is nothing and just go with the same, eh" (N. Blood*). Moving beyond is tricky.

The work I have undertaken in collaboration (Lunney Borden & Wiseman, in press; Wiseman et al., 2012; Wiseman et al., 2015) with pre- and in-service science teachers and science teacher educators in the Indigenous Teaching and Learning Gardens at UA began as a concurrent yet distinct project from that of my dissertation. However, the two projects soon came to converse and inform each other, with the Gardens as a missing instance of enacted practice/curriculum as lived among the planned considerations of policy and practitioners, a means for all principles to touch every aspect of my practice, an instance of doing and being that supported knowing. The Gardens will be explored in Chapter 14. What is important about them at this juncture is that they work from an underlying assumption that the policy mandates for integration and ongoing relations between Indigenous and settler people, peoples, and communities ask for something fundamentally different in terms of practice. As such, my work allies with that of Donald and Styres et al. in assuming integration is two-way, collaborative, immersed in and emergent from relationship, process, and place.

The framing of my research in *māramatanga/*effulgent coherence, where all principles touch every aspect of your practice, strongly suggests that if I come from the position that integration asks for something fundamentally creative and different in terms

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[269] It is possible that the conversations from my own work might expand, complexify, and add to understanding of such perceptions, barriers, and resistances. Perhaps in what follows the expanding, complexifying, and adding to that understanding will occur as a side effect of what I present.

of practice, I also come from the position that research about and around integration requires something fundamentally creative and different. I have already begun to consider such difference in reference to theory and framing research (Chapter 6). In the next two chapters I will begin to consider difference in terms of methodology.

The only thing a hunter knows when they see the track of animal is that the animal isn't there. That's all they know. And they know that's all they know.
(Chamberlin, 2002, p. 67)

In the first year of my PhD, I was discussing the difficulties I was having filling in a methodology box on a scholarship application with one of the Indigenous[270] scholars in our faculty. S/he acknowledged my difficulties as valid and told me to "hold my nose, pick something, and fill in the damn box".

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[270] The general term Indigenous is used in this case to protect the innocent.

Chapter 9: Playing with Methodology, Tracking the Inarticulable

Like theory, methodology is one of my relations. As much as I struggle with theory, I struggle more with the normalized, accepted, and largely taken-for-granted assumptions related to methodology that seem to exist in the academy. I struggle with the fact that, despite the diversity and complexity of the world, the vast majority of methodologies on offer arise out of Western[271] ways of knowing, being, and doing. I struggle with the subject/object split in methodologies arising out of Western ways of knowing, being, and doing. I struggle with the angst over the subject/object split in what are perceived to be more subjective and reflective methodologies in qualitative research (Wiseman, 2014). I struggle with critiques by qualitative researchers of quantitative research (and vice-versa) because it seems to me–most of the time–they do not have a good handle on the living practices they are critiquing and the complexities of their applications and uses. As David Smith (2011) likes to say, "There is poverty in all traditions".

I have railed against the limits of methodologies; of the vanity in choosing a filtering agent at the beginning of the inquiry process before having any sense of what might be important with respect to the question(s) under consideration. It screams to me of the denial of complexity and relationship, of the odd need for control which Cajete (1999b) says underlies Western institutions. Like theory unbalanced by practice, it strikes me as unhealthy. It seems as if the push to methodology necessarily does away with surprise, with the possibility for change, creation, re/creation, with the hope for learning.

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[271] To be clear, my position is not that these methodologies have nothing to offer, quite the contrary. However, a singular reliance on methodologies–or theories, or any kind of thinking–based in one tradition seems at best, naïve, and, at worst, dangerous. There is some research to support my concerns. Henrich, Heine, and Norenzayan (2010), undertook a broad review of human behavioural studies examining "visual perception, fairness, cooperation, spatial reasoning, categorization and inferential induction, moral reasoning, reasoning styles, self-concepts and related motivations, and the heritability of IQ" (p. 61) to identify significant variability in results across populations in different parts of the world. While the differences may not be surprising, they point out a number of areas of concern: most studies in behavioural sciences take place in Western, Educated, Industrialized, Rich, Democratic [WEIRD] societies; researchers (who are frequently WEIRD themselves) tend to assume that research participants from WEIRD societies are representative of humans as a whole; whereas, there is evidence to strongly suggest that people from WEIRD societies are outliers in terms of humanity and may be the "least representative populations one could find for generalizing about humans" (p. 61).

Within complexity thinking, of course, change is learning (Davis & Sumara, 2006). As a learner, I seek change.

My doctoral work is about change, a shift in process, the world in flux, living. While provincial/territorial governments in Canada have been considering Aboriginal education since the 1980s, engagement with Aboriginal perspectives in the context of provincial/territorial K-12 curricula is a newer undertaking. As recently as 1998[272], Mi'kmaq scholar Marie Battiste (1998) lamented the ongoing exclusion of Aboriginal ways of knowing, being, and doing in most Canadian jurisdictions. As such, the very focus of my inquiry is a changing and moving target, and methodologies based on Western ways of knowing, being, and doing–or at least the ones with which I am familiar–do not seem particularly well-suited to considering a world in flux, elements at play. Flux, play, and chaos are, however, underlying assumptions in Indigenous ways of knowing, being, and doing (e.g. Ermine, 1995; Hampton, 1995; Kovach, 2009; Little Bear, 2000, 2012; Meyer, 2013b; Stewart-Harawira, 2005; Wilson, 2008). I thus pay "serious attention … to examining the possibilities inherent in indigenous ontologies" (Stewart-Harawira, 2005, p. 34) and epistemologies to consider what they bring to understanding methodology; how they might shift it, move it beyond the status quo, in attempts to seek out some methdology that allows all principles to touch every aspect of … practice within the relationships, processes, and places of this inquiry.

In making this commitment to Indigenous ways of knowing, being, and doing[273], in sitting with them in the *inter esse* where they circulate with Western ways of knowing, being, and doing, I frequently bump up against the inarticulable[274]. Perhaps the

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[272] Some people might argue that 1998 is not that recent. However, in the world of curriculum reform it is really not so long ago. Consider that Ab currently uses a program of study developed in 1996 for grades 1 to 6 (AE, 1996), and SK uses programs of study developed in 1992 for senior level biology (Saskatchewan Education, 1992a), chemistry (Saskatchewan Education, 1992b) and physics (Saskatchewan Education, 1992c). Milford, Jagger, Yore, and Anderson (2010) note the sometimes significant lag between policy introduction and its uptake in curricular documents in Canadian jurisdictions given curriculum renewal cycles ranging from 7-12 years.

[273] As much as I can understand them.

[274] In foundational work within the field of anthropology, Levy (1973) uses the terms "hypercognized" and "hypercognition" (p. 324) to identify a state in which a person may lack words for a thing/happening/experience/feeling which s/he nonetheless is able to recognize in some manner. He uses the terms primarily in relation to social and cultural groups who have no language related to grief, but nonetheless experience the impact of losing people close to them to

inarticulable is related to Huh?! moments or double binds, but I remain uncertain that it is something entirely describable in noun-based languages. The process at play, however, I re/cognize in the work of Eugene Gendlin.

Gendlin (1995) explores what it is like to have a sense of something missing, something forgotten, something not quite right, and the relationship between language and the bodily manifestation of the missing as a subjective "felt sense"[275] (p. 549). He provides the example of a poet in the midst of writing, searching for a word (perhaps because Coyote has run away with it). The poet reads the line multiple times trying out different options for the word or words that might belong, none of which quite fit. The trying out of words, Gendlin underlines, is representational and linguistic; the felt sense of poor fit is related to the representational and linguistic but is itself "not yet" (Greene, 1998, p. 253) representational or linguistic[276]. It is something at play which results in a physical feeling of tension, perhaps frustration or discomfort. Gendlin describes the

> poet's hand rotat[ing] in the air. The gesture says *that*. Many good lines offer themselves; they try to say, but do not, say–*that*. The blank [the space awaiting the word] is *more precise*. Although some are good lines, the poet rejects them.
> That … seems to lack words, but no. It knows [a][277] language, since it understands–and rejects–these lines that came. … It knows what must be said, and knows these lines don't precisely say that … but it is new to the poet, and perhaps new in the history of the world (p. 548, emphasis in original)

–or perhaps very old. When the word is found, when *that* is re/membered, re/cognized, or re/created, the tension resolves. Within my dissertation there are three chapters (Chapters 9, 10 and 12) that engage with methodology, my tracking of a recognizable but inarticulable *that*, around which I have experienced much discomfort and hand waving. Ultimately, methodology is a finding of the research. It emerges from and is immersed in

suggest "one 'feels' considerably more than cultural forms may make consciously accessible [via language]" (p. 324).

[275] His felt sense seems quite similar to the tensions I have previously described as a bodily manifestation of potential learning.

[276] Gendlin carefully notes that the felt sense is not preverbal in a phenomenological sense, because it is able to reject the things "the blank" (p. 548) is not.

[277] I have changed Gendlin's word "the" in this space to "a" so that there is more openness as to what language might be.

the places, processes, and relationships of my research, and eases–but does not resolve–the tensions.

This first methodology chapter examines how other scholars (both Indigenous and non-Indigenous) who attempt to engage with Indigenous ways of knowing, being, and doing within the bounds of doing research account for methodology. I pay close attention to the ways in which people who work in contexts similar to mine deal with methodology as a means of engaging with my own tensions around methodology. That is, I pay attention to the work of people who are in some way struggling with the manners and means in which different ways of knowing, being, and doing can be acknowledged, valued, heard, and put into play within the context of academic research. While there are copious examples of research where this type of struggle does not occur[278], I choose not to consider these cases as I find they are methodologically helpful only in the sense of making a mental note to "not do that". What I am looking for is tracks that may lead me somewhere fruitful.

In attending to the work of others, I have noticed different approaches–that at times overlap and/or become hard to distinguish one from the other. Throughout these approaches to methodology, the shared, often tacit, assumption appears to be that academic business-as-usual within contexts where different ways of knowing, being, and doing are brought together, or circulate together, is inadequate to the purpose of developing understanding(s)–that something different, creative and beyond the status quo is required. In this chapter, I outline three approaches to methodology I have noted frequently amongst people who conduct research in contexts similar to mine: playing with Western methodologies, sidestepping methodology, and naming responsive (or responding) methodologies. While this exploration might be read as a critical consideration of methodological options for research in the *inter esse*, within the context of my dissertation the exploration primarily serves as a conversation around methodology through which I tracked the inarticulable and how it is at play.

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[278] The type of research which has lead *research* to become "one of the dirtiest words in the indigenous world's vocabulary" (Smith, 1999, p.1).

Western Methodologies: Tracking Around in Ruttish Circles

Some researchers situate their work clearly within Western methodologies, particularly those methodologies that allow for involvement of participants in research and ongoing negotiation between the researcher(s) and participant(s), such as narrative inquiry (Clandinin & Connelly, 2000), participatory action research (Carson, 1990), and self-study (Pinnegar & Hamilton, 2009), or those methodologies which intend to critique and decentre privileged/dominant positions (e.g. Kincheloe & Berry, 2004; Ladson-Billings & Tate IV, 1995). Despite the openness to different ways of knowing, being, and doing offered in these methodologies, in many cases where they are implemented there seems to be some sense that the methodologies still need to be tempered or played with in order to work within the contexts of the research; that to leave them operating unquestioned within the bounds of Western assumptions is somehow inadequate.

For example, Maher (2012) identifies self-study as the methodology underlying her examination of an Indigenous teacher education program in Australia's Northern Territory. She indicates self-study was specifically chosen for the project because of its potential to mitigate power relationships–in her case, between Indigenous pre-service educators and (mostly) non-Indigenous university instructors and mentor teachers– through the implementation of collaborative work and ongoing individual and collective reflection on practice. Still, the methodology alone is deemed insufficient to the task; Maher recognizes the potential for unequal power between peoples and between ways of knowing, being, and doing needs to be more directly addressed. Self-study is therefore grounded in the "two-ways philosophy" (p. 348) of education articulated by Aboriginal and Torres Strait Islander peoples. The philosophy recognizes the co-existence of Indigenous and non-Indigenous peoples in Australia and the need for ongoing dialogue and exchange of meanings where people learn from each other with the goal of mutual respect for each others' knowledges. With the two-ways philosophy as a means of framing the research, the project involves Elders and the adoption of university instructors into local families. It also provides the means to create a mutually supportive relationship between preservice teachers and their mentor teachers, where the former are acknowledged as experts in local ways of knowing, being, and doing and the latter as experts in pedagogical content knowledge.

Other researchers remain even more grounded in Western academic traditions. In examining the impact of integrating Indigenous perspectives in social studies and English language arts, Kanu (2011) writes that her work is supported by an "eclectic theoretical approach" (p. 200). She combines sociocultural theories of learning and cognition, macro-structural theories/explanations of minority school performance, and critical race theory as a means of both framing and analyzing work undertaken with Aboriginal students, their parents, and their teachers in MB over a period of five years. Like Maher, Kanu acknowledges the reputation of research can be challenging in the contexts in which she chooses to work. While she does not weave framework(s) emergent from Aboriginal ways of knowing, being, and doing into her study and analysis as Maher does, Kanu draws on work by Stó:lō scholar Jo-ann Archibald indicating the need for research grounded in trusting relationships. As such, she enters into potential research sites with introductions and support from Aboriginal people with whom she has existing relationships, and works to build relationship with potential participants significantly before research begins.

The play between framing and methodologies demonstrated by Kanu and Maher is something I have noted, particularly in work by other non-Indigenous people who work alongside Indigenous people, peoples, and communities. I understand the difficulties they are trying to address; in working in/with/alongside a culture/paradigm to which one does not innately belong, with which one has no shared language or even language group, there is the clear sense of understanding just out of reach, of something experienced but inarticulable. In my case, I am trying to understand in English (and French) ideas/concepts/perceptions/events for which I literally have no words. And yet, there is so clearly something to understand. It seems to me that in the face of the inarticulable–the experience that defies even phenomenological description[279]–there is a tendency to grasp

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[279] Except perhaps in the language to which the experience belongs. Of course, maybe there is no language for it yet. As van Manen (1997) points out "phenomenological text is descriptive in the sense that it *names* something. And in this naming it points to *something* and it aims at letting *something* show itself" (p. 26, emphasis added). I am unconvinced that what I have engaged in my research is a *nameable something* (yet), although something is clearly at play. Perhaps the difference itself is phenomenological and points to the distinction between *lived* experience, upon which reflection is possible, and the immediate *living* of experience where reflection can be significantly more difficult.

at the theoretical/methodological menu available, take two from column A and one from column B, and hope the resulting combination is something which appears to work.

While playing with existing methodologies approach does seem to support the development of useful research findings, I frequently find it insufficient to adequately and equitably bring together different ways of knowing, being, and doing. For instance, in Maher's work there are hints that despite her explicit acknowledgement and inclusion of the two-ways philosophy, Western approaches are still privileged[280]. These hints are perhaps best illustrated in the aims of the project on which her study is based, the first of which is "[to] empower Indigenous A[ssistant] T[eacher]s[281] to join culturally relevant ways of being, knowing, and doing with contemporary curriculum and pedagogical knowledge" (p. 347). Read uncritically, the statement is no doubt accurate when applied to her project. I wonder, however, in the exchange which she says is taking place, why it is that only the Indigenous participants are perceived to be empowered by the exchange and why it is that only the curriculum and pedagogical knowledge–which in Australia is largely defined within Western assumptions about the world and the way it works–is viewed as contemporary?[282,283]

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[280] This hierarchical privileging of Western knowledges is one of the difficulties Smith (1999) identifies with research in general.

[281] Who are simultaneously preservice teachers.

[282] Cajete (1994) notes this type of largely invisible, time-based hierarchical relationship between Indigenous and Western understandings of the world through the use of the word *contemporary*. He insists that Indigenous knowledges are contemporary because they are understood and used by contemporary Indigenous people/s.

[283] Drawing on work by Bishop (2005) and Denzin (2005), Lunney Borden (2010) underlines that despite good intentions on the part of researchers, the kind of approach taken by Maher and Kanu which "pastes" (p. 65) Indigenous perspectives onto Western approaches to research (and I would argue most other activities) has proven to be largely ineffective in both decolonizing and "giving voice to" (p. 65) Indigenous communities.

The Inarticulable and the Irony of a Simultaneous Requirement for Words:
A Hint Pointing Towards Tracking

I think my nephews may be a hardcore *péquiste*'s worst nightmare. These two boys, who on their mother's side can trace their roots back to one of the original *pur laine* settler families in Québec, are fluently bilingual. In the place where I live and where I have grown up that means they can seamlessly speak *and* think in both French and English in a way not many people in previous generations could. I have met young people in other parts of Canada who can do this as well. I have noticed that their speaking and thinking do not necessarily occur simultaneously in the same language; structures and words from one language slide from one into the other and back again. If you had only a passing familiarity with one of the languages, you might think they were making structural, grammatical or translational errors, or searching for words. I don't think they are. I think they are so used to existing in both these language places at once that they make little or no distinction between them; that these places somehow exist simultaneously for them; are mapped onto each in ways that there are lots of meeting places. Of course, I have no evidence for this (yet).

   For demographic purposes, we are asked to label these kids–Francophone, Anglophone, Mohawk, Cree, *FrancoAlbertain*. The demographics, we are told, support the development of policies and programs that protect and promote language[284] and culture based on those labels. I'm not sure these labels apply to the young people I know. These kids are something beyond the labels; beyond the well-meaning protectionism of the policies and programs. Those policies and programs might have contributed to their formation[285] (in both the English and French sense of the term), but the policies cannot control the people that emerge. (Personal journal, June 24, 2011)

I am going to write largely about words and language. However, what I am trying to get at are tracks of the inarticulable at work and the need to attend to these tracks; sometimes the tracks become evident in attending to words and language. Because I have lived most of my life in a context where my first and primary language is not the majority language, and have entered into work in contexts where my assumptions about the world and the way it works can differ from those of people with whom I work, I am sensitive to how it is that people attempt to understand each other, and how it is we might find meeting places from which to work together. Observing how my nephews have come to

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[284] Or, in the case of Québec, deliberately fail to do so.

[285] In French, *formation* shares the English meaning of creation, shaping or moulding, but also can be read as education or training.

use language suggests that sometimes we can understand each other even though we use different words, but also how sometimes in using the same word we might mean quite different things. Of course, my relationship with my nephews, my family/iarity and kinship with them and with French facilitate my understanding in the contexts where we are together; understanding that for others unfamily/iar with the shared context and place of our being might be more elusive. Similarly, in conversations about Aboriginal education on a national level (which usually take place in English), I have had moments of realizing that while the people around the table were using the same word or words, the meaning of those words is not necessarily shared.

Russell Bishop (2008) notes this slipperiness to the meaning of words as they are used by peoples from different language or cultural traditions. He explains how self-determination as a concept is understood by Māori peoples "in *relation to others*" (p. 440, emphasis in original) but by those of Western origin in "absolute terms" (p. 440). He says these different understandings have been the basis for misunderstandings in negotiations between Māori and settler peoples in New Zealand for the length of their shared history. Chambers et al. (2008) point to slipperiness both more specifically and more broadly in telling a story about Chambers' friend and student, Margaret Lamouche, a Cree-speaking Métis mother, educator, artist, and poet, who writes and studies in English. In describing Margaret's poetry, they write, "Her poems were in English, but the Cree was never silent, more like the music for the song" (p. 147). So, I am not the only one to note that vagaries of language occur in the *inter esse* and have a tendency to point to something interesting; something which may or may not be directly or completely related to language.

In her work on mathematics education in Nova Scotia Mi'kmaw[286] communities, Lisa Lunney Borden[287] (2010) points to what I would call the inarticulable in a number of instances. As a mathematics teacher working with Mi'kmaw students, Lunney Borden has made significant attempts to learn the language of her students. She has come to understand that Mi'kmaw language structures and the ways of thinking these structures

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[286] There are multiple spellings for the word *Mi'kmaq*. The final letter *q* is used for where the word is used as a noun, while the letter *w* is used where the word is used an adjective (L. Lunney Borden, December 11, 2012).
[287] In the interests of full disclosure and exposing all my relations, Lunney Borden is a close friend and colleague with whom I have worked and published. She has reviewed and approved the manner in which I have taken up her work within this dissertation.

support emerge in the way her students structure their use of English, even when Mi'kmaq is not a student's primary language.

Mi'kmaq, like many Indigenous languages, is verb-based (Lunney Borden, 2010); ideas which in English would be described by an adjective (such as *flat*) or a noun (such as *triangle*) do not exist in Mi'kmaq as such (p. 158). More specific to mathematics teaching and learning, Lunney Borden writes of a grade 3 exploration of prisms and pyramids where various models were passed around a circle. Students were asked to share one thing they noticed about an item. Part of the lesson was to get at the notion of flat, a word which does not exist in Mi'kmaq[288]. One of the young girls looked at a prism "placed [it] on the floor and stated 'It can sit still!'" (p. 150). Despite speaking in English, her focus was not on the flat surface of the prism, but rather on what the flat surface allowed the prism to do. Her understanding is, thus, not so much about the word *flat* (although it did eventually come up in the lesson), but about how prisms are and what they can do in the world; about their being and acting.

In another instance, Lunney Borden explains how motion is essential to Mi'kmaq comprehension of the idea that in English is represented by the word, *triangle;* that *triangle* in Mi'kmaq is something which "moves into the point" (p. 159). She spent quite a bit of time speaking to community members about what would be an appropriate Mi'kmaw word to represent triangle:

> The word *nesikk* is commonly used to mean triangle but many community elders *have trouble with the word* because, it seems from our conversations, it lacks this sense of motion. It is seen as a static shape and not in keeping with the grammatical ways in which shape would be described in the Mi'kmaw language. It seems to be a new Mi'kmaq word to represent an English idea. (p. 159, emphasis added)

The word *nesikk* gives the Elders trouble; it causes discomfort. While *nesikk* is "sufficient for the purpose" (Lunney Borden & Wagner, 2013, p. 108), it does not quite fit Elders understandings of a triangle's being in the world. It will do, and in some ways acknowledges the circulation of English and Mi'kmaq conceptions in the same space, but

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[288] To be more accurate, there are words in Mi'kmaq which describe the state of being or becoming flat in precise contexts but they do not focus so much on the flatness as what the flatness can do or how it arises. So, there are ways to describe a flat plank, or a tire in the process of losing air (and thus becoming flat) etc., but no single word with the broad application of *flat* as in English (L. Lunney Borden, December 10, 2012).

it is still not entirely adequate. It is this same sense of inadequacy and discomfort I have with Maher and Kanu's methodologies. I suggest that this difficulty and discomfort with words and methodology are perhaps indicative of a scalable phenomenon–what I am describing as the inarticulable (in part because of the difficulty of finding words for it in any language[289])–which manifests at all levels of organization in contexts where different ways of knowing, being and doing circulate together. This discomfort also seems to manifest in the manner in which people are coming to understand what it means to integrate Indigenous perspectives in science curricula.

Meyer (2003) writes about the importance of words, how they are used, where they belong, and how they sometimes need to be abandoned. She says that on returning to Hawai'i after completing graduate work at Harvard, she found she had to abandon the word *epistemology* because it "was not organic to these shores" (p. xvi). It did not fit, it could not do anything useful in her context, and so, despite her continued work in the academy, she left it with a friend on Maui. This type of giving away (or side stepping) of methodology is another strategy I have noticed in the work of scholars in contexts similar to mine.

Side-stepping Methodology: Ignoring Tracks

My experience of the inarticulable–the work of being in the *inter esse*–is certainly that it can be uncomfortable[290], but I have had the good fortune to work and develop relationships with people who have been able to support me in it. What I have come to understand is that the discomfort may not ever disappear, but that it is possible to become comfortable with the discomfort (Wiseman et al., 2015). More importantly, the discomfort is often fruitful; a sign that I am indeed in a space where different ways of knowing, being, and doing are circulating together, a signal that learning is potential. As I have pursued the work for this dissertation, I have come to realize that it is the discomfort of the inarticulable from which, in part, my difficulties with methodology arise. At

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[289] It has been suggested that perhaps the language I am seeking once existed but has been forgotten (M. Cardinal Collins & L. Lunney Borden, November 27, 2013) and so the difficulties I am having around language and the inarticulable may in fact be an act of remembering.
[290] Physically, emotionally, intellectually, and spiritually, but in the end the result of working through the discomfort to become comfortable with it appears to be an improved well-being in all these areas.

points, the question of methodology was so uncomfortable, I was tempted to avoid it completely, to deliberately not play with it or let it out to play. I have noticed that some scholars who work in contexts similar to mine also seem to ignore or sidestep explicit in-depth discussion or exploration of methodology. They include methods, ground the work in existing literature, provide theoretical perspectives[291], discuss results and implications of the research, but do not interrogate methodology in any great detail. Given my own experiences, I wonder if this avoidance is a result of a similar discomfort arising from the inarticulable.

For instance, Brigham and Taylor (2006) examine a school-to-work transition program for Aboriginal students in northern AB via "qualitative research methods" (p. 165), but with no real explanation of the philosophical assumptions in which the methods are embedded. Similarly, Fuzessy (2003) interrogates the definition of teachers' roles within schools of the Kativik School Board serving the region of Nunavik[292] via the "qualitative methods" (p. 201) of interviews and short-answer/Likert scale questionnaires. While he notes that his role in the research process is as interpreter, his approach to interpretation does not appear to be grounded in any particular interpretive tradition.

I am not being critical of the lack of engagement with methodology; despite its relative absence in the examples provided, the research produces useful findings. I am, however, noting that the sidestepping of methodology exists, and–given my own struggling with it–wondering whether or not methodology is required in all cases.

What is Methodology?: Deleuze, Guattari, Coyote et al. Track Around the Inarticulable

This wonder leads me to another: what is methodology? As a concept it is frequently referenced in research discussions and texts usually by way of pointing to a specific example in a particular case. But I am wondering, what is it that the concept

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[291] In fact, theoretical perspectives sometimes seem to take the place of methodology.
[292] Nunavik is a self-governing (largely) Inuit region comprising the northern third of the province of Québec.

itself is supposed to re/present in the context of research? What is it I am supposed to be labeling in a chapter on methodology[293]?

One of the clearest explanations of methodology is offered by van Manen[294] (1997):

> 'methodology' refers to the philosophic framework, the fundamental assumptions, and characteristics of a human science perspective. It includes the general orientation to life, the view of knowledge, and the sense of what it means to be human which is associated with or implied by a *certain* research method[295]. We might say that the methodology is the theory behind the method, including the study of what method one should *follow* and why. (p. 28, emphasis added)

While I can agree in principal with the description of methodology laid out by van Manen, it strikes me as a somewhat reactive image of the concept.

Wallin (2010) reviews Pinar's concept of curriculum as *currere* and suggests that–as a concept emergent from the Latin verb meaning *to run*–it conjures up both reactive and active images. Active images focus on the process and joy of running, and the multiplicity of courses which might emerge from it. Reactive images become constrained by pre-existing ideas about what it means to run and where running generally occurs. It is a "Deleuzeguattarian" (p. 3) framework for considering the multiplicities of a concept in which active images offer less certain, less determinant (and thus more open) possibilities because they allow for ongoing, creative engagement with and response to the world, whereas reactive images offer more certain, predictable possibilities bound up

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[293] It does seem odd that I can get through an entire Master's degree and the better part of a PhD without more clarity than I seem to have about methodology. Although it appears I am in good company. In the *Handbook of Critical and Indigenous Methodologies*, Sandy Grande (2005), a professor of Quechua Peruvian descent at Connecticut College, writes that when she was asked to write a chapter for the book she began by "asking everyone I know how they define [methodology] and trying to determine whether or not I do it" (p. 233).

[294] Methodology as a term seems to be somewhat of a taken-for-granted in scholarly work. It is challenging to find a good description of the term. Nearly every other clear description of methodology I was able to find was offered by Indigenous scholars (e.g. Absolon, 2011; Cajete, 1994; Gehl, 2012; Grande, 2008; Meyer, 2008; O'Reilly Scanlon, Crowe, & Weenie, 2004; Rigney, 1999; Smith, 1999; Weber-Pillwax, 1999; Wilson, 2008) whose work challenges and/or is searching for some kind of "congruency" (Absolon, 2011, p. 81) between Western and Indigenous ways of knowing, being, and doing.

[295] This general sense of methodology is echoed by others under different labels. Prasad (2005) refers to it as a research tradition, Denzin and Lincoln (2005) and Guba and Lincoln (2005) as a research paradigm.

in traditional or preexisting definitions of what a concept *is*. In terms of *currere*, Wallin points out that over time reactive images risk becoming well-worn ruts, "dominated by disciplinary processes aimed at keeping students on track" (p. 5).

Considering the definition of methodology offered by van Manen as a concept within the framework Wallin proposes, it might be possible to reimagine methodology in a more active manner as a process within research that frames, assumes, orients, views, and/or theorizes by engaging with the world. At the same time, even with the shift from noun to verb, it seems difficult to distance these actions from their ruttish relationship with a "*certain* research method ... one should *follow*" (Van Manen, 2006, p. 28)[296], where the word "certain" seems to take on the sense of both *particular* and *determinant*, and the word "follow" appears to privilege method over the process, place and/or relationships of the research question under consideration[297].

For Indigenous scholars, the privileging frequently appears to be flipped; the question, and the relationships from which it emerges, are key. Burkhart (2004) makes this clear in his exploration of American Indian[298] epistemology/ies by discussing how Coyote teaches by way of not being very adept at learning. Coyote's missteps, miscues, and mistakes are examples of what is potential when one forgets one's place and relations[299].

> Coyote ... shows us that the questions we choose to ask are more important than any truths we might hope to discover in asking such questions, since how we act impacts the way the world is, the way in which the question will get answered. The way in which we ask questions (the way in which we act towards our relations) guides us, then, to the right answers, rather than the other way around wherein what is true directs the method of questioning and the questioning itself (i.e., we can ask any question we desire and in any way we desire, the answer remains the same). (p. 16)

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[296] Harding's sense of methodology as "a theory and analysis of how research does or should proceed" (in Smith, 1999, p. 143) might be more helpful in this regard. Of course, Harding's work very much focuses on exposing the taken-for-granted in research.
[297] In van Manen's (2006) case methodology, and specifically phenomenology, absolutely leads research.
[298] I use Burkhart's (2004) term.
[299] Of course, Coyote is tricky, and sometimes I get the sense his mistakes are rather well-conceived precisely for their pedagogical purpose.

Burkhart says in American Indian[300] ways of knowing there is an ongoing relationship between the questioner and the world that impacts what arises in relation to the questions asked. As I understand this perspective, the impact on answers should not be read as confirmation bias on the part of the questioner; instead, here the world is an active agent, which both acts on and is acted upon by the questioner (and the question(s)), and so answers get bound up in the particular and mutually changing relationships shared between the questioner and the world through the process of exploring the questions. Kovach (2009), working from Cree/Saulteaux perspectives, sees a similarly bound up relationship between methodology and researcher (and the question(s) and the world). However, she notes that relationships can be inequitable, unacknowledged, or defined in unresponsive manners which privilege one element over the others, and this is what she suggests often happens in research undertaken from Western perspectives where "methodology *itself* influences outcomes" (p. 13, emphasis added). Burkhart and Kovach speak from positions where the world and everything in it are in flux. It seems to me, that from such a perspective it makes no sense to engage with ways of thinking (or methodologies) which are unresponsive to engagement with the world or treat it as an object. At the same time, there are parallels to their thinking offered by some Western scholars.

Jardine (2000a) suggests that educational inquiry has become largely subject to technical approaches whereby the focus is on the already experienced, the already lived, and the thus-assumed-to-be-understood (or, at least, understandable). He writes, "what is most fundamentally granted or given in [such] inquiry is not *the matters themselves*, but rather the *method* whereby what is given is rendered objectively presentable" (p. 116, emphasis in original). Like Kovach, Jardine finds that the results of such inquiries are largely dictated by whatever methodology is applied to them. His position is that inquiries where method is privileged over question(s) (or questioning) are only and "essentially *informative*" (p. 116, emphasis in original). There is little or no space in them for the ambiguous; findings which exceed methodology, bring forth the new, or engage

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[300] As laid out in previous chapters (e.g. Chapter 7), I understand from the work of people such as Cajete, Ermine, and others, along with conversations with numerous Indigenous colleagues and friends that the sense of relationship described by Burkhart shares similarities with that of other Indigenous nations.

the world in inherently creative ways. Jardine's exploration of methodology is a just a piece of a much broader body of work (Jardine, 1998b, 2000b; Jardine et al., 2006) in which he strongly argues that concepts such as methodology, mathematics, pedagogy, and teacher education are significantly more complex than mere Cartesian objects which can exist in isolation from anything else except themselves. Drawing heavily on the philosophical hermeneutics of Gadamer (1989), Jardine suggests that these concepts are fields of living inheritances which we enter into and with which we build mutually changing and sustaining relationships as we become family/iar with their ways of being (and doing). His living fields are certainly capable of reacting to relationships, if not acting in and of themselves[301]. I sense Wallin (2010) both echoing and extending Jardine's thinking through his postmodern consideration of *currere*[302]. While Wallin offers definitional representations of *currere* as the concept in which he is engaged, ultimately he is not so much interested in what concepts are but how it is they might be at play, and how they act in the world.

Given that my questions focus on engaging with a shift in process, the world in flux, ideas at play, this attention to how concepts/ideas/ things/people act (and interact), how they are at play, what they might put into play, track around the inarticulable for me because such motion is hard to pin down. I get the sense that in terms of methodology I have to be looking not for a "*certain* research method … [I] should *follow*" (van Manen, 2006, p. 28), but to the relationships acting in the places where my question encounters the world (or vice-versa). In my review of the work of others whose research occurs in contexts similar to mine, this kind of responsive (or perhaps responding) methodology is also evident.

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[301] I remain uncertain whether Jardine thinks living fields can act. It seems to me that the potential for their acting is implied, but never explicit in hi work.

[302] Perhaps not a surprising connection given that Jardine was Wallin's M.A. supervisor.

The Naming[303] of Responding Methodologies: Tracking to New (or Perhaps Very Old) Places

Some researchers situated in spaces where Western and Indigenous ways of knowing, being, and doing come together take up methodology as actively at play in their research. They approach methodology not as a privileged overseeing element of a generalized research practice which one follows, but rather as a responsive element which develops in relationship to the processes, places, and relationships in which their specific inquiries are immersed and from which they emerge. As these methodologies arise, the general practice is to name them, often with Indigenous words/language or conceptions[304]. Frequently emergent from researchers' previous work and/or relationships with Indigenous people, peoples, and communities, these approaches are not necessarily labeled as methodology per se, but sometimes as theoretical perspectives, or guiding principles, etc[305]. They nonetheless offer a means of framing methodology in that they provide "a theory and analysis of how research does or should proceed" (Harding in Smith, 1999, p. 143).

There are some interesting commonalities to note with regard to these named methodological approaches. First, while they bring together Indigenous and Western assumptions about the world and the way it works, they generally privilege Indigenous assumptions[306] in efforts to counter existing systemic inequities between Western and Indigenous worldviews within Western institutions (Blackstock, 2011; Hatcher, Bartlett, Marshall, & Marshall, 2009; Lunney Borden, 2010). Second, they all focus, to a greater or lesser extent, on relationships, process, and place. Third, they acknowledge the tension of the *inter esse*, and remain in that space despite the tensions, often considering the tensions as generative or creative. Fourth, unlike the other approaches to methodology

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[303] Naming is one of the methodological projects Smith (1999) lists as being undertaken by Indigenous communities and researchers as a means of re/claiming and re/accessing understandings.

[304] Sometimes they are named in English, sometimes in Indigenous languages, other times in both.

[305] I will suggest this seemingly off labeling may occur because when people work from a more wholistic perspective the interconnected complexities of the individual components of that work begin to reflect each other as they are brought into relationship with the larger whole of the work.

[306] And / or actively resist Western research conventions.

presented, named responsive or responding methodologies seem to both be immersed in and emergent from *māramatanga*/effulgent coherence.

In her research examining the disproportionate representation of First Nations children in the Canadian welfare system, Blackstock (2009, 2011) begins from the position that "problems streaming across western and First Nations cultures require an ethical space where western and First Nations knowledge can coexist to inform solutions" (p. 1). By attending to the processes through which the tensions between Western and First Nations assumptions about the world *act* within the context of the welfare system, she has named an emergent bi-cultural theoretical approach for the social sciences and humanities which she calls the Breath of Life (BOL) Theory. While she posits BOL as a testable theory, its tenets have the potential to serve as methodology. As described, such a framework would consider emotional, cognitive, physical, and spiritual experiences of individuals and broader communities[307] in relationship to each other. In addition, in order to extend the tendency of Western research to provide a static image of a particular time and space (the empirically observable), BOL would take into account First Nations ideas of time, "where the past, present, and future are mutually reinforcing" Section 3, para. 4) and informing, and space conceived as a "multidimensional … reality" (Section 3, para. 6) where some dimensions are empirically observable and others accessible through spiritual practice, dreaming, etc. Analysis would subsequently consider relationships between individual(s) and community/ies arising from the past, manifesting in the present, and with impacts into the short-, medium-, and long-term futures[308]. BOL is intended to be broadly applicable, but within particular inquiries asks researchers to attend to the specific location of the inquiry (geographically, politically, economically, culturally, etc.) in order to understand its impact on and relationship to the relationships under study. In addition, researchers taking up BOL would likely attend to the places where and the ways in which relationships established through the movement back and forth between individual(s) and community/ies and through time and space(s) are nurtured (or not).

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[307] Which would likely include the other-than-human.

[308] Blackstock suggests the longer-term future would account for the subsequent seven generations. Cajete (1995) also points out that in terms of education (and one might argue all human activity) Indigenous peoples tend to "operate in terms of 'generational' strategic plans" that go "far beyond the five- or ten-year strategic plan of modern mechanistic planning" (p. 633).

Chambers, Hasebe-Ludt, Donald, Hurren, Leggo and Oberg (2008) name *métissage* as a political, reading, writing and research praxis; an active, enacted, living practice of engaging with re/claiming, re/telling, and letting things be in relationship, difference, and multiple complexities. In the Canadian colonial context where *Métis* is a term referring to people with both Aboriginal and European ancestry, the naming itself is a reclaiming from a "racial category translated as 'mixed-blood' or 'half-breed' with the negative connotations of animals (and humans) breeding across species" (p. 142) to a means of bringing together multiple voices, genres, media, and traditions in the consideration of what it means to be and to be together in a sense that extends beyond the anthropocentric. As a methodology it asks researchers to consider the processes, places, and relationships of specific inquiries in multiple forms, "braiding" the results together through negotiation between author(s) and text(s) as a way of "resisting 19th-century scholarly conventions of discrete disciplines with corresponding rhetorics for conducting and representing research" (p. 142). The braiding and negotiation serve as a means of creative activity where the resulting final product is both a part of and a result of the research.

Another example of naming can be found in Lunney Borden's (2010) dissertation on mathematics education in Nova Scotia Mi'kmaw communities. She writes that in terms of methodology:

> I wanted a word that would be used to describe the activity of people coming together to discuss an issue or solve a problem. During a conversation I had with the Grand Chief about my work, he suggested that I might want to use the word *mawikinutimatimk* which means 'coming together to learn together'. (p. 73)

Relationship, process, and place are evident in the translation of the Mi'kmaw word describing the methodology and in Lunney Borden's description of its origins, but its naming was not unproblematic (Lunney Borden & Wagner, 2013) because naming is a powerful act.

Tracking Back to the Inarticulable Through the Practice of Naming

Within Indigenous communities naming is highly significant. In many nations, the naming of people and the stories connected to those names speak to a person's place and

role in the community and his/her own life (F. Glanfield, personal communication; C. Mount Pleasant-Jetté, personal communication). Thus, names are not arbitrary signifiers, but meaning/ful(l) reminders of stories that place people in all their relations (Gibson, 2013; Smith, 1999; Zimmerman, 2013). Similarly, Kovach (2009) writes about the importance of place names and the stories of their origins as a means of locating people(s) and connecting them through place to ancestral wisdom and memory; "they are repositories of *science*, they tell us of relationships, they reveal history, and they hold our identity" (p. 61, emphasis added). Her position echoes that of Basso (1996) who writes how Apache Elders' relationships to the places they inhabit support both re/membering and understanding of new relationships in ways that connect the nation's contemporary life with its past on a daily basis.

In counterpoint, Anishinaabe activist, environmentalist, economist Winona LaDuke (2005) considers naming in terms of the covering up, removal, and appropriation of Indigenous names and symbols by colonizing peoples. She identifies the naming of three Minnesota reservations for US Army Forts "pushed into the heart of Indian Territory" (p. 137) as prime examples of separating people and places from their relations by un-naming and renaming. She also points to the appropriation of Indigenous "names, likenesses and … symbols" (p. 143) to market products or sports teams as a trivializing, demeaning, colonizing practice that frequently dehumanizes Indigenous people/s, relegating them to the past and erasing their existence as active contemporary peoples. As Peter Garrow* insists, "we're not symbols, we're not the Cleveland Indians, the Atlanta Braves, or whoever … we're real people and that has to [be] recogni[zed]".

Within the realm of research, Smith (1999) says, "by 'naming the world' people name their realities" (p. 157), and describes naming as political act which has proven very powerful in the articulation of a research methodology 'native' to Aotearoa / New Zealand:

> This naming of [Kaupapa Māori] research has provided a focus through which Maori people, as communities of the researched and as new communities of the researchers, have been able to engage in a dialogue about setting new directions for the priorities, policies, and practices of research for, by and with Maori (sic). (p. 183)

Smith describes naming in the context of research as a means of reclaiming and reasserting power and sovereignty, of returning the act of research to its proper relationships in particular places. And this thought returns me to Lunney Borden's work.

As I have shared, relationships are foundational to my work. Lunney Borden, or Lisa as I know her, is not just a person whose work I admire but a colleague and friend. I know her work through knowing her and seeing her thinking develop over time in a personal way. We have sat together in numerous places in Canada to discuss at length our positions as white women working in largely Indigenous contexts, and the depth of learning we have been gifted with through the relationships developed in these places. Our work is similar and mutually supporting in many ways (Lunney Borden & Wiseman, in press). It differs significantly in terms of place; she has spent most of her professional life placed and engaged within Mi'kmaw communities in Nova Scotia, while I have been placed (largely) in Montréal but engaged with people, peoples, and communities–First Nations, Métis and Inuit; status and non-status; urban, semi-urban, suburban, rural, and remote–across Canada (and into the United States). While we have both located our doctoral inquiries in the relationships in which we are bound up, Lunney Borden's context is significantly more local than mine, and thus the naming of her methodology, *mawikinutimatimk,* emerges from and is bound up in that place. Still, her awareness of the tensions around naming (and the fixing of things that is a side effect of writing) caused significant difficulties through her doctoral work, "it was hard for me to commit the word to writing; it was hard for me to say, 'This is it!' I grappled with that for a long time" (Lunney Borden & Wagner, 2013, p. 110). She is explicit that *mawikinutimatimk* belongs only in and to the communities where she undertook her doctoral work, that it would be inappropriate in another context.

Recognizing truth in her claims, what I take from her methodology is not its naming nor the manner in which she describes it, but the way in which she journeyed toward it through a process of community, discovery, and learning. It is not "a *certain* research method … one should *follow*" (van Manen, 1997, p. 28, emphasis added), nor a word applied to methodology because of the need to "pick something, and fill in the damn box", but instead a way of theorizing about and analyzing her inquiry that emerged from the relationships, processes, and places in which it is located. However, it leaves me

wondering how it is that in the broader context in which I work–where multiple peoples, languages, ways of knowing, being, and doing exist simultaneously and cotemperously–I might move from the inarticulable to appropriately name a methodology[309]. Thus, while named responsive or responding methodologies seem to reflect *māramatanga/*effulgent coherence[310], and in some ways ease my tensions with regard to methodologies, I am still left with uncertainty around naming a methodology, and still caught up in the inarticulable.

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[309] For me, this question also makes me wonder if there is any way in which we can think of Canada as a singular place, or if it is only a construct of the interrelationships between the multiple smaller places within the physical borders described as Canada.

[310] Meyer (2013b) has put forward *māramatanga/*effulgent coherence in a different manner than Lunney Borden has described *mawikinutimatimk.* In Chapter 6, I outline why I use Meyer's term, and why I maintain the Hawai'ian / English tension in my use of the word.

These insights resulted from an inquiry process that avoided naming an explicit research methodology or theoretical framework at the outset. This hermeneutic stance was encouraged by my mentor and supervisor ... but also resonated well with most of the methods and frameworks that I encountered and studied. I found myself piecing together aspects of different ideas and influences and working them in ways that maintained the spirit and intent of what I wanted to say. As the inquiry process continued to move and flow, I increasingly felt a strong desire to speak, write, teach, and act with a spirit and intent that enabled me to assert Indigenous philosophies[311] and ways while also drawing on the diverse influences and affiliations that have constituted my life. I wanted to find a way to hold seemingly disparate standpoints together without necessarily choosing sides. (Donald, 2009, pp. 4-5)

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[311] In my case, it is to assert what I understand of Indigenous ways of knowing, being, and doing.

Chapter 10: Methodological Starting Points: Playing with and Creating Possibilities

I am convinced that in attempts to decolonize academic inquiry, methodology should be responsive to the processes, places, and relationships in which specific inquiries occur, it should demonstrate and allow for *māramatanga*/effulgent coherence. What emerges in specific inquiries may in fact be the need for existing methodologies, but there is no real way to be certain at the beginning of the process. Still people do not come to inquiry without some kind of knowing and when one must pick something and fill in the methodology box that knowing can be useful to identifying options, or at least starting points from which something might grow in the middle.

My previous work and current inquiry bring together people who and ways of knowing, being, and doing that are grounded in both Indigenous and Western traditions. The current inquiry concurrently focuses on the bringing together (to a greater or lessor degree) of Indigenous and Western ways of knowing, being, and doing in science curricula. To honor, acknowledge, and reflect that coming together and create a space in which conversations might be potential within my research, in my dissertation proposal, I suggested that I would begin (and *only* begin) by drawing on ideas from Indigenous/Indigenist research methodologies (IRMs) and more ecological interpretations of hermeneutics. My interest in these approaches initially arose from their resonance with my question/s, their commitments to process, place, and relationship, and their deep attending and responding to the contexts of any particular inquiry. I was not so much looking at them as methodologies but rather as ontological stances[312] with implications for the manner in which coming to know–both my own and that of the people with whom I spoke to as part of my inquiry–might occur. Here the goal of coming

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[312] The difference between "methodologies" and "ontological stances" may be entirely semantic here, but it is nonetheless helpful for my thinking and being in relation to doing research. To my reading, methodology seems like something completely intellectual that is focused only on knowing (or perhaps a more static knowledge), where as an ontological stance has more to do with being and how I hold myself in the world. I can always change my stance and thus it is more dynamic.

to know is not to attain discrete bits of fact or information (although this may also occur) but to develop deeper understandings over time through recurring engagement with[313].

Even as a beginning place, I understand the choice is un-easy. Kovach (2009) underlines that IRMs cannot be fully classified within the qualitative traditions of Western research, because they emerge from distinctly different epistemological, ontological, and cosmological assumptions about the nature of reality and truth. She suggests that these tensions make it challenging to "make room to privilege both" (p. 29). If I look on the surface of the two approaches I have identified, I must agree with her position, there are challenges to *māramatanga*/effulgent coherence in bringing the two methodologies together. Hermeneutics focuses on the ways in which humans come to understand their own being in the world through the act of linguistic interpretation. It emerges from textual tradition, has a history within institutions which have perpetuated European colonization (Kulnieks et al., 2010; Weaver, 1998), and traces its roots back to Plato and Aristotle (Grondin, 2002; Smith, 1991). Indigenous research methodologies focus on understandings developed via being and being-in-relationship in a manner that extends well beyond the human to include "the entire created order" (Weaver, 1998, p. 22). They emerge from oral traditions, are committed to decolonizing (Kovach, 2009; Smith, 1999, 2005; Wilson, 2008), and trace their origins to a time beyond the oldest remembered stories. A compare and contrast approach yields a rather dubious common ground or alignment between the methodologies. Still, I remind myself that in moving away from representations of concepts it becomes easier to see how they act, or interact, to examine what they do. In the interaction, I find, as does Kovach (2009), that qualitative methodologies which "assume a relationally constructed aspect of knowledge production" (p. 34)–such as hermeneutics–and IRMs might be allied, if not precisely aligned.

Taken up as a–sometimes messy, tension-filled–alliance, there is a conversation between IRMs and hermeneutics in the context of my research that has proven generative and fruitful in terms of identifying what to attend to within the flux at play in the focus of my inquiry. In this second methodology chapter, I examine this alliance, consider what it

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[313] I deliberately end with a preposition as I do not yet want to identify the relationships of the engagement.

puts into play in terms of relationship, process, and place, and while acknowledging "Western research and Indigenous inquiry can walk together only so far" (Kovach, 2009, p. 30), suggest that when they walk together, or circulate in the same space, there is the potential for them to create. I begin the chapter by clarifying my understandings of IRMs and hermeneutics. I then explore how an ecological turn can position hermeneutics more fruitfully in relation to IRMs, and lay out what one can attend to in research through an allying of the two stances. I end the chapter by explaining how the methodologies were so generative that–in conjunction with the conversations I had with educational stakeholders–they lead me to recognize in the processes, places, and relationships of doing my research what was actually occurring in terms of methodology.

Indigenous or Indigenist Research Methodologies (IRMs)

> IRMs presuppose research the privileges Indigenous ways of knowing, being and doing (Weber-Pillwax, 2001). They are deeply concerned with relationship, place and process. (Wiseman, 2011, p. 32)

Within the academy[314] the provenance of Indigenous or Indigenist research methodologies (IRMs) can be traced back to political resistance movements of the 1960s and 1970s (Smith, 2005; Wilson, 2008), and subsequent work by Indigenous scholars and communities reclaiming and complexifying the histories/relationships between Western and Indigenous peoples (Deloria, 1970; Sioui, 1992), providing their own understandings and interpretations of Indigenous knowledges, philosophies, worldviews, and epistemologies, and asserting the place for Indigenous knowledges, philosophies, worldviews, and epistemologies within public policy, education, and the academy. As this body of work developed, discourse concurrently emerged, (largely but not exclusively) among Indigenous graduate students and professors[315] (mostly) in former colonial nation-states, around the challenges and difficulties of doing research accountable and responsive to, respectful and in support of Indigenous people, peoples,

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[314] As noted in the introduction to this chapter, the understandings IRMs are based on can be located much further back in time.

[315] The wording here is difficult because while the timing of the public discourse within the academy is reasonably accurate given evidence such as publications, conference papers etc., the understanding within Indigenous communities that Western research and methodologies were problematic in terms of accounting for Indigenous ways of knowing, being, and doing significantly precede this period.

and communities within frameworks and methodologies defined from the perspectives of colonizing/settler peoples. As an alternative and resistance to colonizing epistemologies, ontologies, and methodologies, these same people started to consider questions such as "What is Indigenous research?" and "Might there be Indigenous methodologies that could support such research?"

In the 1990s[316], a number of scholars in what are now the nation-states of Australia, Canada, and New Zealand (notably Rigney, 1999; Smith, 1999; Weber-Pillwax, 1999)[317] began to open up broader conversations in the academy by articulating possible answers to these questions. Although this early thinking occurred in distinctly different places, by people from distinctly different nations[318], it was responding to historical circumstances, challenges, and issues arising from European colonization both within and outside the academy; and so, key commitments of IRMs began to emerge from resonances between the individual pieces of work. These commitments include, but are not limited to:

- deep relationality[319], whereby the interconnectedness of all life and creation is acknowledged and respected;
- responsibility and reciprocity to the people, non-human beings, and communities who inform research;
- ongoing reflexivity on the part of the researcher with regard to their own integrity and intentions, the integrity of the research project, and potential outcomes, applications, and places of application of the research;
- decolonization at individual, local, and global levels;
- recognition and respect of local languages and cultures;
- research as a collective, ongoing, transformative process.

In their articulations of what IRMs might be, each of these authors acknowledge that what they offer is an invitation to ongoing conversation and consideration of what

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[316] Happily, right at the time I was beginning to struggle with the writing of my Master's thesis.
[317] This work draws on slightly earlier articulations from Smith (1990) and Bishop (1994).
[318] Weber-Pillwax is Métis from northern AB, Rigney is Narungga from South Australia, and Smith is Ngati Awa and Ngati Porou from the northeastern part New Zealand's North Island.
[319] Similar to that described in Chapter 6.

else IRMs might be, and also how IRMs might act within research, the academy, Indigenous communities, and society as a whole.

More recent work reiterates the initially identified commitments, while simultaneously clarifying and complexifying IRMs through deeper exploration of their relations. Indigenous researchers identify the importance of: spiritual practice, ceremony, dreaming, and story (Absolon, 2011; Archibald, 2008; Kovach, 2009; Wilson, 2008) as means of coming to understand and re/member within research and research practice; the fluidity of conceptions of time where past relationships become present in current research and reflect ongoing commitment to people, peoples, and communities that extends to the future; and, ethical relationality/relational accountability that works against the simple binaries of "colonial logics" (Donald, 2009, p. 7) which seek to divide people and peoples from all their relations instead of opening a space where they might co-exist (Andreotti, Andreotti, & Cooper, 2011; Donald, Glanfield, & Sterenberg, 2012; Smith, 2005; Wilson, 2007, 2008).

Over and over again, explorations of IRMs return to questions regarding epistemologies, or perhaps more accurately epistemological-ontologies[320]. These ways of knowing, being and, doing are emergent from and located in the multiple relationships of an identifiable physical place. As Meyer (2003) writes:

> One does not simply learn about land, we learn best *from* land. … How you are on land or in the ocean tells us something about you. *Absolutely.* It opens doors to the specificity of what it means to exist in a space and how that existing extends into how best to interact in it. (p. 219, emphasis in original)

Specificity is important here because, as I understand it, the land of Kainai territory in southern AB, the plants, rocks, animals, and people that live in it, the water and air that flow through and over it, the ceremonies and annual cycles which occur there, and the language that it speaks come together in ways of knowing, being, and doing that are quite distinct from those of the Mohawk nations close to Montréal, or Cree nations in northern QC and AB. In terms of research, different epistemological-ontologies suggest different methodologies. IRMs are then (or can be), as the name suggests, multiple and context responsive.

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[320] Or ontological-epistemologies.

These specificities related to epistemological-ontology/ies raise the question of who can engage IRMs in research. There is some suggestion in certain uptakes of IRMs (Rigney, 1999; Steinhauer, 2002) that Indigenous researchers as–assumed[321]–insiders to Indigenous ways or knowing, being, and doing, languages and communities are more likely to be accountable to communities, and better placed to understand the responsibilities inherent in engaging with Indigenous people, peoples, and communities in research. I have no doubt that in many cases there is truth to these assumptions. I also recognize that, while I am committed to the foundations of IRMs, I am limited by the fact I do not speak an Indigenous language, nor belong to an Indigenous community[322]. My learning with respect to Indigenous ways of knowing, being, and doing has occurred over nearly half my lifetime, but is always somehow in relation to the Western ways of knowing, being, and doing into which I was born and which formed my earliest understandings. I am aware that in taking up this work I must always ask myself the questions Kovach (2005) says challenge non-Indigenous people in contexts such as my own, "Am I creating space or taking space?" (p. 26). The intention is always the first, but the second is potential.

I come back to Rigney, Smith, and Weber-Pillwax's writing regarding IRMs and how their work suggests not just what IRMs might *be* but how they might *act*. In more recent work, Smith (2005) has examined how research acts more closely. She says research is not solely about epistemology, methodology, and the results of such practice applied, but that it is also "deeply connected to power" (p. 87); and so the commitment of IRMs to decolonize research:

> is not simply about challenging or making refinements to qualitative research. It is a much broader but still purposeful agenda for transforming the institution of research, the deep underlying structures and the taken-for-granted ways of organizing, conducting, and disseminating research and knowledge. (p. 88)

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[321] Given the complexity of Indigenous identity in nation-states such as Canada, Australia, New Zealand, and the United States, where most people, no matter what their background, have been exposed to and in some ways formed by colonial logics, and the long-term impacts of colonial practices (Dwayne Donald, May 4, 2013), there are many degrees of "insider"ness. I know Indigenous people who would not consider themselves insiders at all.
[322] Within the context of Canada, where I live. I supposed I am technically Indigenous to Scotland, although I feel more grounded in the places, people, and relationships of where I live.

It is about challenging existing understandings, relationships, and structures for the potential of a transformation and creation which allows for a more pluralistic, multivocal (and perhaps more just) engagement with the world (Andreotti et al., 2011; Cajete, 1994; Gehl, 2012; Smith, 2005; Weber-Pillwax, 1999; Wilson, 2007). Weber-Pillwax (1999) writes such transformation and shared meaning are unlikely to emerge if we remained mired in polite conversation; they require struggling, "suffering" (para. 2) and doing as a means of coming to know–a commitment to *māramatanga*/effulgent coherence, and to taking Indigenous ontologies seriously (Stewart-Harawira, 2005, p. 34). These are in fact, among the commitments I bring to research, and Wilson (2007) says that commitment is all that is required. It is my hope that by sharing my own serious attention to such possibilities, I can give back to the people, peoples, and communities who have given me so much over the last two decades, and in doing so support movement towards decolonizing and indigenizing (Barnhardt, 2008; Brown & Strega, 2005; Smith, 1999; Wilson, 2008) the academy so that it may become a place for all our relations.

Hermeneutics

Hermeneutics focuses on interpretation and the development of understanding(s) via questioning and human language. It has a long history within such areas as theology, jurisprudence, and literary theory (Prasad, 2005). As such, it has a strong connection to interpretation and understanding of texts, although the nature of text has evolved over time from religious texts, to include speech events, artifacts within the arts, and the experience of being (Jardine, 2006b; Prasad, 2005; Smith, 1991; Taylor, 2002). While there are different ways in which hermeneutics is and has been taken up in research, there are some key commitments to this type of work that have been in place for the last 200 years (Ellis, 1998). These commitments include creativity in interpretation, an ongoing exploration and consideration of part/whole relationships (Ellis, 1998; Smith, 1991), and the role of language as "central to all understanding" (Roy & Starosta, 2001, p. 9). I find myself particularly drawn to the philosophical hermeneutics of Gadamer (1989) and more recent uptakes of his work by others which I read as extending and challenging in a deeply ecological manner its existing sense of relationship, the nature of text, and the

privileging of human language (Barsh & Marlor, 2003; Basso, 1996; Friesen & Jardine, 2009; Jardine et al., 2006; Kulnieks et al., 2010; Meyer, 2003, 2008).

Gadamer's hermeneutics is not an objective means to knowledge–or perhaps knowing–but rather an exploration of entering into and coming to understand "great image-filled, sensory, alluring *topics* that address us and draw us into their sway and ask things of us" (Jardine, 2006b, p. 272, emphasis in original). While it includes cognitive understanding, or *episteme*, (Grondin, 2002), it extends significantly beyond knowing as accrual of fact (Taylor, 2002). Understanding for Gadamer (1989), includes *phroenesis* or "practical skill" (Grondin, 2002, p. 37), in the sense of knowing one's way around something, or becoming familiar with/recognizing it in the experience of everyday life (Jardine & Field, 2006). Understanding also includes "coming to an agreement" (Grondin, 2002, p. 39) which Gadamer (1974/1989) refers to as a "fusion of horizons" (p. 304).

The fusion of horizons is key. As Doll (1993) suggests, this type of understanding "is not extracted from … text: it is created in our dialogue with … text" (p. 135) whatever text happens to be. In Gadamer's hermeneutics then, the process of coming to understand is relational. Moreover, it is itself embedded in and emergent from a web of relationships–defined particularly by the culture, historical moment, and place–in which the interpreter is immersed and from which s/he emerges. It is only from within these multiple preexisting relationships–or "prejudices" (p. 271)–that the reader interprets text. Doll points out that Gadamer picks up on Heidegger's concept of "being-in-the-world" and the caughtness of readers (or interpreters) in their own webs. These prejudices are not to be understood in a negative sense, but rather as the ways in which we have been taught to understand, which we carry with us, and through which we attempt to make sense of the world. In addition, prejudices are essential to furthering understanding, as they are the thing against which the new, the different, the as-yet-to-be understood bump up and make us take notice. They are thus the means by which we are able to recognize a relational "we" (Gadamer, 2004, p. 8) which is attempting to find common ground; the recognition that "I am more than me. I am connected to you. I am a member of we" (Stanley & Loy, 2013, p. 40).

That "we" can be "more than me" suggests another aspect of Gadamer's (1989) work, the hermeneutic circle; the ongoing interplay between whole and part in the process of coming to understand. The hermeneutic circle is not a static model, but a space which acts[323]; it "invites researchers to recognize the stories uncovered in their research as microcosms of larger macro stories" (Ellis, 2006, p. 116), it "tries to get beyond *the letter* of any text's message in order to [consider][324] its *spirit*" (Prasad, 2005, p. 35, emphasis added), it "describe[s] the constant process that consists of the revision of the anticipations of understanding in light of a more cogent and better understanding of the whole" (Grondin, 2002, p. 47). This last suggestion implies that while horizons may fuse, any understanding is always tentative, always temporary, always subject to the new, the different, the unanticipated. Understanding is thus an iterative process that is always in play, always in flux, quite like the experience of living. (See Chapter 3 for a deeper consideration of play).

Finally, Gadamer insists on language, or linguistic being, as the medium through which interpretation and eventual understanding occurs. I agree that language is deeply connected to being, to interpreting, to making meaning, to developing understanding. My experience with Indigenous people, peoples, and communities points to the importance of language[325], and particularly languages located in specific places as the site of understandings about that place. At the same time, this experience also underlines the limits of human language in terms of developing deep understandings. It is here where an ecological turn to hermeneutics might ally it more peacefully with IRMs.

An ecological turn

Kulnieks, Longboat, and Young (2010) assert that Gadamer's position on the linguistic nature of all experience and understanding places his "work [firmly] within Western intellectual traditions that demand knowledge and wisdom to be linguistic and in the legitimizing of language above all other media" (p. 16). They go on to describe hermeneutics as a "conceit of and by the dominant culture as an insight into meaning that

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[323] And within which acting might occur.
[324] I have replaced Prasad's word "capture" with "consider" in this quote because it seems to me that capturing the spirit of something may not be such a relational process.
[325] And to the belief that some understandings exist only in certain languages.

requires textual convention" (p. 17). As I see it, their objections arise from a breakdown in the relationality of hermeneutics demonstrated by Prasad (2005) when she suggests that the hermeneutic uptake of language allows us to listen "to texts and allow[s] them to 'speak' to us *even though this is not possible in a literal sense*" (p. 37, emphasis added). For many Indigenous people, peoples, and communities, text–whatever it may be–speaks; it is our responsibility to learn to listen to it despite its lack of human voice. My experience also suggests that, if you look deeply into the relationships in which you are immersed, there in the middle is something else–perhaps the inarticulable[326]; a being in the world beyond human language, but from which learning and interpretation are still possible. I see the extension of hermeneutics from a philosophical stance to an ecological one in this inclusion of the other-than-human in the relationships in which we find ourselves, in acknowledging that the other-than-human has a voice and something particular to say. Jardine's (2006b) uptake of Gadamer hints at this possibility when he suggests "we live in the world and the world houses us and our thinking and experiencing. We do not house it in our constructs"[327] (p. 271). The connection is perhaps more clear in work by Indigenous scholars and scholars who work closely with Indigenous people, peoples, and communities.

Despite their difficulties with Gadamer, Kulnieks, Longboat, and Young (2010) remain committed to hermeneutics as a means to understanding through an embodied engagement in[328] the land that extends beyond the linguistic. They posit an "eco-

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[326] I understand I am offering multiple definitions of the inarticulable. This lack of precision in language reflects in some ways the challenge of what I am trying to describe in general– something in process on tricky ground. I am hoping by the end to get at how it is possible to recognize the inarticulable but still be unable to adequately articulate its being, other than to be able to firmly say something is clearly going on here, it sort of has a shape, and so I am giving the inarticulable time to emerge by engaging with it in a somewhat recursive fashion.

[327] Although I am not entirely certain he would interpret this sentence in the manner that I do.

[328] Generally, people speak about being "on" or "out on" the land rather than in it. However, in an email conversation with Glen Aikenhead (personal communication, May 13, 2013), he shared the following story.

> During the development of our Rekindling Traditions project, one of the
> communities had a long conversation over the title of a unit they (the community
> and science teacher) were developing – "Survival on Our Land" or "Survival in
> Our Land". This Woodlands Cree community decided on the latter because they
> felt that their Cree language suggested that they were enveloped by Mother Earth
> (thereby living "in" Mother Earth) rather than being "above" Mother Earth as

hermeneutics" (p. 15) in which the land is both "a source and a record of meaning" (p. 17). It is an idea that may be challenging to consider; one of the adjustments it involves is extended understanding of the "I-thou"/ "me-we" relationship beyond the human.

For Gadamer (2004) understanding is potential, even between people who speak different languages, because of the basic relationality/common ground implied by way of a shared humanity[329]. This fundamental commonality extends to all humanly produced texts–conversations, the written word, art, architecture etc. For many Indigenous people, peoples, and communities, the ground (literally) for relationship is much more broadly conceived/experienced and extends to the other-than-human–animals, the air, the water, and the land–as described by scholars and community knowledge holders (for example see Chapter 2). There is thus a multiplicity of "I-thou"/ "me-we" relationships from which understandings might arise, human linguistic understanding is just one form. Kulnieks, Longboat, and Young (2010) write that with the broadening of "I-thou",

> the story is told not as a static [written] text but dynamic meaning derived from the restless and changing energies of the Earth and her dynamics [both linguistic and embodied] in human form within a transaction of the ecology of meaning". (p. 17)

Eco-hermeneutics, or ecological hermeneutics, then, engages with the flux–the understandings/stories told, being told, and yet to be told that come from relationships with the land and all our relations.

Basso (1996) demonstrates one way in which this more broadly conceived sense of understanding might manifest. He describes Apache relationship to the physical landscape they inhabit; "familiar places are experienced as inherently meaningful, their significance and value being found to reside in the form and arrangement of their observable characteristics" (p. 108). He outlines how long-term experience and

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conveyed by "on" Mother Earth. The general issue here is to make the English language represent, as much as humanly possible, an Indigenous perspective. I have subsequently adopted this structure in my own languaging.

[329] The assumption is not without its problems. Butler (2010) acknowledges that in "coming up against" (p. 34) the complexity of the world, there is the potential for people to recognize others "as 'like'" (p. 36) themselves, i.e. recognize relationships via shared humanity. At the same time, she believes such recognition can be actively limited or discouraged by the manner in which certain people, peoples, groups, or communities are framed in public discourse via government, the media etc. For example, in circumstances of war or colonization, these institutions frequently frame certain combatants and/or local populations as less-than-human and therefore unworthy of the same consideration as those who are considered fully human.

knowledge of the stories resident in these physical places can be accessed in an almost prescient manner by community Elders. That is, Elders have cultivated their knowledge of the places in which they live to such a degree that it is immediately accessible to them. Moreover, they re/member what has occurred in such a way that they see new connections, new relationships–and hence how specific prior understanding may or may not apply to them–as they emerge. Elder's wisdom is literally placed in the land and gives back to it; they walk through it daily in physical, spiritual, emotional and intellectual ways, living its changes and changing it by living[330]. As Basso underlines, this type of relationship/understanding takes years to develop; it is embodied by Apache Elders, but begins with mindful interaction with the land, stories, and practices of the nation from a very young age.

Barsh and Marlor (2003) present another possible example of ecological hermeneutics in action through their exploration of Blackfoot and Western understandings of bison and bison hunting[331]. In a back and forth between the different ways of knowing, being, and doing they first corroborate scientific contention that wolves "share humans' capacity for mentally mapping landscapes and forecasting the movements of other species" (p. 582) with Blackfoot stories about learning to hunt bison by observing wolves[332]. They then challenge the "science" by shifting the origin of understanding about bison from humans to wolves. They posit that by combining empirical observations over thousands of years with ceremonies[333] in which hunters perform wolf in order to embody wolf for the hunt, the Blackfoot have come to a deeper and more complex understanding of bison behaviour than that of Western scientists.

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[330] This livingness is experience both immediately present but also enmeshed in the past; and is somehow in contrast to lived experience as described in phenomenology (van Manen, 1997).
[331] Their text is inherently hermeneutic. It can be read as an academic exploration of a particular Indigenous practice within a specific context, but on a deeper level they underline the complexities of bringing together Indigenous and Western understandings. Each section layers more and more meaning onto the narrative, and it is the reader/ learner's responsibility to "listen" for the hints the storytellers provide.
[332] Actually by observing the relationship between local hydrology and topography, seasonal weather fluctuations, and the behaviors of wolves (which hunt bison), coyotes (which do not hunt bison), and bison.
[333] Cajete underlines the key roles ceremonies had in the process of intergenerational learning. As such, the Blackfoot ceremonies pass on knowledge of bison and wolves from adults to children.

In these examples, the land, the animals, the other-than-human speak and can be read; they are texts (conceived in a very broad sense) that can be listened to, can be heard. They demand our attention, "*strike* us, *catch* our fancy, *address* us, *speak* to us, *call* for a response, *elicit* or *provoke* something in us, *ask* something of us, *hit* us, *bowl* us over, *stop* us in our tracks, *makes* us catch our breath" (Jardine, 2006b, p. 270). They have voice, although it may not be a human one; they are capable of supporting a developing understanding, although sometimes in an embodied inarticulable way rather than a linguistic manner.

The ecological turn in hermeneutics is possible because, as Smith (1991) points out, hermeneutics is not overly concerned with its own traditions; it is itself an interpretable text. He writes:

> the hermeneutic imagination is not limited in its conceptual resources to the texts of the hermeneutic tradition itself but is liberated by them to bring to bear any conceptualities that can assist in deepening our understanding of what we are investigating. This means that the mark of good interpretive research is not in the degree to which it follows a specified methodological agenda, but in the degree to which it can show understanding of what it is that is being investigated. (p. 201)

I am not certain that Gadamer would object to the shifts towards a more ecological uptakings of hermeneutics. He, like all of us, was defined and worked within his own time, his own history, his own relationships, his own prejudices. He was responding to the circumstances and things he was able to recognize; the things that presented to him in his time and place of experiencing the world. He also acknowledged the ongoing potential to recognize more, to become more open through living in a world that asks things of us "over and above our wanting and doing" (Gadamer, 1989, p. xxvi)–we just need to be able to listen to it.

Relationship, Process, Place: Finding Method in Methodologies without Method by Tracking the Play between IRMs and Hermeneutics

So, what happens when IRMs and ecological interpretations of hermeneutics circulate together in the same place? What do you attend to in the research? What methods do you use with methodologies that do not specify methods? Where do you even

begin? The answer to the first three questions can, perhaps, be found in considering the fourth.

I begin in the middle–the *inter esse*–my "deep connectedness, … interestedness [and] and investment in the issues at hand" (Jardine, 1998b, p. 7). I begin in the middle of research, of theories, of methodologies, of ways of knowing, being, and doing; in the middle of life and living. Here I sit with what I understand of Western and Indigenous ways of knowing, being, and doing and attend to the *"patterns in the middle that are very much alike" (*Darren McKee*),* as well as the differences which keep things in motion and have the potential to admit or generate the new (or return to the very old). In this place, I let them circulate together, feel each other out, and converse with each together, or not, as they will.

In the middle–the *inter esse*–I can hear Manulani Meyer (2008) say "What we have in common is our difference. It begins first with this, and it is the leaping-off point to the beauty of specificity that will bring us to a common knowing" (p. 220) and I am reminded of the integrity of all people and the importance of deep listening.

In the middle–the *inter esse*–I can hear Linda Smith (1999) say,

> Sharing is a good thing to do, it is a very human quality. To be able to share, to have something worth sharing gives dignity to the giver. To accept a gift and to reciprocate gives dignity to the receiver. To create something new through the process of sharing is to recreate the old, to reconnect relationships and to recreate our humanness" (p. 105)

and I am reminded that research is about giving and receiving, and the ways in which past and future become present in the work.

In the middle–the *inter esse*–I can get that Gadamer's fusion of horizons leads to understanding that is both temporary and tentative, and simultaneously get that this type of understanding may not be possible in the places of my inquiry. In some circumstances, the optimal outcome may be to agree there is no fusion, but instead separate horizons that may nonetheless inform or complement each other in their differences. Sometimes it is more important that we are able to sit together in the difficulties of our differences than to resolve the differences themselves.

In the middle–the *inter esse*–I am enmeshed in and acknowledge all of my relations. I must honour and give back to them in a way that makes them more not less

(Doll, 2003; Kovach, 2009); that creates space for them rather than taking space from them (Kovach, 2005). When I am in the land, I therefore walk softly. When I am in conversation, I am mindful of the irony that "dialogue is often the solution to fractures created through lack of dialogue between those with power and marginalized groups" (Smith, 1999, p. 91), and, thus, also walk softly. My relations also remind me that I am very much placed, very prejudiced, very much a microcosm of the macrocosm not just in the stories I hear and tell, but to the core of my very being. I thus need to pay attention to the wholes and parts, the layerings and interplayings of understandings (Kovach, 2009; Prasad, 2005), however they make themselves known–via language, via embodied experience, via dreaming, via tracks in the snow that may lead somewhere fruitful (but possibly inarticulable).

In the middle–the *inter esse*–I understand that putting these commitments into practice and doing is necessary; it is only in this way that I will learn, experience change, come to understand what the questions I have asked might mean, be able to ask or listen for new questions. In the inquiry, therefore, my doing has consisted of conversations with the policy and curricula documents that mandate integration of Indigenous perspectives in K-12 science, of conversations with people–Elders, teachers, policy makers–who are trying to understand the policy and curricula and render it meaningful, of conversations with pre- and in-service teachers in specific places, of spending time in the land with all my relations attempting to hear them speak (see Chapter 4 for more details on method).

So I begin in the middle–the *inter esse*–return to it over and over again, and, no doubt, (seem to) end there as well. The *inter esse* is tricky ground. It is always in motion, always in flux, at play, living. I am not trying to pin it down and make it something it is not. As such, "My tools are story, metaphor, history and philosophy, leavened with empirical claims" (Luke, 2013, p. 146), a meditative, reflective stance, and long walks in the various places in which I find myself. In these places, I watch and listen carefully for signs, for tracks of Coyote, Naapi, Raven, Hermes and their friends, for hints of teachers and teachings involved in creating or growing in the middle. There *is* trickiness in this place, but much to be learned.

"This Is It!" But Not Really: The Creative Emergence of an Inarticulable No-thing

I could end here and say "This is it!" (Lunney Borden & Wagner, 2013, p. 105); this tension-filled but generative conversation between hermeneutics ecologically-conceived and IRMs defines the methodological space, commitments, and struggles I sit with in attending to the processes, places, and relationships of my inquiry. I do sit with the commitments and struggles, and so I suppose the assertion is *good* enough. It provides an adequate beginning to conversations with and between people, policies, and practice (my own and that of others) as I consider what each says, how they might be related and placed, and in what ways a larger conversation might emerge from the all the individual pieces. And yet following from *māramatanga*/effulgent coherence where all principles touch every aspect of your practice, I am left uneasy, because methodologically what I have described is not *true* enough to what has occurred[334].

Shawn Wilson (2008) writes that "Rather than viewing ourselves as being *in* relationship with the other people or things, we *are* the relationships we hold and are a part of" (p. 80). Considering academic inquiry from this position Kincheloe and Berry (2004) say transforms the object of inquiry "from the 'some-thing' of substance to the 'no-thing' of relationship" (p. 92); rendering it, in some ways, not an object at all. The no-thingness reminds me of a question Jardine, et al. (2006) asks in relation to mathematics.

> [What if mathematics] *is not an object at all?* What if … the *world* of mathematics (as a living, breathing, contested, human discipline that has been handed to us) needs our memory, our care, our intelligence, our work the 'continuity of [our] attention and devotion'… and understanding if it is to remain hale and whole. (p. 90-91, emphasis in original)

While I am less anthropocentric in approach, Jardine's position resonates strongly and seems to sit more comfortably with empirical observations of the places and processes at play in my research where something–or perhaps a somewhat inarticulable no-thing (Kincheloe & Berry, 2004)–seems to have emerged from the creative energy and relationships generated by bringing together IRMs and ecological interpretations of hermeneutics. As much as it would be easier and more comfortable to say "This is it!" (Lunney Borden & Wagner, 2013, p. 105), to ignore the emergence, hold it in hand and

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[334] And perhaps I am still too much of an empirical engineer to let that go.

explore it at in some other place, to do so would not honour the sharing and work of the people who have informed this inquiry, because it was in listening to them–to the places, processes, and relationships of this inquiry, to the calling of *māramatanga*/effulgent coherence –that methodology emerged. To understand that emergence, however, I have to first explore process more deeply, and consider doing in relation to my research.

I love when people ask me what I do. My response, changing the views of knowledge and intelligence, is mostly met with disbelief and doubt. Those who respond positively are most often Indigenous or just slightly crazy. We seem to be on the same team. We who thrill to non-uniform patterns in nature. We who value what is distinct. We who know that beauty and inspiration come also from dreams, smells, and mountain vistas. (Meyer, 2013a, p. 250)

Part II Redux: Initial Conditions and Early Iterations: Being Uncomfortable and Doing It Anyway

The relationships in which my research is immersed and from which it emerges are the interconnected, entangled relationships between Aboriginal and settler people, peoples, and communities at play in policy, history, governance, education, research and, and, and … . The connections live in my own stories and experiences of the relationships in my living and learning in many places and contexts. To focus on just one or two of the pieces, to deny the complexity and multiplicity of the living situation and what is at play, would be easier to track, perhaps more comfortable, but I am uncertain what I would learn from that approach, moreover, I suspect it would fall over into the colonizing process of taking space rather than creating it, and eschew *māramatanga*/effulgent coherence. In acknowledging the multiplicity and complexity, I seem to be able to maintain a generative tension in the inquiry that opens up the *inter esse* and recognizes the possibility of living. The *inter esse* neither collapses into a singularity or explodes into a vastness where elements are so distant from each other that likelihood of relationship is minimal. I take this ongoing tension as a sign that principles and practice are somehow informing each other.

While I have engaged with my relations more deeply in this writing, they were, in large part, evident to me at the time of my proposal. Still, now–as then–I am left decidedly uncomfortable, particularly with regard to the early iterations of methodology. It is not quite right, does not quite fit. Given unlimited space and time, I could talk *around* its inadequacies with respect to this particular inquiry almost to distraction, but I cannot–or perhaps could not–express what *is* right, what *does* fit. When I have tried to come directly at what the framing or methodology might be to name it, or describe it, the reaction is visceral. I screw up my face up, shake my head, wave my hands in the air. It is really uncomfortable in all sorts of ways. This experience is part of what I am calling the inarticulable.

In the preceding chapters, I have offered multiple definitions/explanations of the inarticulable as a recognizable entity in the inquiry. In some ways that multiplicity reflects the challenge of what I am engaged in and thus trying to describe–something in

flux, something at play on tricky ground. There is clearly something going on here–with respect to integration of Indigenous perspectives in K-12 curricula, with respect to research in the *inter esse* where different ways of knowing, being and doing circulate together. It has a shape (or perhaps pattern) I am beginning (or have begun) to feel out, but I am still searching for a more satisfying–effulgent coherence and/or *māramatanga*. I am giving it time to emerge in sitting with the discomfort, tension and difficulty, and by returning to it over and over again to engage with it in an ongoing fashion.

While initial conditions and early iterations may seem somewhat piecemeal and unconnected, if I return to the chapters in this part and consider them as a whole, I find a particular thread that runs through the work–learning and living as processes at play, of enactment, doing. I find the thread in the work of scholars whose thinking has supported my writing and thinking. People such as Rigney (1999), Smith (1999, 2005), Weber-Pillwax (1999, 2001) and Wilson (2007, 2008) who take up IRMs as means of doing research. Gadamer (1989) who, despite his privileging of language, recognizes that part of understanding arises in application and doing. All of the people who focus on doing research differently in spaces where Western and Indigenous ways of knowing, being, and doing circulate together (Blackstock, 2009, 2011; Chambers et al., 2008; Lunney Borden, 2010). Wallin (2010) who is more interested in what concepts do and how they act, rather than what they are, thus opening some space for considering what is going on with the inarticulable (and curricula). Abele et al. (2000) who insist that policy "is what any government decides to do or not do" (p. 3), a position that suggests ideas require enactment in order to live in the world, and echoes the sense of Treaties–even those embodied without words (Mount Pleasant-Jetté, 1998)–as living, acting documents. Hart (2002) who writes in a similar manner about the enactment of K-12 science programs of study. Meyer (2013b) who re/frames relationship between knowing, being, and doing, saying that doing is key to knowing and not the other way around. Hampton (1995) who shows what it means to be directed by your relations in research in a generative manner. Bavington (2010) who demonstrates what theory can do, how it might act with unintended consequences when freed from the complexity of its relations. Anyon (1994) who looks for theory to be useful so that it can do something and allow for action in the world. My earliest relations with family who insisted that I both act in the world and

reflect on acting. Raven and Coyote (Cole, 2012) who have tricky conversations about how "mainstream research works" (p. 17) and what it does, and remind me to pay attention to all my relations.

Raven and Coyote also remind me that learning is tricky–as they are–and transformative ideas can hover over seemingly disparate fields, or hide inside conversations that may seem unrelated to the topic at hand. I was reminded of the transformative potential of doing, and particularly doing differently, when conversations about integration and K-12 science curricula turned to racism. Jules Lavallée* spoke of systemic racism where institutional structures around credentialing were not adequately flexible for an Elder to be the principal instructor for courses offered within a graduate program; Narcisse Blood* of a more overt episode of racism where young people were captured on camera jeering and throwing pennies at presenters at an Indigenous language conference. In each case, the response was not to focus on the racism by giving up, walking away, or giving in to frustration and anger, but rather to acknowledge the racism, and then reframe it by doing something different, and perhaps unexpected (or tricky). Jules' reply to the institution began with the suggestion that "for every situation there's always a solution. Right?" and a way was found for him to teach. In the incident Narcisse* related, the institutional response was to immediately consider expelling the students, instead, however,

> Leroy Little Bear was asked to come in and we talked about it. And he says, 'No, I don't want them expelled. Let's have a dialogue. Bring their parents in. Let's sit down'. And there was a few of us that sat down and we had a dialogue about racism, rather than just kicking them out.

Randy Herrmann* and Peter Garrow* spoke more broadly about the need for recognition and respect of Indigenous people, peoples, and communities as well as their historical and contemporary contributions to living and thinking. Peter focused on how such respect and recognition acts to counter racist narratives perpetuated by a long list of publicly accepted practices, such as team mascots and official histories taught in schools. He offered the example of a school board in the United States that changed the celebration of Columbus Day to the celebration of Indian Heritage Day, and noted the importance of doing something different, "I go wow, that's an active school. You know somebody has put something, really thought behind it, … and I thought that was significant". In

discussing how the conversation in SK has begun to shift across the education system in response to the mandate for integration of Indigenous perspectives in K-12 curricula, Darren McKee* pointed to the need for doing, and deliberateness as a means for bringing about transformation,

> [certainly] the conversation has changed. … [But] I still get people telling me, board trustees telling me, you know, 'I don't want my kids to learn about the treaties. It's not going to help them any time in the future. And, you know, why are we learning it?' … You still have people out there doing it. And, I have no doubt in my mind that there are still teachers out there who find it distasteful. There are still parents who find it distasteful. ... and the challenge is, that when you don't address racism, you're condoning it. Right? And so, it just, we need to take the attitude that it's no longer acceptable. And it's the same with relationships. Whenever you're not building these relationships you're tearing them down. So be deliberate, build the relationships.

I am (and have been) inspired by their examples, because in the places I cannot find words to describe what I am inquiring into, in the moments where the inarticulable is clearly at play and knowing fails, I can recognize the tension and discomfort, sit with it, live with it, let it be and do something any way by deliberately building relationships; in that building, in the doing, in the process sometimes a sense a pattern between disparate pieces begins to emerge.

Among many First Nations, Coyote and her/his/its many manifestations is considered a Trickster character who has lots to learn and teach while travelling the world. The English word "trickster" is a poor one because it cannot portray the diverse range of ideas that First Nations associate with the Trickster, who is sometimes like a magician, an enchanter, an absurd prankster, or a Shaman, who is sometimes a shape shifter, and who often takes on human characteristics. Trickster is a transformer figure, one whose transformations often use humour, satire, self-mocking, and absurdity to carry good lessons. Other well-known Trickster characters include Raven, Wesakejac, Nanabozo, and Glooscap. Trickster often gets into trouble by ignoring cultural rules and practices or by giving sway to the negative aspects of "humanness," such as vanity, greed, selfishness, and foolishness. Trickster seems to learn lessons the hard way and sometimes not at all. At the same time, Trickster has the ability to do good things for others and is sometimes like a powerful spiritual being and given much respect.
…
    [Gerald] Vizenor (1987) who is of the Minnesota Chippewa Nation, believes that the Trickster is a 'doing, not an essence, not a museum being, not an aesthetic presence' (p. 13).
    The notion of Trickster as a 'doing' rather than a 'being' fits with how I have come to appreciate the process of learning through Trickster stories. The Trickster as a doing can change and live on through time as people interact with the Trickster through stories; one does not have to be too concerned about what the Trickster looks like if he/she/it is a doing rather than a being. This notion of the tribal Trickster lets me interact with him/her/it. Coyote, then, helps me to reflect and gain understandings, challenging and comforting me just like a critical friend. (Archibald, 2008, pp. 5-6)

Part III:
Getting a Sense of Pattern in the Flux
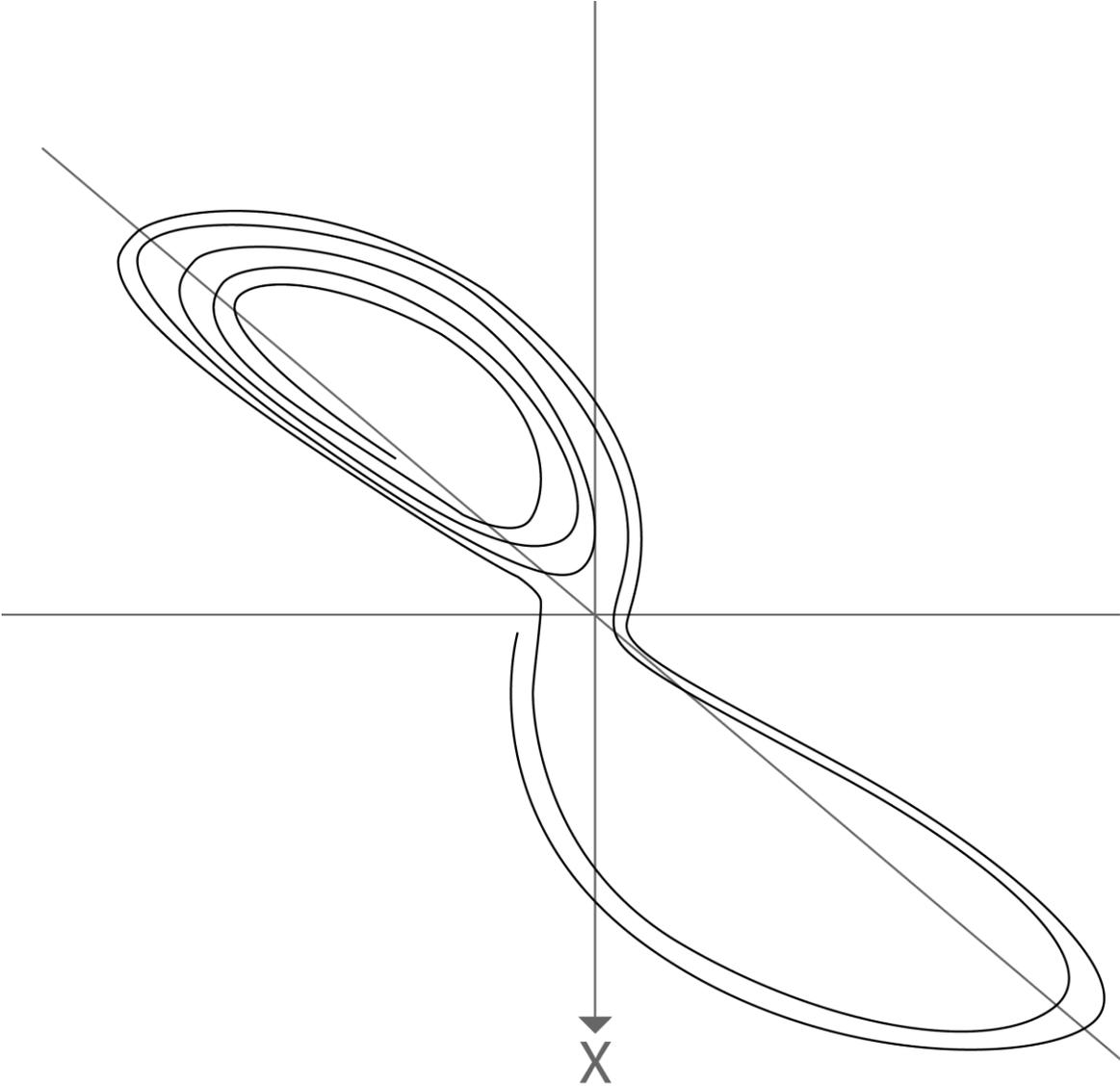
[Image credit: D. Wiseman & P. Williams]

In which I Engage with Process and Remember to be
Comfortable with the Discomfort by Chasing Coyote's Tail

Unable to name[335] or articulate methodology, I stepped back into the framing of the inquiry as tracked by relationship, process, and place and the sense that all principles touch every aspect of your practice, as I suspect the inarticulable is a doing[336] or happening, like Coyote, as opposed to the noun it appears to be[337]. This sense (has) led me to pay close attention to what I had/have/am *doing* in terms of research with the hope that some kind of *knowing* might emerge from it. It returned me–not for the first time–to recordings and transcripts of the conversations I had with people across Canada to examine more deeply and broadly what they have been *doing* with respect to integrating Indigenous perspectives in K-12 science curricula. It returned me also to my proposal, to what I had written so far, to further consideration of framing, of IRMs and ecological conceptions of hermeneutics, to work on the Faculty's Indigenous Teaching and Learning Gardens, and to some beginning-to-be-well-worn readings. It returned me to my work of the last two decades. Return was clearly important, yet the running around (seemingly) in circles chasing someone's tail made me rather dizzy and stirred things up in the *inter esse*. So I stopped, paid attention to where I was, waited for things to settle a bit, and listened very carefully "to the rhythm of things, to the music that resonates with my desire to know differently" (Somerville, 2008, p. 210). In these moments I began to get a sense of pattern from what had before seemed separate and disparate pieces at play.

Listening was key. Though I have been taught to listen from a very young age, my friend and colleague Ed Galindo from the University of Idaho helped me understand about different ways of listening[338]. Ed has worked for many years with his students and community members to reintroduce salmon to the Columbia River in the northwestern United States (Galindo, 2009). They hatch salmon eggs in old refrigerators placed by the banks of the Columbia into which the fry are eventually released. The project has gained some attention, and Ed has found himself bringing interested scientists, politicians, and other people out the hatching sites on multiple occasions. The drive to the site is long. He says when he goes out there with Indigenous students from his own Yaqui nation or other

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[335] Aoki (e.g. 2005a; 2005b) also suggests that there is some difficulty with naming associated in considering multiplicity.
[336] Or at least something active.
[337] The inarticulable, it seems, is also tricky.
[338] Ed has also taught me about the importance of finding openings in unexpected places, a practice he refers to as stealing horses.

local Native American communities, the drive is often passed in quiet companionship, and work at the site is also quiet and attentive to what is present. In Ed's experience, non-Indigenous visitors are often much more noisy; they ask more questions, but spend less time listening to what is going on. A consummate teacher, Ed (August 26, 2013) points out that there are many lessons in this story:

> 1) Being quiet and listening is a form of learning. 2) Listening to what people say is a form of learning. 3) Reflecting what is being said and NOT being said is a form of learning. 4) Being respectful of a person's space[339] is a form of learning, and 5) Being compassionate with folks that do not lean this way, is not only a sign of respect but also a way of learning. 6) Not ALL non-indigenous folks are noisy.

Biologist Robin Wall Kimmerer (2003) has written similarly about listening. She has spent her life coming to know moss both as a university researcher and a Potawotami woman, and writes that learning to see moss requires "straining to hear a faraway voice or catch a nuance in the quiet subtext of a conversation[, it] requires attentiveness, a filtering of all the noise, to catch the music. … You can look at mosses the way you can listen deeply to water running over rocks" (p. 11). This listening is different because sometimes it involves doing, other times just being with the mosses in order to hear what they have to teach. It has a hermeneutic-like back and forth to it from which an understanding knowing might emerge.

The type of listening described by Ed and Kimmerer sits well with me, it is the kind of listening through which I was taught to learn about salmon, and rose hips, and co-existence with urban raccoons, and how to bundle sage, and, and, and … . It is another meeting place in the *inter esse* between my own life and what I have learned alongside my Indigenous teachers. I have come to understand that while listening to people is vital, listening to other entities at play is also important.

In listening to the 16 people I had conversations with as a part of my research, I heard in their practices and doings my own rhythm of return. From within the related rhythms the loud and insistent question "What is going on here?" came to me over and over again. Every time I heard it I caught glimpses[340] of a brownish-grey tail

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[339] And by this he means who they are and where they come from.
[340] I take seriously Aoki's (2005e) suggestion "to call upon *sonare* juxtaposed with *videre*" (emphasis in original, p. 373) as a means of keeping possibilities open in the places we inhabit as

disappearing around the corner or behind a tree, but it may also have been black or golden wings, or just a trick of light. Tracking these sights and sounds, the question brought me to the questions: "What is at play in my inquiry?" and "What is at play in engaging with Indigenous perspectives in science curricula?" I now see these questions as indicative of intimately related, layered undertakings within much larger conversations aimed at reconsidering the fundamental relationships between Aboriginal and settler people, peoples, and communities in Canada. My work, and the work of the people with whom I spoke as a part of this inquiry, are both bound up in and reflect those undertakings; we are small parts of a larger fractal whole, different layers of a complex system, microcosms of a macrocosm (Cajete, 2006a) each in our own places. In returning to *doing*, I was able to re/cognize tracks laid down/being laid down/yet to be laid down by both myself and many others as we have been caught up in–within/alongside/as a part of the larger undertaking–trying to understand the ways in which Indigenous and Western ways of knowing, being, and doing might circulate together in academic inquiry, in K-12 science curricula, in Canada, as a particular place (or places) in which wisdom resides (Basso, 1996). It was in returning to *doing* that I was able to re/cognize recursive patterns emergent from and immersed in the activity of creation, and finally recognize space for *māramatanga*/effulgent coherence.

I call this part "Getting at a sense of pattern in the flux, in which I engage with process and remember to be comfortable with the discomfort by chasing Coyote's tail". As a whole it examines tension and discomfort as a generative means of moving people to do things differently in terms of engaging with Indigenous perspectives in K-12 science curricula and research. As the title implies, there are areas within Part III where it may seem like I am going around in circles. It is ultimately about finding a sense of pattern by getting caught up in process and doing before understanding or knowing where the process would/will end up. Here I began tracking connections and relationships between the previously isolated and disconnected, here I begin to recognize *māramatanga*/effulgent coherence.

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teachers and learners; listening and seeing are thus both active processes in this work and not solely a means of mixing metaphors.

The echo has much to teach us. If we listen for echoes, and listen to them, our listening can grow in wisdom. The echo is a precious gift to hearing. (Levin in Aoki, 2005e, p. 372)

Chapter 11: Recognizing Parallel Struggles at Play:
Tension, the Rhythm of Return, and Setting Things in Motion

As I have noted (see Chapter 2), I have a particular stance on struggle and tension, on the bodily sense of frustration and discomfort that can occur in bumping up against something unfamiliar or something that exposes the previously taken-for-granted. When I teach, I suggest to students that the type of discomfort that comes from sitting with such tension–whatever the source–might be a sign they are in the process of learning. In my experience, there is always a way for people to explain away the tension and discomfort by talking around it: "I'm not good at this", "I don't know even what it looks like", "People have tried but can't explain it to me", "I don't have more time to spend on it", "Nobody really cares if or how I do this". The type of statements identified by scholars (Aikenhead & Huntley, 1999; Blood, 2010; Donald, 2009; Kanu, 2011) as challenges, barriers, and resistance to integration of Indigenous perspectives in K-12 curricula (as discussed in Chapter 8).

I am not taking the position that these kinds of responses are unimportant. Neither am I taking the position that these responses have nothing to do with learning; being able to say "I really don't get this, I don't know what it looks like" can be a big step. It is perhaps a good enough first step in working towards doing things differently. However, I am taking the position that in moving beyond the immediate explanation, in sitting with the tension and trying to become comfortable with the discomfort, it might be possible to follow the tension and discomfort into deeper learning, to move beyond the status quo. In sitting with my own tensions regarding the framing and methodology for this inquiry, in letting them be, something interesting happened in doing the research.

One of the things that somewhat surprised me in the conversations I had for this inquiry is that, without fail, every educational stakeholder I spoke with–even those who expressed significant tensions around not knowing how or where to start, even those that I chose to spoke with because I thought they would have some difficulty with integration–is doing something with respect to integration of Indigenous perspectives in

K-12 science curricula[341]. As I listened to educational stakeholders talk about integration of Indigenous perspectives in their own practices, I recognized in them a number of physical reactions I had observed in myself–screwed up faces, shaking heads, waving hands. There was so much hand waving around something just out of reach, something they could not quite describe–the inarticulable. It did not happen with everyone, but it happened often enough to stand out, make me sit up and pay attention.

In this chapter, I present two instances of educational stakeholders bumping up against the inarticulable in their attempts to integrate Indigenous perspectives in K-12 science curricula, and how they engage in return in efforts to relieve the resulting discomfort and tension. I step back to a broader consideration of conversations to explain how these individual returnings are reflective of similar practices evident among many of the people I spoke with as part of this inquiry, and how that recognition was helpful to my own thinking. I then return to a specific conversation with Darren McKee* to explain how he positions the role of tension and discomfort as generative within the mandates to integrate Indigenous perspectives across K-12 curricula. I end by explaining how these instances allowed me to recognize a larger process at play in my research that helped me to clarify the emerging methodology of my inquiry.

Caroline's Return: Time and Resources

Caroline teaches in a small, suburban elementary school near Toronto, ON. She has more than 20 years experience teaching primarily grades 4 to 6, and has taught grade 6 or a 5/6 split for the last several years. Her description of the school where she teaches is of a place with little diversity, where the majority of students have blonde hair and blue eyes. Caroline and I graduated in the same year from a private girls' high school in Montréal. To the extent that our shared experience in that setting allows me to understand what she

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[341] Given what I had read in the literature around challenges, barriers, and resistances to integration of Indigenous perspectives in various K-12 curricula (Aikenhead & Huntley, 1999; Blood, 2010; Donald, 2009; Kanu, 2011), and the prevalence of death by suggestion in science programs of study in certain jurisdictions (see Chapter 8), I expected that at least one of the people I spoke with might somehow manage to avoid engaging with integration in some manner. I am relatively certain there are instances where such avoidance occurs. Darren McKee* says he has seen instance of it, but it was not evident in the conversations I had with educational stakeholders except as a reference to what colleagues did or did not do (G. Henkleman*; R. Herrmann*; H. King*).

was exposed to in terms of teaching and learning in high school, I assumed–like most teachers in Canada–she would have had little familiarity with Indigenous people, peoples, and communities and/or their ways of knowing, being, and doing prior to the curricular requirement for integration in ON.

Overall impressions

My first impressions of the conversation with Caroline were largely as I had expected; it seemed she was experiencing the resistances to, and tensions and discomforts around integration of Indigenous perspectives that I had witnessed in my course colleagues at the University of Alberta and that have been identified in the literature (Aikenhead & Huntley, 1999; Blood, 2010; Donald, 2009; Kanu, 2011). My field notes from the conversation (April 9, 2012) indicate what stood out in relation to her experience of integration: a lack of time, a lack of resources, a lack of support from the school board, a lack of connection to her students' lives, too much other content to cover, and no accountability to anyone for addressing the requirement with regard to integration. The one contrasting note was "She pulls together science and native studies unit" (field notes, April 9, 2012), a point we had some discussion about that did not particularly stand out in my memory.

In relistening to the conversation and rereading the transcripts of it, I noticed how often Caroline spoke about the lack of resources and time to adequately address integration of Indigenous perspectives. These two issues in particular cause her significant tension. More than once, the lack of time was linked to the requirements of ON's province-wide assessments of Grade 6 students, where Indigenous perspectives are "not really referenced" and have not been "in a long, long time". Also, with respect to provincial testing Caroline referenced Canadian multiculturalism in the manner St. Denis (2011) says erases and silences Aboriginal perspectives in curricula:

> [The test] is standardised for everybody. And so, you know, you can't make it too, too difficult, and you can't make it in such a way where other people don't have any point of reference. So, if you've got people coming into our country from all kinds of other countries, you have to make sure that they're able to handle the standardised testing and for them, they don't have any point of reference as far as native Canadians. (C. Laflamme*)

My overall impressions were that what Caroline does with respect to integrating Indigenous perspectives in science or any of her teaching is "sparse", "isolated" and "not a lot", because these were the words she used. I did note (field notes, April 9, 2012), however, that she is always looking for additional resources.

The doing

When I returned my attention to research conversations as a means of identifying what educational stakeholders are actually doing with respect to integration of Indigenous perspectives in K-12 science (or any) curricula, my impressions of the conversation with Caroline shifted significantly. I was struck by how much she does do, and how she brings multiple pieces together in an intertwined manner.

Caroline marries the ON grade 6 science biodiversity unit (OME, 2007a) with the social studies unit on Native studies (OME, 2013) to open up a number of explorations. Her students investigate animal adaptations where she makes connections to story and storytelling as explanations for why and how adaptations occur. They also create snail habitats in the classroom by first studying snail habitats in place outdoors. She explains that "we talk about the importance of replicating that habitat, but then putting the animals or creatures back into nature" because that is where they belong, place is important. In addition, her students explore food chains, in which she takes up what she understands of Aboriginal hunting practices–particularly the respect for the animal killed. She makes connections across the various classroom activities in the units to respect for the earth, respect for animals, and connections between them, and asks "the kids to adopt th[ese] attitude[s] towards their unit in biodiversity".

Caroline also takes her students on field trips where they might learn more about First Nations people, peoples, and communities in ON. They travel to Crawford Lake, a conservation area that includes a longhouse village where students can learn about the history of First Nations peoples from the southwestern part of the province[342]. While there were no indications in our conversation[343] that members of local First Nations are

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[342] On the Crawford Lake web (Conservation Halton, 2013) site the village is described as Iroquoian.
[343] There are also no indications on the Crawford Lake web site that members of local First Nations are involved in the field trip.

involved in the field trip, Caroline herself notes the limits of the excursion in not addressing the diverse realities of contemporary Aboriginal peoples. To counter this absence, she also takes her students to the Canadian Aboriginal Festival in Toronto and Hamilton, ON[344]. Here students meet with Aboriginal people from ON and other parts North America. As she explains:

> there's [an] education day, where schools are invited down … to go in and participate in various hands on things, you know [students] make little musical instruments, they listen to legends, they look at how various homes were made … they look at birch bark canoes, things like that. So it really is a valuable experience.

Once a year, Caroline accesses a program available through the Royal Ontario Museum (ROM) where classrooms can borrow crates containing "original artifacts or reproductions" designed to complement the Grade 6 ON Native Studies unit (OME, 2013). She notes that not all the crates contain the same artifacts but often tools, fur samples, and other elements that can support the social studies curricula. In addition, under an umbrella topic of bullying, Caroline has spoken with students about the establishment of the reserve system in Canada, how First Nations peoples have been forced from most of their traditional territory, and the impacts that has had on people, peoples, and communities.

Caroline pulls together these various explorations and experiences related to First Nations largely through a focus on critical literacy[345], and connects them across nearly every subject area. The only subject she did not specifically mention in regard to Aboriginal perspectives was mathematics. While the explicit connections she makes to science are more limited than those to language arts and social studies, there is tremendous potential in the activities she has described for connections to her science curricula.

The tension

With the proviso that I have not been in Caroline's classroom, and so cannot comment on the quality of what she[346] does with respect to integration, I was struck by

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[344] At the time of my conversation with Caroline, the festival was ongoing. It seems to have been on hiatus for about two years at the time of writing.
[345] Critical literacy (OME, 2009b) is one of two primary foci in Ontario elementary curricula, the other is numeracy (OME, 2012).
[346] Or most of the educators I had conversations with as part of this research

how much she does do, and how much of what she does is interconnected and integrated throughout her teaching. Given my initial impressions of our conversation, the list above surprised me. Given our conversation, I think it would also surprise her.

Caroline kept telling me that she does not do very much with respect to integration, that she does not have enough time to really focus on it, that there are not enough resources to support her teaching in this regard, that she herself does not know enough about Aboriginal people, peoples, and communities, or their ways of knowing, being, and doing to take up integration with her students in an effective manner. Our conversation seems to indicate that she does not experience the goodness and joy of *māramatanga*/effulgent coherence, but rather a lot of tension around integration. Still, in trying to relieve the tension she is always looking for other explorations and resources to bring into her classroom.

While Caroline's approach to integration of Indigenous perspectives in science seems to be moving beyond content in the way she intertwines and interrelates various explorations and experiences regarding Indigenous perspectives, and asks students to consider and take on Aboriginal perspectives in their exploration of biodiversity, she does not seem to recognize the extension beyond meeting a requirement of her program. When I asked her how she came to bring together the biodiversity unit in science with the Native studies unit in social studies, she responded that:

> It's about squeezing as much as you can out of the curriculum, in the time that you have. And so for me … I try as closely as I can to marry whichever units I can so that I'm not wasting precious time. So for me it just seemed that the two of those units would complement each other.

While Caroline senses the units complement each other, the approach she takes is primarily about time and efficiency. When I tried to focus how the units complement each other, there was hand waving, and head shaking, and a return to time and efficiency:

> you have to be creative, I mean for me, with only ten months to work with you have to try and cover as much of the curriculum as you can, so if I can give the kids an assignment where I can get a social studies mark and a language mark, and possibly a science mark, you know it's grasping a little bit, but that's what you kind of have to do, and so for me if I look at the units, in biodiversity and native studies, then great, that's awesome.

The return

  Caroline is being creative, she is meeting the requirements of her programs of study regarding integration in science and other subject areas. It seems to me that she is attempting to enter the *inter esse* without adequate language to speak about it, and being caught up in the inarticulable leads [347] to the discomfort and tensions she expresses around time and resources. She is not recognizing how such tensions are being generative in her practice, perhaps not yet "wide awake" (Greene, 1978, p. 156). At the same time, the tension and discomfort are not leading her to abandon attempts to take up integration of Indigenous perspectives across curricula. She keeps trying to resolve the tension, keeps returning to it in attempts to relieve the tension in her search for resources.

<center>

Tracy's Return: The Terrible Lesson

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  At the time of our conversation, Tracy* was on leave from her position as a high school biology teacher at a school in a small city near Edmonton. There was a population of Aboriginal students in the school and in her classes, though she describes the school as "very homogenous, … very, very Caucasian, … very, very European-centred". When we spoke she was just beginning her Ph.D. after completing an M.Ed. examining challenges for biology teachers with respect to integration of Indigenous perspectives (Blood, 2010).

Overall impressions

  I walked into the conversation with Tracy knowing about her research. While she says she initially "had no actual knowledge about Indigenous perspectives or anything" and was thus "in the position, I think most biology teachers in Alberta are in", it was clear in our conversation that her research had led her to spend considerable time thinking about the implications of integration in the AB context. She had considered some of the difficulties presented by the science programs of study and the manner in which they frame integration and open (or not) space for it within curricula.

  One of the issues we discussed is how the language in the program of studies impacts integration of Indigenous perspectives,

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[347] At least in part.

Tracy: [The Alberta science programs of study] talk about science as being knowledge about the natural world. That's like really the overarching definition, right. It's knowledge about the natural world. Well, what's the natural world?

…

Dawn: Do you think [the definition] implies there's a non-natural world?

Tracy: Oh, absolutely. Yes, there's natural things and then there's not. That we talk about … biotic and abiotic. Living. Non-living. And to me, I feel like in that definition [of science] there's living and non-living. And so we talk about how the non-living things affect the living things, but we never look at the other way round. Right? We never talk about how the living things are affecting the abiotic pieces. And I think that is part of that definition too. Right? [But if the definition of science is] knowledge about the natural world, we don't care about the things we wouldn't consider natural.

Dawn: But see now here's ... so that, that split, that living/non-living split. It's one of the big ... sort of areas where things can bump up against each other. Right?

Tracy: Sure.

Dawn: Because in many Indigenous perspectives there isn't, there isn't that split. Right? Um, because things are seen in relationship. And so–and again I throw this out just for the sake of conversation, because we talk about how those non-living things impact the living. What would be gained, um, in the kids learning, or in our teaching, if we did acknowledge those, you know, that's not a one-way relationship?

Tracy: Oh my goodness. Don't you think that if we had actually addressed that–would we be in the position where we've extracted our natural resources to the point of, like, they're going to run out? We've actually exploited natural resources. I mean they are counted as abiotic in the curriculum. And so, if you actually talked about them as being in a reciprocal relationship and had an appreciation for those things, I don't know if a lot of the environmental issues that we're facing would be as severe, potentially.

Tracy understands there are significant complexities at play with regard to integration of Indigenous perspectives in K-12 science curricula. She recognizes the lack of *māramatanga*/effulgent coherence in the AB science programs of study (in her case particularly AE, 2005, 2007a, 2007b). Like Caroline, however, she has experienced

tension around available time and resources, a tension Tracy also recognized in the educators who informed her own research,

> I mean what all the teachers were saying is that they had to satisfy a content objective with the perspective. So, it couldn't be something that was additional to [the requirement of the program of study], it had to encompass [an existing outcome] as well.

The doing

Despite the tensions involved, after finishing her M.Ed., Tracy felt the need to take what she had learned from the people she had spoken with and put it into practice. In order to attempt to address the time/resources tension, she developed three lessons to align with the programs of study for high school science, particularly biology and chemistry (AE, 2007a, 2007b). One lesson explored systems of classification[348], another ways of knowing[349], and the third menstruation and reproduction. While the first two lessons were not perfect, they were workable within the classroom context in that they opened up means for students to consider Indigenous perspectives about the world and the way it works. The third lesson was different.

The tension

In Tracy's words, the third lesson was, "just terrible". She tried it twice, and on both occasions it fell completely flat. When I asked her tell me a bit more about the lesson, there was considerable hand waving and head shaking around trying to describe the differences in relation to the more successful lessons. What she was able to say was

> It was terrible. It was my own fault. I didn't have a good enough background I think in, um, what the perspectives were. And so it was about the womb and about menstrual cycles and why women have menstrual cycles and what causes those and what facilitates that. There was a, a - - - I tried but it became so overtly 'This is an Aboriginal perspective, this isn't' whereas the other two were quite organic in how they came about. And so I think the problem is that I presented it so 'Here's one way, here's another way'.

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[348] The lesson on classification (Onuczko, n.d.-a) has also been used to consider and engage with integration of Indigenous perspectives within undergraduate and graduate science curriculum courses at UA.

[349] The lesson on ways of knowing (Onuczko, n.d.-b) also aligns with AB's *Science 10* (AE, 2005).

The "terrible" lesson has caused Tracy considerable tension. So much so that at first she did not want to talk about it in our conversation.

The return

At the same time, like Caroline, Tracy does not give up in the tension. Having now been involved with her in the Indigenous Teaching and Learning Gardens I could provide many examples of how she returns to things to sit with them in attempting to relieve the discomfort and tension of being in the *inter esse*. In fact, when I followed up with her to ask if she was done with the terrible lesson she explained how the work in the Gardens has returned her to it:

> Since looking at a number of plants for [a related] project. I have been thinking about the plants that cause spontaneous abortion (which there are a few) and how this affects the hormones for the menstrual cycle or in pregnancy, as this is an outcome in Bio 30. However, I do not know if any of these were actually used for abortive purposes [by Indigenous people] or not, or even if people knew this–but there could be something potentially interesting here, I would just need more information (personal communication, April 28, 2014).

The Rhythm of Return

I could continue. There are multiple examples from my conversations of educational stakeholders waving their hands, screwing up their faces, shaking their heads, and otherwise demonstrating physical indications of tension around something they could not easily, entirely, or adequately articulate. At the same time, despite these (often significant) tensions, they were all doing something with regard to integration of Indigenous perspectives in science curricula, something that somehow allowed them to speak around the inarticulable. In their talk of "see[ing] what we could do" (B. Dobbs*), "try[ing] lots and lots of things" (T. Onuczko*), reconsidering, revisiting and reframing "discouraging experience[s]" (S. Taylor*), recognizing "dogmatic" (F. Elliott*) or ruttish teaching practices (J. Kreuger*; K. Ealey*) and attempting to step outside of them, move beyond them (N. Blood*; S. Daniel*; P. Garrow*; G. Henkleman*; R. Herrmann*; H.

King*; J. Lavallée*)[350], they acknowledged a felt sense of tension, discomfort, unease, unfamiliarity as a "*direct referent*" (Gendlin, 1995, p. 549) of something missing; a some how re/cognizable but inarticulable *that,* but also the need to return to it as a means of attempting to ease the tension. The tension set something in motion. I heard in their words, the same rhythm of return that I was experiencing with respect to framing and methodology, the same searching for *māramatanga*/effulgent coherence, and this similarity intrigued me. As such, I began looking for return in other places. One of the first places I found it was in my conversation with Darren McKee*.

Darren's Return: Disruptive Innovation or Letting the Terrible out to Play as a Not so Bad Early Iteration

Darren has had a long career as a teacher, school/school system administrator, and policy maker in Saskatchewan. He is currently the Executive Director of the Saskatchewan School Board Association. When I first met him through NAEP, he was working for Saskatchewan Education where he spent four years as an Assistant Deputy Minister of Education in the period where the province was working towards the current presentation of integration in K-12 science curricula. In our conversation, Darren and I spoke at length about the challenges of change in general, change with respect to integration of Indigenous perspectives in K-12 science curricula in specific, and the tensions and discomfort experienced by teachers around the change.

Darren draws on a idea initially put forth by Bower and Christensen (1995) that they name "disruptive innovation" (p. 43). They apply it to describe technological change that fundamentally disrupts existing understanding about what is possible within existing markets and how such disruption subsequently generates new and unanticipated markets. Working with others (Christensen, Baumann, Ruggles, & Sadtler, 2006), Christensen has since taken the model of disruptive innovation and examined it in broader contexts including those of social change. Darren tracked a similar path in our conversation, beginning by talking about early iterations of cell phones and personal computers, but

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[350] Conversations focused on moving beyond ruttish practice in both people's personal practice the practice of others.

quickly moving into how these processes might parallel what is going on in integration of Indigenous perspectives in K-12 science curricula:

> The point is if you compare [the initial cell phones or personal computers] with today, they were terrible, but they were the disruptive innovation, right? It was a fundamental, that was a transformational shift to where we are today. And so that's what I'm saying is that–you need some lead instigators in order to do that. And you need people with courage and vision to instigate and make people uncomfortable. Really uncomfortable, because that's the only way you're ever going to change, because if you're comfortable, you're going to continue to do what you're doing. Right? That's human nature. And so, this disruptive innovation context really is the one I'm talking about when it comes to, you know, having Indigenous way of knowing and Western science walk together.

So, Darren suggests the discomfort and tension educators experience with respect to integration of Indigenous perspectives in science curricula is intentional (at least in SK). In fact, the discomfort and tension are needed to in order to generate change. Darren acknowledged that the change across curricula would throw off teachers' existing approaches to curricula, their sense of *māramatanga*/effulgent coherence, particularly for science teachers who see themselves as subject matter experts. He added that (at least in SK) they are perfectly ready for initial responses, early iterations, like Tracy's terrible lesson. Darren underlines that early responses to disruptive innovation may in fact be "terrible" and unsatisfying–and thus, unsuccessful in alleviating discomfort–but that they simultaneously open up expectations about what might be possible. In so doing, the discomfort generates ongoing conversations as and around responses that might be less terrible and more satisfying, more comfortable to live with. But in order to eventually get at the more satisfying responses you have to start the cycle, so you make people uncomfortable and require them do something anyway.

Returning to My Own Tensions and Discomfort

In beginning this inquiry, it never occurred to me that what educational stakeholders might share with respect to meaning and developing understandings in regard to integrating Indigenous perspectives in K-12 science curricula would speak so directly to my own struggles with methodology. I was only able to recognize what they

were saying through the commitment to sitting with the difficulties of the *inter esse* and framing my work in *māramatanga*/effulgent coherence. When I recognized the parallels between the tensions and discomforts of educational stakeholders and my own, I was inspired to return to the early iterations of methodology and attempt to articulate it again.

I think it is possible to look at these different–but related–returns and developing understandings as indicative of Gadamer's (1989) hermeneutic circle, and while I will admit there are perhaps nuances to that circle I might be missing, it does not seem quite right in terms of the complexities at play. What Darren McKee* describes, what the educators I spoke with are doing, and the way I am/have been engaging with framing and methodology are not a simple return of going around in circles–although sometimes it feels that way. It is a return that is that is informed by and emerges from what came before it, a return that is caught up in living relationships and accounts for them, a return that may look (and sound) different depending on place but nonetheless follows a similar rhythm. This recognition helped me to clarify the emerging methodology of my inquiry.

For me, this understanding of process is the intellectual equivalent of predators slowly and patiently circling their prey and remaining attentive to the context and landscape of their work as they gradually close in on their goal. (Donald, 2009, p. 84)

The irony, of course, is that through this philosophical struggle, I return to the ways in which I have learned to work with people over the last two decades. I just had to figure out how to translate the some times inarticulable living experience of doing and being into words acceptable in the academy in order to express knowing. (Excerpt from personal journal, July 2, 2013)

Chapter 12: Methodology Emerging:
Hunting, Tracking, and Letting the Inarticulable Be

At first, all I could do was re/cognize[351] emerging methodology, and recognize the difficulties inherent in its engagement within the bounds of a dissertation. As in my early days at UA, I found myself bumping up against taken-for-granted ideas of what a dissertation is, what it is supposed to do, and how it should look. I was haunted by a conversation from a course taken in the first year of my doctoral program where Jean Clandinin (class notes, EDES 510, October 7, 2009) spoke about her recognition of emerging methodology in her own dissertation work. She said she had never intended to be a methodologist. I have distinct memories of asking her how she addressed the emergence in doctoral writing; she did not. I appreciate her choice much more now than I did then.

While I am still coming to understand this emerging methodology, find coherence in it, and languaging for it–while I am still waving my hands in the air, there is now at least some direction and patterning or rhythm to the gesticulation, some sense of *māramatanga*/effulgent coherence brought about through my conversations with educational stakeholders. Still, as much as I would like to declare "This is it" and provide a neatly packaged, concise definition of my methodology, it remains somewhat inarticulable–more a doing and being than a knowing, somewhat in flux. Again, given my focus on change, flux, and play, such motion in methodology seems appropriate. Still, this piece of writing was difficult and I remain somewhat uncomfortable with it, but I have been/am reminded by my all relations that the discomfort is necessary and generative in work that occurs in the *inter esse*, that engaging with the discomfort is part of a commitment to *māramatanga*/effulgent coherence.

In this chapter, I bring to a close (at least temporarily) my (still) ongoing complicated conversation with methodology. It follows my seeing and reading through from IRMs and hermeneutics to mappings of recursive equations of complex processes active in the world as a means of thinking about active methodology emergent from and immersed in all the relations of my inquiry. While, I draw on the postmodern sensibilities

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[351] With no small amount of horror.

of Deleuze, I temper the potential flightiness and deterritorialization of postmodernism by finding ways of remembering my location in the *inter esse* where Western and Indigenous ways of knowing, being, and doing circulate together, and provide examples of other scholars engaged in similar processes. In the end, while the methodology remains nameless, I explain what it helps to attend to within the inquiry, how it reflects the places, processes, and relationships of my inquiry, and how it allows me to find comfort in my general discomfort with methodology.

Conversation as The Act of Living With:
Discomfort and the Generation of Recursive Creation

> Today though, lots of people want to fix things. Make them static. Predictable. Only simple and complicated systems are predictable (Davis & Sumara, 2006). Life is complex. It breathes, it grows. It moves and changes. It flows. To fix it is to deny its very nature. Fixing it–as if it is broken?–removes life from Life. Fixing it, breaks it. Irony. (Wiseman, 2010b, p. 13)

> I am interested in process. My goal is not to find *the* answer; a solitary answer to be held up as truth that will fix and thus break things again. My goal is to open up the potential to see possibilities and develop understandings; to problematize the space around Indigenous perspectives and science curricula. To have conversations and create relationships. The goal is not synthesis but sitting with the difficulty, learning to live with the difficulty, with each other, reveling in all the contradictions. Finding openings, points of connection. My goal is learning to live. It is finding life in learning. (Wiseman, 2010b, p. 47)

As I began to share early findings related to my inquiry in papers and at conferences, it became necessary to fill in the methodology box. Caught up in the emergence of an inarticulable no-thing, I met the methodological expectation by talking around methodology and focusing not on what IRMs and ecological hermeneutics are, but rather on what they do and how they act/are at play in my work. How in the flux that emerges between them they both create a space for conversation and generate conversation:

> When brought together, [IRMs and ecological hermeneutics] create a space for conversation that has the potential to resist simple, easy interpretations and the need for definitive solutions; at points where one methodology/worldview moves towards an answer, the other raises

> questions regarding the potential response that necessitates continued inquiry, conversation, and negotiation. In this way, the methodologies allow for an ongoing "activity of creation" (Reynolds, 2006, p. 47) with the potential to lead to new understandings and more subtle, nuanced interpretations of meaning. (Wiseman & Onuczko, 2014)

The description is immersed in and emerges from the supposedly pre-modern of IRMs, the modern of hermeneutics, and the post-modern of Reynolds's (2006) Deleuzean-inspired exploration of multiplicities between curriculum and cultural studies. To date, no reviewer has expressed any discomfort with the multiple traditions the description brings together, perhaps because there is no obvious "blank" waiting to be filled. While the description thus seems to fulfill its purpose, I retain a sense of discomfort with it because the description is not quite right. Because the description is not quite right, I return to it over and over again in attempt to alleviate my discomfort and create a more satisfying description I might better live with. I am doing with methodology in relation to research where Indigenous and Western ways of knowing, being, and doing circulate together, what educational stakeholders are doing with science curricula in relation to integration on Indigenous perspectives. In this way, the discomfort is both generative and creative.

Darren McKee's* suggestion that discomfort is essential to beginning ongoing conversations (in Chapter 11) seems similar to that of Gendlin (1995). Gendlin's felt sense of discomfort–something missing, something not quite right–*acts* to open up the type of ongoing conversation Darren says is required with regard to integration of Indigenous perspective in science curricula. The felt sense points to the existence of the blank or *that*, it recognizes *not that*, thus initiating and maintaining a process of attempting to identify what belongs in the blank as long as the felt sense of *that* remains[352]. Gendlin writes the felt sense "rejects" (p. 548) *not that.* In my own experience, and in the conversations I had with people as a part of this inquiry, however, *not that* was often much easier for people to put into words; to articulate. As such, *not that* was not so much rejected as held on to as means feeling out, tracking around, or moving toward a sensed *that*. In this way, the *not that*s entered into a pedagogical or

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[352] It seems in some ways related to Gadamer's (1989) address, which does not act itself but does cause one to act (or at least render acting potential).

perhaps educational[353] conversation with the felt sense around what *that* might be (and/or how it might be acting/at play).

That the emerging conversation–or parts of it–might be inarticulable does not seem to matter. The English word conversation derives from the Latin *conversātiōnem* meaning "the act of living with" (Converse, 2012, p. 217). In this sense of the word, linguistic engagement is not excluded, but neither is it absolutely required, whereas doing–"the act of"–and being–"living" and "living with"–are. It is conversation that might be described in relation to academic inquiry as "waiting in the chaotic place of unknowing" (Nakamura in Somerville, 2008, p. 210) or "watching to see until it becomes clear to you" (Atleo, 2008, p. 221). It is conversation that might be described in relation to classroom life as indwelling, "not so such much a matter of overcoming tensionality but more a matter of dwelling aright within it" (Aoki, 2005g, p. 163). I thus suggest that in the case of integrating Indigenous perspectives in K-12 science curricula, or bringing Indigenous and Western ways of knowing, being, and doing together in the context of academic inquiry, the felt sense has the potential to go beyond language or to a place where language is in fact "not yet" (Greene, 1998, p. 253)–the inarticulable–a place where different ways of knowing, being and doing might circulate (and perhaps converse) together. Here the felt sense which indicates a blank or *that* points to a recognition not of a need for a singular word which provides closure but of a need to enter into, engage with, converse with, live with something[354] that is in process, acting, at play, in flux; in which closure is unlikely and there is always potential for the entry, emergence, or creation of the new (or perhaps remembering the very old).

I recognized that I might be following the right tracks in returning to my conversation with Sherry Taylor*. Sherry, headed a (now-shelved) program of study redesign/renewal process for elementary science in AB, that involved consultation with First Nations, Métis, and Inuit communities in the province. She says that in the committee meetings with people in community, committee members did not do that much talking, instead, "We did a little bit, just to kind of tell them what we were up to,

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[353] Educational in the sense of its Latin root *educare* which means to bring forth (Jardine, 1998c, p. 74).
[354] For lack of a better word at the moment.

but mostly we listened and we just tried to have a framework within which we could start *conversations*" (emphasis added).

AND as a Means of Creation when Faced with the Multiple

To be clear, in my own acts of living with methodology and in educational stakeholder's acts of living with integration of Indigenous perspectives in K-12 science curricula, the distinction between *that* and *not that* does not appear to be a border crossing either/or between Indigenous and Western ways of knowing, being, and doing, but rather consideration of both/and[355] spaces/places/means[356] whereby Western and Indigenous ways of knowing, being, and doing might circulate and converse together. Tracy Onuczko* pointed to a difference between the approaches in speaking about her three lessons (described in Chapter 11). The terrible lesson focused on "'Here's one way, here's another way'" and its either/or approach was not generative in the manner of the other lessons she identifies as "quite organic"; lessons which seem to *both* emerge from *and* engage with both/and, or the multiple. Here the highlighted "both … and" is important because it is in emergence *and* engagement (or perhaps immersion) that we might be able to begin to see and hear, to perceive, what to do.

Reynolds (2006) highlights how *AND* acts in Deleuzean conceptions of multiplicity:

> *AND* is neither one thing or the other, it is always in-between, between two things; it's the borderline, there is always a border, a line of flight or flow, only we don't see it because it is the least perceptible of all things. And, yet it's along this line of flight that things come to pass, becomings evolve, revolutions take shape (Deleuze in Reynolds, p. 47, emphasis in original).

In Tracy's more successful lessons she has a sense of negotiating this liminal position along and between borders, the location I might call the *inter esse*. Here she opens up and creates (in a very real sense) new possibilities for teaching and learning; lines of flight as the activity of creation that resist informational and instrumental means of control and adherence to the status quo–in her case expressed as "Here's one way, here's another

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[355] Or what Aoki (e.g. 2005a; 2005b) describes as and, and, and… spaces where multiplicity is at play.
[356] Again, I lack an appropriate word.

way". It is precisely such creation and resistance that Somerville (2007, 2008) identifies in methodologies that emerge in the process of research. She also explains such emergence through the postmodern sensibilities of Deleuzean lines of flight that emphasize new and creative possibilities for understanding that develops amidst the messiness of life in process.

Because they emerge in resistance to the status quo, Deleuze and Guattari (1987) characterize lines of flight as "living weapon[s … that] are very dangerous for societies," (p. 204). Lines of flight can escape control, even from the people who create them, and offer the potential of soaring off into the unknown; that is, lines of flight can be flighty. However, in most of the cases Somerville (2007, 2008) brings together, lines of flight, while creative, do not soar off into the uncertainty of the unknown but instead cohere into more re/cognizable, rhythmic patterns of return. Somerville (2007) describes such methodologies as "*iterative process[es] of representation and reflection through which we come to know in research*" (p. 235, emphasis in original). I recognize the processes she describes in my own inquiry, but I would change her word "iterative" to "recursive" as I shall expand on shortly.

Another Aside on the Difficulties of Language:

Playing with Images as a Means of Reading in the Absence of Language

Many ways of knowing, being, and doing from my education as an engineer have stayed with me as I have moved into other areas of inquiry. One of these is the imperative to step somewhat outside language to visualize, to draw, to map, to diagram, to photograph what appears (via empirical observation) to be going on in order to consider it differently. This way of living with ideas is second-nature to me; when I am struggling and stuck, images that lead out of ruttishness often appear seemingly unbidden. As I sat waiting for something to become clear, considering the activities of creation and return that seem so prevalent in my inquiry, the work of the educational stakeholders I spoke with, and other emerging methodologies, a number of images came to mind. The most fruitful was that of the Lorenz attractor (Figure 3). Published in the early 1960s by

Edward Lorenz (1963) the image tracks convection[357], a phenemona previously considered too chaotic for description.
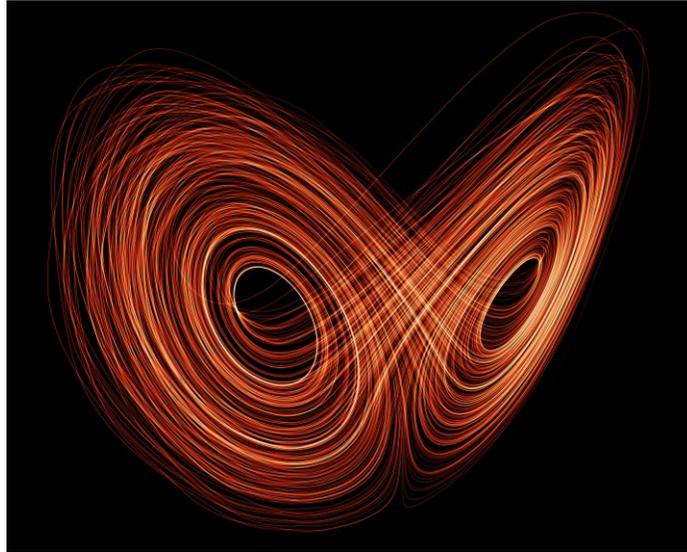

Figure 3. Lorenz attractor.
[Image credit: Zentilia, Bigstockphoto.com, see Appendix D]

I will return to the fruitfulness of this image in relation to my inquiry shortly. First, however, I will acknowledge that there are tensions in combining empirical practice from the sciences and engineering[358] with philosophical inquiry; but like the tensions between Indigenous and Western ways of knowing, being and doing, the tensions can be creative, can be generative.

Ihde (1996, 1998) considers some of these tensions in relation to Heiddegger's[359] difficulty with the scientific production and use of images by the manner in which climate change is inferred via meta-analyses of global observations and measurements. According to Ihde (1998), Heidegger distinguishes between "good artifactuality" as represented by artwork (including architecture), and "bad artifactuality" (p. 56), as represented by the output of mediating technologies in the sciences. What renders "bad artifactuality" bad is the perception that, for example, satellite images of the Earth reduce the entire world to a picture, "whereas the world (itself) cannot be so reduced" (p. 56). Ihde (1996) suggests this sense of reduction is based on a flaw in Heidegger's

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[357] Convection is "the circular motion of hot air rising up [then cooling] and [dropping] around like a ferris wheel" (Gleick, 1987/2007, p. 26).
[358] As they seem to be generally perceived to be taken up.
[359] Ihde addresses in particular Heidegger (1977).

understanding of science praxis[360] and the manner in which images act within such praxis; "no scientific seeing takes the image for the referent itself, nor confuses the world with its picture. Rather, all pictures and images are themselves instrumental and are seen or read through" (para. 29). As Ihde proposes, the seeing and reading through is an opening up to a deeply hermeneutic practice within the sciences where "one must learn to read the interrelations" (para. 34), in his example, between an image showing variations in ocean surface temperatures over a fixed geographical area with re/presentations of temperature found in multiple and historical "material 'calendars'" (para. 34) such as tree rings, glacial ice cores, and soil sediments, and–I would add–stories of northern peoples– like the Inuit–who have much to share on the issue of changing climate.[361] What he suggests is that the manner in which such visuals act has a significant contribution to make to developing understandings, to "a 'hermeneutics of things,' not merely of languages" (para. 34).[362]

Frascara (2001) more clearly connects to relationship in considering the practice of diagramming in the sciences and the manner in which the practice has the potential to expose interrelationships between elements that might not otherwise be or become evident. Like Ihde, Frascara's examination of the way in which diagrams can act points to the manner in which the visual supplements "the limited capacity [of noun-based languages] to convey … the perception of context, complexity, and simultaneity … due to its inability to promote thinking in terms of ecologies of information" (p. 167). In Frascara's explorations, I hear echoes of Blackfoot Elder Leroy Little Bear's (2012) discussion of the limitations of English[363] as applied to physics; "English can't quite explain, due to its structure–you know for instance the binary notion in English–can't quite explain certain things accurately. In others words, it has a hard time with this notion of wave-particle duality".

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[360] For Ihde science praxis is the enacted embodiment and relationship of scientific theory and practice.

[361] I would suggest that it is precisely the difficulty of seeing patterns and relationships between such disparate pieces of evidence that lead some people to deny climate change.

[362] I am actually uncertain why Ihde (1996) uses the word "things" (para. 34) because he actually seems to be exploring process and understandings emergent in the relationships between things; nonetheless his work is helpful to moving my thinking in new directions.

[363] Little Bear (2012) is speaking in a context where the shared language is English, I suspect his remarks apply to a greater or lesser extent to most noun-based languages.

While verb-based languages may better support thinking which allows for the manner in which what appears to be a noun is actually an entity emergent from the relationships in which it is embedded, these languages can also be aided and complemented by the visual. Somerville (2007) shares the story of her colleague Chrissiejoy Marshall, a Yuwaalaraay-speaking PhD student from New South Wales in Australia. Marshall drew on her heritage to produce a painting and CD of images as part of her dissertation. She notes that:

> What anthropologists and others have described as crude and unsophisticated art, was actually Aboriginal pictorial reflections simply for the passing on of knowledge, so that the listener or learner could visually grasp the concept or subject matter being given. … The symbols and drawings described by those anthropologists and historians actually constitute a complex code of interaction that continually reflects on Aboriginal cosmology, philosophies, spirituality, history and laws that have been used for thousands and thousands of years. (in Somerville, 2007, p. 238)

The visual artifacts in Marshall's dissertation serve as a means of "access[ing] the unsayable in her writing" (Somerville, 2007, p. 229), of seeing and reading through, and making visible both for herself and others the complex ecologies of information in which they are immersed and from which they emerge.

Marshall's work underlines that the type of reading suggested by Ihde neither originated in Western understandings of science nor is particularly new. Chamberlin (2002) locates it very early in human cognitive history with the development of the ability to track. He suggests "tracking as a form of 'literate' reading" (p. 70) that is simultaneously "simple, systematic and speculative …[and] involves taking information from animal signs to determine what an animal was doing and where it was going: *following* the tracks, where possible; *finding* them, where necessary" (p. 77, emphasis in original). In order to be successful, trackers (who are simultaneously hunters) must inhabit the land, and sometimes relatives in the land who know more/understand it differently such as wolf[364]. In this way trackers hear the land speak–and understand what is and is not present and where it might be found. In the chaos and complexity of the real world, trackers/hunters have the ability to discern and predict the presence or absence of entities from patterns "often barely perceptible or distinguishable" (p. 77). Chamberlin

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[364] A relative of Coyote.

likens the speculative aspect of tracking to hypothesis in the natural sciences, where, for example, the existence of the Higgs Boson can only be inferred[365] by the tracks it leaves behind in interacting with other particles at very high speeds. The Higgs Boson is known not for any representation of itself but by the way it acts in the world, and its activity of creation.

The Lorenz attractor is a tracking emergent from the chaos and complexity of the real world that has allowed me to consider the inarticulable and to see and read through some of my struggles with methodology particular to this inquiry. It is not perfect in this regard, the analogy falls apart with too much consideration of the manner in the image functions in its own context; it serves, however, as a pragmatic means to an end.

Chaos, Complexity, Emergence at Play

In the Western search for order, predictability, and certainty, many real world phenomena like convection, friction, turbulence, climate, weather, collective movement, and the sway of buildings under earthquake conditions refuse to submit. Such systems are tricky, in flux; they change the rules of the game as it is being played (Smith, 2007). Western ways of knowing, being, and doing have had difficulties with the chaotic and complex that Indigenous peoples seem to have avoided in their acknowledgement of ongoing process and relationships. Little Bear (2012) explains how:

> In the Blackfoot mind there is chaos underneath [everything] as opposed to [the Western assumption of] order–there's chaos. The flux is working … My culture, my language attempts to take and make sense, make order out of that underlying chaos. In other words, from the Blackfoot culture perspective I'm trying to make sense of the underlying [chaos]. That's why sometimes I say 'I was a scientist a long time before it was cool'. … If you can picture a flux–as a Blackfoot, as a Cree–I'm always looking for regular patterns–that narrow spectrum of existence [which supports life and living]–regular patterns that I can hang my hat on.

Little Bear offers the example of how someone might translate the English word *dog* into Blackfoot, "They would say *imitaa* … but [what *imitaa*] really means is 'a being of some kind'–we're not making any statements about what it really *is*–'a being of some kind on the move'". *Imitaa* is not just a noun signifying a particular kind of animal, but a means of seeing or reading through to the possibilities and relationships in which the being to

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[365] Quite strongly at this point.

which it refers is embedded and from which it emerges, to that being's ecologies of information. There is no ultimate certainty in *imitaa*–one gets the sense that this dog might easily transform into Coyote and back again[366]–but there is a regular pattern [you] can hang your hat on.

The Lorenz attractor is such a pattern. To generate it, Lorenz (1963) simplified the processes of convection to three interrelated, non-linear equations each with three variables (x, y, and z) that describe relationships between the motion of fluid in convection, and the relative velocity of that motion (Gleick, 2008; Smith, 2007). The equations are recursive; that is the output from one solution serves as the input for the next. Using a computer to generate and track solutions over time, Lorenz produced hundreds of results; each a set of three distinct but interrelated numbers–a value for x, y, and z in each solution of the equations. He then mapped these values as coordinate points in three-dimensional space to track the manner in which the system changes over time (Gleick, 2008), resulting in Figure 3. As Doll (1993) describes it, the tracking is not a representation of the roiling movement of convection itself, but is instead an "abstraction … onto a graph that correlates the movement's variables into a single point and looks at these points over periods of time" (p. 91) that allows us to see or read through to the possibilities and relationships in which convection is embedded and from which it emerges; to convection's ecologies of information. Because the general assumption of Western science at the time[367] was (largely) of an underlying order, what the tracking describes was completely counter-intuitive; a system that neither settles into a steady state nor repeating periods but

> Instead … displayed a kind of infinite complexity. It always stayed within certain bounds never running off the page but never repeating itself either. It traced a strange distinctive space … like a butterfly with its two wings. The shape signaled pure disorder, since no point or pattern of points ever recurred. Yet it also signalled a new kind of order. (Gleick, 2008, p. 30)

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[366] In Thomas King's (2014) latest book–where Leroy Little Bear and Narcisse Blood are mentioned as having a relationship with the protagonist–there is no Coyote, but a dog of changing name–Dog, Sold, Soldier, and Salvage–who seems to be slightly more present to what is going on around him than Coyote, but nonetheless closely related to him.

[367] Chaos and complexity thinking/theory open up Western science to the potential for more multiplistic thinking which balances movement and change with the determinism of Newtonian clockwork (Peat, 2005).

The Lorenz Attractor is thus neither ruttish–as in Wallin's reactive images of *currere*–nor dangerously flighty–like Deleuzian lines of flight. It is creative and generative, emergent from and immersed in the relationships that describe it. It thus signals the kind of simultaneous order/disorder you might hang your hat on.

The emergence I noticed in my own conversations around methodology and in the conversations with educational stakeholders regarding integration of Indigenous perspectives in K-12 science curricula seemed to share features of recursion. This resonance suggested to me that something about the research both asks for and attends to recursive processes in a manner that appears to draw on but might also extend Gadamer's (1989) notion of the hermeneutic circle, rendering it more explicitly dynamic, and not necessarily circular. As I returned to work of others with research contexts and commitments similar to my own, I found recursion informing methodology.

Recursion and Methodology

> Doll (1993) speaks of postmodernity, of complexity, of ecology. He puts things in relationship. Other people see these things differently. I don't, I'm with Doll. (Wiseman, 2010b, p. 36)

> Recursion: (n) The repeated application of a recursive procedure or definition. From late Latin … *recurrere* '[to] run back' (Recursion, 2014), to recur, to return (Recur, 2012).

> The reason for seeking to articulate such a[n alternate] methodology was that in educational research generally, and in the available pedagogical processes for research students in particular, there appeared to be a closing down rather than an opening up of the possibility of generating new knowledge. (Somerville, 2008, p. 209)

Somerville's (2007, 2008) work on emerging methodologies is less explicitly interested in recursion than in emergence. The examples she provides, however, reference the search for patterns emergent in chaos, and places of unknowing that my recursive experience of coming to methodology echoes. Somerville (2008) also identifies what I read as recursion as part of methodology; creative generation and subsequent modification based on feedback from the inquiry into the inquiry. As an example, she presents the work of Nancy Toncy (2008) whose research explores the embodied tensions of Muslim women in Egypt through dance. "[Toncy] choreographs a dance in response to

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each woman's individual story, dances the dance back to the woman and then refines her dance-as-analysis" (Somerville, 2008, p. 216) from their feedback to her. Each version of the dance is emergent from the relationships active in the research and remains embedded in them, but nonetheless changes over time. This connection to relationships[368] makes Somerville's uptake of post-modern lines of flight somewhat dubious as lines of flight are, in part, "defined by … deterritorialization" (Deleuze & Guattari, 1987, p. 222) or a lack of (historical) relationships.

The stripping away of relationships is Donald's (2009) critique of post-modernism. In his examination of teachers' responses to AB-based efforts to engage with Indigenous perspectives in social studies curricula, he draws on recursion in methodology while advocating for extreme caution with respect to embracing post-theories. The warning arises from the tendency of postmodernism and postcolonialism to out-of-hand reject what might be considered essentializing categories/labels/representations and thus separate the focus of study from the complex of relations in which it is bound and from which it emerges. Here again, I think the difficulty may lie in the challenges presented by the structure of European languages and thought, where such representations are generally conceived as things or objects instead of patterns you can hang you hat on that are in fact constituted by the very relationships in which they are bound. In any case, Donald (2009) suggests that separation from relationships allows for the denial or erasure of identity and history, and for the discounting of the importance of place. These denials may in turn minimize considerations of power dynamics; questions around who gets to speak and act and on whose behalf they get to speak and act[369]. Donald also points to the manner in which recursive tellings of stories can lead to the entrenchment and taken-for-grantedness of grand narratives such as that of European ascendency; the type of ruttishness Wallin identifies in some interpretations of *currere* (see Chapter 1). Ultimately, however, Donald relies on recursive inquiry as both a means of "searching

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[368] Admittedly in my reading, not necessarily hers.

[369] Here, for example, I think of the people of Elsipogtog and their neighbours in New Brunswick who have been protesting seismic testing for the purposes of eventual shale gas extraction on lands in and near their traditional territories. The protests are not just about treaty rights as has often been reported in the press, but also about stewardship and the Mi'kmaq's reciprocal relationship with the land on whose behalf they have a responsibility to speak (particularly to people who have no ability to hear the land themselves) (multiple examples at "Pages tagged "#ElsipogtogSolidarity," 2013).

for points of affinity, connectivity, and insight" (p. 9) between EuroCanadian and Aboriginal ways of knowing, being, and doing and of grounding his research in:

> the notion of ethical relationality—an ecological understanding of human relationality that does not deny difference, but rather seeks to more deeply understand how our different histories and experiences position us in relation to each other. This form of relationality is ethical because it does not overlook or invisibilize the particular historical, cultural, and social contexts from which a standpoint arises. It puts these considerations at the forefront of engagements across frontiers of difference. (p. 73)

Donald thus suggests an educative form of *currere* which acts to bring forth through ongoing return to and re/cognition of that which has come before and all our relations, and from this place of embeddedness allows for imagination and (perhaps) creation of the new.

Here again, I return to the Lorenz attractor and (always warily) post-modernism, although in the more grounded sense of Doll (1993). Doll also uses the Lorenz attractor as a means of seeing and reading through the challenges of considering open, chaotic systems, to suggest that such happenings[370] ask us[371] to shift our attention "from the discrete to the relational" (p. 97) and our own place within those relations. With respect to curriculum, he suggests such a shift results in *currere* "as a process of [ongoing] experimental transformation" (p. 97) in which reflecting and returning act as a kind of ritual[372] recursion and contribute to ongoing renewal that avoids ruttishness. Like Jardine's exploration of mathematics as an interrelated world (see Chapter 1), Doll suggests that chaotic systems require our work; a particular kind of care and attention in order to emerge and be sustained, to avoid–or perhaps temper[373]–the dangers of post-modernism (Deleuze & Guattari, 1987; Donald, 2009; Masny & Daignault, 2011). Doll looks to patterns you can hang your hat on and, like Little Bear, considers that ritual[374]

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[370] While the Lorenz attractor can seem like a static image it is actually a happening where each point represents movement and each subsequent point emerges from that movement.

[371] Perhaps "over and above our wanting and doing" (Gadamer, 1989, p. xxvi).

[372] Doll actually wonders if in the shift (or return) to the relational there is a concurrent need for a deep rethinking of cosmology including "the ritual, story and myth whereby we express and develop … beliefs" (p. 90). It seems reasonable to assume Doll is implying questioning of Western cosmologies given that he draws almost exclusively on work developed within Western traditions.

[373] Because there is always danger in living.

[374] Little Bear uses the term *ceremony*.

plays a significant role in their on going renewal and recreation.

Recurrere **(?)**

My sense of recursion is similarly bound up in active return to the act of living with all my relations. It includes deep reflection–often meditative and in the land[375]. I wonder if this process is more fruitfully considered as *recurrere* (Recursion, 2014)–a word somehow more helpful to my thinking as the "re" prefix reminds me to remember (Cajete, 1994, 1999c) that what I am seeking is a means of maintaining openness, ongoing conversation, and the act of living with all my relations in research, teaching, and learning.

Having means of remembering to remember is important; without it there is the possibility of forgetting who we are and where we have come from and missing/losing/giving up on the vitality/fertility in our work as researchers, as educators, as learners. Jardine (2014b) expresses the type of lament that can arise from such forgetting.

> *After nearly 30 years of working with teachers and students in Calgary, Alberta, I mused that, basically, "things" are exactly the same as they were when I started. We then all began the hard work of considering what to do with such a statement, how not to simply "give up," but how, maybe, to aspire to something different*. (p. 185, emphasis in original)

He reminded me of a similar story from my own practice.

In late 2013, I attended a week-long workshop examining the research possibilities of engaging with First Nations, Inuit, and Métis communities regarding the relationships between wisdom traditions and mathematics teaching and learning. Participants were university-based researchers, Elders, students, and educators; Aboriginal and non-Aboriginal. I have known a number of them for many years. On the first day of our meetings, a tenured colleague who is Aboriginal[376], who I have known for almost two decades, expressed a sense of frustration with ruttishness; how we seem to need to start over every time we meet. My colleague feels a sense of urgency related, I think, to the realities of supporting communities in meeting the priorities they set for themselves and how these priorities are sometimes complicated by ongoing tensions

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[375] Even if the land happens to be the urban setting of Montréal.
[376] Here I am using the broad term Aboriginal to maintain his anonymity.

around engaging with mathematics[377] in the community. However, as the week progressed and people shared stories of work undertaken in local places, it became clear that we were neither starting over, nor stuck in a rut; that in fact, we were all in our own ways and places caught up in the act of living with our relations in the communities in which we find ourselves and in their engagements with mathematics. Because our work is complex, we sometimes find ourselves in recognizable, family/iar places that, if left unexamined, might be mistaken for the same place we have found ourselves in on previous occasions, and hence the worry of "starting over" again and again. Instead, while we discovered we stood in a recognizable, family/iar place, we were not in exactly the same spot starting over because since our last meeting we have been engaged in generating understandings. At the same time, we also realized that something was missing in our work that could connect understanding where we had come from and what we had learned in the intervening period; something to ground us in our relations, allow us to both see and read through to sustaining patterns we might hang our hats on and in turn sustain those patterns. Within the context of the academy, this role is in some ways taken up by academic journals, but academic journals have some difficulty accounting for ways of knowing, being, and doing beyond the Western. As such, in this case, the chosen means of making that connection is ceremony and a mathematics bundle[378] which will travel with one of our colleagues and return to us, and those who come after us, to tell stories of mathematics in different places. What we came to is ceremony and ritual as a means of returning, re/membering, renewing, and re/creating in a recursive manner.

The being and doing of this shared experience brought me to a deeper understanding of what it is the Lorenz attractor allows me to see and read through in terms of educational stakeholders' practice in integrating Indigenous perspectives in K-12 science curricula, and my own attempts to honour both Indigenous and Western ways of knowing, being, and doing in methodology (and research more generally).

- I can see that early trackings may appear very much like border lines (see Figure 4), those dangerous areas where "things come to pass, becomings evolve, revolutions

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[377] Not just in schools.

[378] There was much discussion around the appropriateness of the creation of a bundle within the gathered group. The decision to create the bundle was not taken lightly, and only with the support and guidance of participating Elders who had experience in this area.

take shape" (Deleuze in Reynolds, 2006, p. 47). In early trackings it is very difficult to know that such barely perceptible places might open up to create the more clearly inhabited territory of Figure 3, particularly when one is caught up in the generation and creation of such territory.
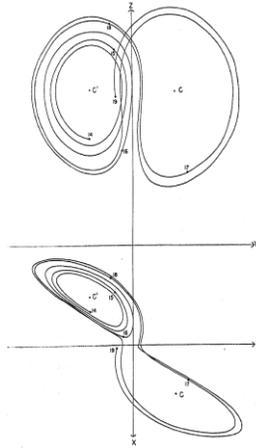

Figure 4. Lorenz's (1963, p. 137)[379] published mapping.
Lorenz's early version of his attractor tracked hundreds of solutions, but still very little of the image with which we are familiar today.

- Second, what one person might be doing in terms of methodology that tries to allow Indigenous and Western ways of knowing being and doing to circulate together in academic inquiry, or in terms of integration of Indigenous perspectives in science curricula might look very different than what another person is doing, but they both may be valid responses to a similar set of conditions. Systems such as the Lorenz attractor are extremely sensitive to initial conditions. While tracking of solutions to the three equations Lorenz used to describe convection will resolve into the pattern of Figure 3, even very small changes to the starting values of x, y, z can significantly change specific, subsequent solutions. As a hypothetical example, the 1000th solution of the equations for starting values of x, y and z will produce a point some where in the top part of the left lobe of the tracking; whereas the 1000th solution of the equations for starting values of x+0.01, y+0.01 and z+0.01 may be located on the bottom part of the right lobe of the tracking. These two points seem to be quite different places, but they emerge from and are bound up in the same set of

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[379] See Appendix E for copyright information on Figure 4.

relationships.

- Third, such sensitivity to initial conditions also allows me to see that while our work may be very local and impact relatively few people, as Corinne was fond of reminding people, making a difference for one person is still making a difference; and that difference may in fact, over time, be the difference that makes a big difference[380].

- Finally, trackings of the Lorenz attractor allow me to see that while we never end up in the same place starting over again, past, present and future can actually lie very close together in the complexity of living in the world. It is therefore important to find ways to remember and honour those places and happenings we return to so we might remember what they have taught and might teach anew. Māori scholar Makere Stewart-Harawira (2005) has made a similar point using the symbol of the double spiral (see Figure 5) or *takarangi*, which she translates to English as *chaos* (p. 34). She writes that "interrelationships of past, present and future, of time and space, of spirit and matter … are profoundly represented within the symbol" (p. 34).
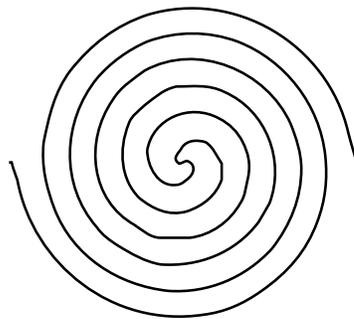
Figure 5. A double spiral similar in structure to takarangi. [Credit: D. Wiseman]

The *takarangi* has deep, personal meaning for Stewart-Harawira. Like my exploration of the Lorenz attractor, it seems to have allowed her to see and read through difficulties with the ruttishness of hermeneutic circles (pp. 49-50) to a more active "new/old way of thought and action embedded in the participatory forms of creation and existence of

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[380] Corinne always noted the difference could be positive or negative and so espoused an ethics I now understand as very similar to the manner in which Donald describes ethical relationality.

indigenous (sic) ecological humanisms" (p. 34). Here, again, I find work similar and informing to what I am trying to articulate, to the living of methodology in inquiry that occurs in the *inter esse*.

What I am Attending to

The methodology for this inquiry emerges from and is immersed in conversations between IRMs and ecological hermeneutics. Those relations are not forgotten in the seemingly new (or perhaps very old) process that I have tracked/continue to track and re/cognize as a part of this inquiry. Much of what I attend to is thus described toward the end of Chapter 10: remaining aware of all my relations, who they are and where they come from; the importance of deep listening; whole and parts; and reflection. As Blackstock (2009) points out, however:

> The differences between western [sic] and First Nations ontology are so vast in dimension, scope, and value that they cannot be substituted for one another without significant impact to the theoretical model of question under study. They can, however, bring very different and valuable perspectives to the same phenomena, opening up new pathways of understanding and intervention. (para. 16)

It thus seems the recursive methodological processes set in motion by my conversations with educational stakeholders have come to create new pathways and perhaps the beginning of new territory/ies. In this place, I look for re/generation and re/creation emergent from being and doing–both in my engagement with the inquiry and in the engagement of the people I spoke with as part of the inquiry. I attend to what ever appears to keep systems open and conversations going; whatever allows the act of living with to thrive[381], *māramatanga*/effulgent coherence emerge. I work to remember how closely the past, present, and future can be, and thus return to the work in all its manifestations over and over again to see what else opens up through those returns and through the learning that has occurred between returns. While I am uneasy claiming any connection to Little Bear's ceremony, I find ways of being and doing within the inquiry that might be akin to Doll's ritual; ways to acknowledge and enact both my responsibility for and complicitness in the

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[381] While always taking note of whatever seems to have the opposite effect.

relationships, processes, and places of my inquiry. The ritual reminds me that returning and recursion can be tricky, but also allows me to track changes, see new openings, listen for change, and feel my way to patterns I might hang my hat on; I am still chasing Coyote's tail here, but I am starting to get the sense that he might be moving just slow enough for me to follow along.

A Few Final Words as a Means of Temporarily Ending the Conversation

My process is and always has been to find meeting places in the *inter esse*– between Indigenous and Western ways of knowing, being, and doing–that allow for generative conversations and the act of living with. I learned this from Corinne over many years. She always described it in the words of Hunkpapa Lakota Chief Tatanka-Iyotanka[382] as "Let us put our minds[383] together and see what life we will make for our children". In my experience, the new, what we make together, the creative, requires becoming decidedly uncomfortable, sitting with the difficulty, listening to all our relations, playing, engaging in the flux, and reaching into the unknown–perhaps towards each other. First it requires the recognition that "Something is waking up here at the edge of familiarity" (Donald, 2009, p. 83), or perhaps around the "patterns in the middle that are very much alike" (D. McKee*).

What I have tried to describe as a methodology that honours both Indigenous and Western ways of knowing, being, and doing, what I have seen educators doing in their coming to understand what it means to integrate Indigenous perspectives in K-12 science curricula, is not unique. Other people seem to be engaged in the process with respect to methodology as well (e.g. Atleo, 2008; Donald, 2012; Somerville, 2008; Stewart-Harawira, 2005).

Some people have recognized the process emergent in the shared history between Aboriginal and settler peoples in Canada. In their examination of Aboriginal policy in Canada, Abele, et al. (2000) underline that successful work generally arises only in those circumstances where there has been genuine collaboration and respect between the

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[382] Sitting Bull
[383] In some translations "minds" is replaced by hearts.

parties, what they refer to as dialogue as opposed to soliloquy. Ralston Saul (2008) goes further[384]. He suggests that Canadian national ethos was formed out of early contact and living together with First Nations people; that Canada was, and is in fact even now, a Métis nation. While he admits there have been periods where this close and mutual relationship has been forgotten and severely abused, Ralston Saul believes over last 40 years we have begun to reclaim it[385], and must continue to do so. He says we are at our best as a nation when we remember these origins, and that we stumble and fail as a result of forgetting (or repressing them) and trying to fit ourselves into a poorly fitting European box.

The creativity, fertility, and fecundity of places where and/or ways in which differences come together are also recognized in Indigenous languages. In the language of the Yolgnu people of northern Australia, *ganma* means mangrove lagoons and also the complex, productive ecology that emerges in places where salt and fresh water come together (Hickling Hudson, 2003; Yunkaporta & McGinty, 2009); *ganma* is being used in some Australian contexts as a concept for framing curricula. In Cree, the phrase *miyo wicihitowin* means "the helpful energy that comes when we are together" (course notes, February 9, 2010). Donald (2013b) translates the words to English as *ethical relationality* and uses the concept to frame curricula and education as a healing medicine.

There are layers upon layers reflected in my struggle with methodology (and research more generally); in each one I see, or sense, or hear, the same kind of processes at work. I have discussed it in terms of the complexities of recursion through the beauty of the Lorenz attractor because my background in science, mathematics, and engineering prepare me to think that way. In my newer ways of thinking, what it re/calls is Thomas King's (2003) Massey lectures where he tells a story about how our world floats on the back of a turtle. Like him, I have heard this story in a number of places, from different people, always with variations to the tale, but in the end the Earth sits on the back of a turtle, who sits on another turtle, who sits on another turtle, who sits on another turtle, in

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[384] I have heard people argue that he has a romanticized view of relations between Aboriginal and settler peoples, such critiques should be considered.
[385] The book was published prior to the 9-year period of Conservation government that just ended.

fact, "it's turtles all the ways down" (p. 2). To me, this seems to be the essence of living, and life is what I am searching for in learning.

And so, here–finally–emergent from and immersed in my inquiry is something with which I can live with in terms of methodology; perhaps *recurrere*, perhaps just the beginnings of understanding how to track Coyote–it is still too early to tell. In her seminal work, *Decolonizing Methodologies*, Smith (1999) writes:

> Within an indigenous framework, methodological debates are ones concerned with the broader politics and strategic goals of indigenous research. It is at this level that researchers have to clarify and justify their intentions. (p. 143)

Given who I am and where I come from, my work can never fall completely within an Indigenous framework, but it does fall into the *inter esse* where Indigenous and Western ways of knowing, being, and doing might circulate together. Politics, strategic goals, ways of knowing, being, and doing are often in tension in such a place; but the tensions can be generative, if you are willing to sit with them, converse with them, live with them, and feel them out to patterns you can hang your hat on. At this point I have a sense of pattern in terms of methodology, but I remain aware of the politics of naming. So in order to avoid "the illusion of benign translatability" (Battiste & Henderson, 2000, p. 80), I choose to remain caught up in the inarticulable and not name the methodology emerging. It is a practice perhaps unwise in terms of filling in "the damn box", but it is true[386] to what has transpired in the processes, places, and relationships of my inquiry. Being true, it allows/has allowed me to proceed with some sense that, now, I am practicing the teachings and ideas that I am teaching so as to live the ideas I believe in, that I am striving to have all principles touch every aspect of my practice, that I am not saying one thing and doing another. I am not just be saying something and not doing anything. "[I am being] both" (Meyer, 2013b) or at least trying as well as I can. *Māramatanga*/effulgent coherence. Joy.

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[386] In the sense of "consistent with observation" (Aikenhead, 1998a, p. 92).

I had once referred to this process and thinking as the Triangulation of Meaning. It was meant to bring coherence between the three operating principles, but it gave the impression of a linear sequence and unnatural hierarchy. I had initially thought that information came first in some kind of text or noun form, then it was experienced, then *it was understood. Here is the dilemma of our schooling system. For years I've been trying to understand what happens simultaneously and yet it was described as sequence, the lock-step approach found in modern expectations more interested in quantity, control and time rather than* quality, consciousness, and space. *(Meyer, 2011, p. 3, emphasis in original)*

Part III Redux: A Process Emerging from and Immersed in the Relationships at Play

In doing the research, in being with it, by engaging in acts of living with[387] before making claims to knowing, I was able to get a sense of pattern in the flux, and begin figure out both how to follow tracks and lay them down. Through recursion and return, I was able to remember to be (or to become) comfortable with the discomfort by chasing Coyote's tail. The process, the tracking, allowed me to see and to hear how educational stakeholders are coming to understand what it means to integrate Indigenous perspectives in K-12 science by doing, by engaging with Western and Indigenous ways of knowing, being, and doing in their own contexts, in their own acts of living with; recursive processes of responding to the requirement for integration, by feeling out a pattern they might hang their hat on, and–if not finding comfort with the discomfort–attempting to relieve the tension of the *inter esse* through an ongoing activity of creation.

Because educational stakeholders are caught up in the struggle with the tensions, their own ability to see or articulate a sense of pattern or larger whole varies considerably. Here I find the Lorenz attractor a particularly useful image for seeing and reading through the significant variation of doing I observed in their acts of living with. The convection that the Lorenz attractor tracks is a process active in the world. Once the conditions for its emergence are present convections occurs. Hot air rises, cools, falls down again–repeat. It seems so simple, but it is tremendously complex. Lorenz may have tracked the attractor that bears his name one iteration at a time, but the whole is potential in the initial conditions. Hot air rises, cools, falls down again–repeat. Tracking of early iterations (Figure 6), which may be missing an entire lobe of the attractor

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[387] Both my own acts of living with and those of the educational stakeholders with whom I had conversations.
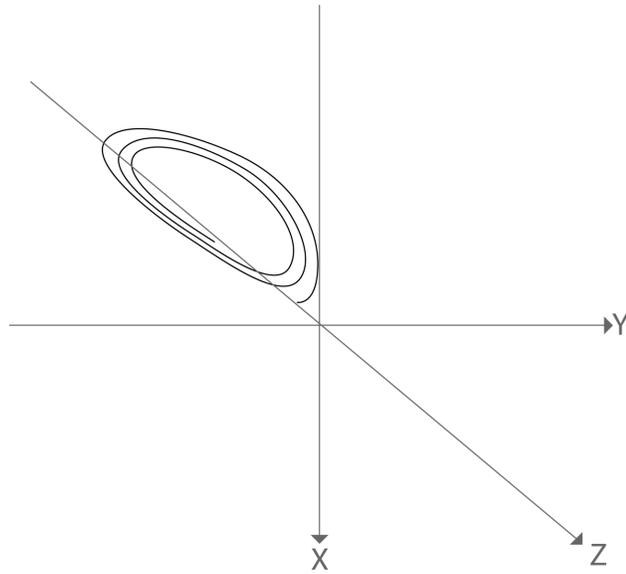
*Figure 6. Early iterations.*

do not begin to articulate what the attractor looks like when the pattern begins to emerge (Figure 7),
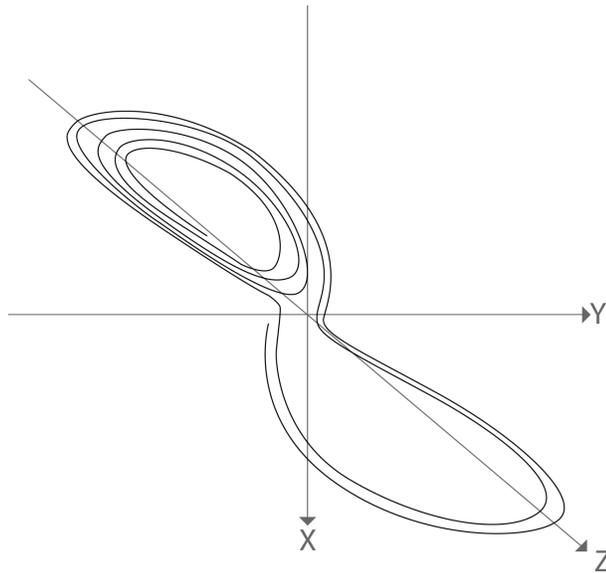
*Figure 7. Getting a sense of pattern.*

and certainly give little hint to the beauty of the whole (Figure 8).
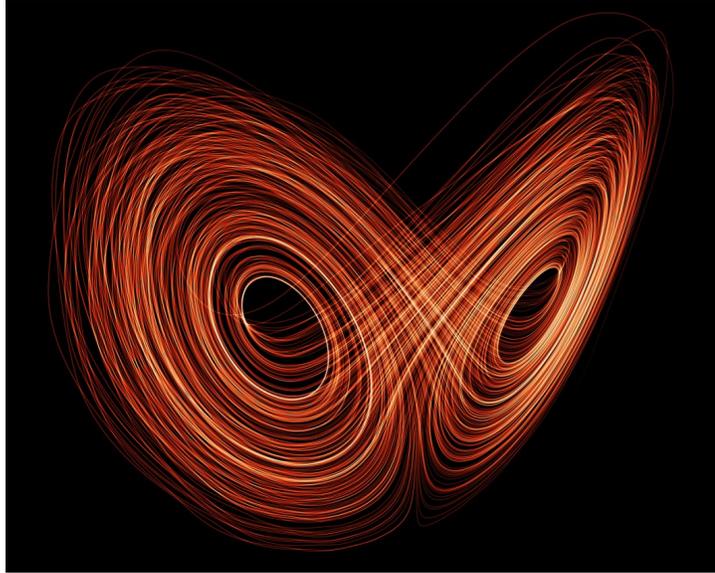
Figure 8. The beauty of the whole.
[Image credit: Zentilia, Bigstockphoto.com, see Appendix C]

I acknowledge that *whole* in this case is a poor descriptor, because the process, the tracking (and the simultaneous laying down of tracks) could continue *ad infinitum*. It is always growing from the middle. The relationships are always at play, always in flux. Hot air rises, cools, falls down again–repeat, repeat, repeat–somewhat like the nature of Aoki's multiple ands. Such is the nature of complex processes.

In the conversations that serve as examples in Chapter 11, Caroline* knows the requirement for integration of Indigenous perspectives in K-12 science (and other) curricula asks her to do something. At the same time, she seems caught up in early iterations where she has some difficulty re/cognizing and articulating how what she does do with respect to integration is interconnected and interrelated instead of individual pieces. It is about content, time, and resources for her. There is as yet, little or no sense of pattern, nothing she can confidently hang her hat on, but she seems to keep looking for a pattern because of her own going tension and discomfort. Tracy* has begun to feel her way to a sense of pattern. Although she still cannot directly articulate a fullness or wholeness to the differences between her three lessons, in recognizing that the underlying assumptions of Indigenous ways of knowing, being, and doing can lead to significantly different ways of understanding the world, she seems to sense that integration asks her not just to do something, but to do something different, even though she feels constrained

by existing programs of study. I noticed this attempt to do differently among a number of the educational stakeholders with whom I had conversations.

Hailie King*[388] has gone through a number of iterations of attempting to get at integration of Indigenous perspectives in high school science curricula in a manner that she feels extends beyond the "fluff" of a one-time, content-based, exploration or example that does not fit with the rest of her program of study other than to say "this is a curricular point, so we're going to cover it". She views the requirement to integrate Indigenous perspectives in science curricula as fundamentally interesting, and not solely or primarily about content.

> There is so much that could be incorporated in a meaningful way… not just for the worldview or the science of it, but also for changing perceptions of what native culture is.

Hailie is particularly drawn to Indigenous thinking about interrelationships and interconnectedness. The idea that everything is a:

> whole instead of piece by piece. So, even just that concept, I mean to me, that just is the whole idea of integration. Because nothing stands alone. And so being able to incorporate that in a more meaningful way so that students even learn from just that concept–that nothing stands alone–and use that in a way to further enhance their own thinking … their own learning.

Hailie has tried to take up this idea in practice by reconceiving one science course through a unifying idea that might give students "more of a sense of integration of everything [across the sciences]". She tried to implement the course in two schools, but was unable to do so because both scheduling and assessment practices in place worked against conceiving the course as a whole instead of several individual units. While Hailie remains uncomfortable with the limitations on the manner in which she can live with integration of Indigenous perspectives in science curricula, she has found a way to be deliberate about the relationships she is trying to build by returning to a goal of framing science as *a* way, not *the* way, for understanding the world, and trying to support developing student understanding of how different perspectives might complement each other. As such, she does not focus too much on provided textbook and program of study

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[388] Hailie* teaches in a large, urban high school in a western province. She has been teaching chemistry, biology, general science, and mathematics for about 18 years at senior high school levels

examples, but instead speaks with students about "Elders in Indigenous cultures–as knowledgeable people, not as a stereotype[s], and with really thoughtful ideas that actually fit in with what we're talking about in class". She admits that the practice is limited by of her own understanding of Indigenous ways of knowing, being, and doing. There is hand waving and grimacing in the discussion around what she does not know. She also knows what she is doing is a small act of living with, but it is nonetheless generative because it allows her to return to previous conversations with students "as we hit things like the ecology later on, or even in [a later course], trying to bring that back to this whole idea of an overall viewpoint". She has felt and is continuing to feel her way to some sense of pattern.

Like Hailie, Greg Henkleman*[389] is caught up in considering what it means to integrate Indigenous perspectives in science curricula. He also feels the need to move beyond mere content. He explains how:

> As a science teacher, the more I actually delve into life, truly studying life, the more I realize there's much to learn from many different perspectives, philosophies, earth-centered religions. Just an overall spirituality to it that, you know, is kind of not discussed at all in science. Not that I stand in front of my class and give a theological treatise, but I think having that [sense] allows you to share what it means it means to live here now. … I think you can gain from wisdom from the past. It can help us solve future problems. It's not all past. So maybe [Indigenous] wisdom traditions can give us more to work with. And that's far greater than trying to say–I know with chemistry teachers, they've said 'Oh yeah, pigments, we have to talk about how Aboriginal people use pigments or created pigments'.

Greg is not interested in such "artificial" means of engaging with Indigenous perspectives for himself or his students. He spoke about integration largely in relation to the field study requirement in AB's Biology 20 (AE, 2007a) program of study. He described how the national park where he takes students for the field study has been and is used for this purpose by multiple schools in the areas in and around Edmonton. His visits to the park began well before the requirement for integration of Indigenous perspectives because the location offers plenty of opportunities for sampling water, counting species, doing

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[389] Greg* is an award-winning biology teacher in a large, urban high school in Edmonton, AB. He has been teaching for about 15 years and often teaches Advanced Placement courses.

transects[390] etc. The park is home to two species of bison, moose, deer, elk, and hundreds of smaller animals species including mammals, birds, amphibians, etc. Greg explains the location is a place where there is evidence that the relationships explored in science curricula are active in the world, but his students do not see it as such. Most of them are urban young people with little or no "visceral" connection to the world beyond the city. Many of them suffer from the biophobia described by Cajete (2006b), which Greg sees not only as a hindrance to learning, but dangerous because it can lead to a misunderstanding that science is about the abstract:

> People are afraid of animals. People are afraid of sharks. People are afraid of bison. People are afraid of grizzlies. I think there are reasons why and I'm not going to discount that. But that fear of nature is a really bad perspective to take in science–that's a very dangerous perspective–and I think that's where an Indigenous perspective is so valuable.

He has been deliberate about building relationships during the excursion by returning to the intentions and purpose of the field study alongside the requirement to integrate Indigenous perspectives in science curricula. As such, "the field study side of [the national park visit] has become secondary", to he and his students learning together about being in and experiencing place. Greg first tries to break down some to the fear, by talking with students about how they are feeling while walking in the park, and only then supports them in building connections to science that would have been difficult for them to see when fearful. He describes how some (not all) of his students seem to "understand … without verbalizing" the both/and of the visit being about their biology course and content, and not at all about their biology course and content. Greg has developed a sense of pattern, but still experiences tensions around integration because he feels his ability to discuss land, the spiritual, and how they might have conversations with what he is teaching in *Biology 20* (AE, 2007a) is limited. He understands that the discomfort might be read as resistance, and suggests it is a resistance "not by ideology, but by lack of preparedness, psychologically a lot of times". He does share stories with his students that he has heard from Indigenous colleagues and Elders, but is not sure he is telling the

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[390] A transect is a series of measurements or observations along a predetermine path (often a straight line). Measurements and observations included in transects vary widely but might include the number of occurrences of and distances between a particular species of plant, moisture content in soil at fixed intervals, abundance of species along the transect path etc.

stories in the right place or at the right times, so the practice is more like "disseminating information" , than learning that is interconnected and intertwined. Still, he continues to try and have an Elder or local knowledge holder join him and his students in the national park, to add another voice to the conversation, because he senses such learning together brings something fundamentally different to the experience.

Tracy Onuczko*, Hailie King*, Greg Henkleman*, and a number of the other educational stakeholders (not all of them classroom teachers) I spoke with have or are getting at some sense of pattern in relation to integrating Indigenous perspectives in science curricula. Despite their disparate initial conditions in terms of location, local constraints/opportunities, practices etc., they do appear to be laying down and gaining some sense of a trackable pattern via doing. The pattern seems to involve a re/cognition that integration of Indigenous perspectives is not solely about content and doing things, but about doing things differently, being creative, and deliberately working towards change in the status quo–not just picking something and filling in a required box. In working towards that change, they struggle in the tensions between Indigenous and Western ways of knowing, being, and doing. None of them will say "I know how to do this" although they can tell you what they have done, how it has made them feel, and what they are coming to understand via the doing. The one thing they can say with some certainty is that what they do is not quite right, does not quite fit their sense of what the pattern is (or might be)–with the attendant heading shaking and hand waving. As in my questioning of the assumption that methodology is "the theory behind the method, including the study of what method one should *follow* and why (van Manen, 1997, p. 28, emphasis added), in their deliberateness, and despite the hand waving, educational stakeholders who are getting a sense of pattern with respect to integration of Indigenous perspectives in science curricula, question the authority of programs of study and begin to seek out more open possibilities where living and learning come closer together (F. Elliott*; G. Henkleman*; R. Herrmann*; H. King*; T. Onuczko*; S. Taylor*). In fact, Greg describes the process as "more of a journey than [following] a guideline". Some of them also question their own authority and move much more to learning (at least some of the time) alongside their students and/or colleagues (F. Elliott*, G. Henkleman*; R. Herrmann*; S. Taylor*). It seems to me that their deliberateness is in some ways a search

for *māramatanga*/effulgent coherence, of practicing–if not what they believe–what they are coming to understand in manner that fits their understandings of what integration of Indigenous perspectives might be. In their search(es), there is a sliding away from mere integration. These educational stakeholders who are getting a sense of pattern, are trying to understand, trying to engage with Indigenous perspectives, trying to find ways for Indigenous and Western ways of knowing, being and doing to circulate together, trying to find meeting places from which other conversations might begin.

Having pointed to the similarities within the manner in which Tracy Onuczko, Hailie King, Greg Henkleman, and others are getting at a sense of pattern, I do not want to give the impression that early iterations, getting a sense of pattern, or even the beauty of the whole are hard and fast stages or categories that can be identified via checklist. Early iterations, getting a sense of pattern, and the beauty of the whole are simply ways of seeing and reading through a complex process that I have found helpful in thinking through how educational stakeholders are coming to understand integration of Indigenous perspectives in science education. Within the process there is a constant movement brought about by recursive return in response to ongoing tension and discomfort *AND* a simultaneity to the whole because the process is immersed in and emergent from all of its relations. It is always in flux, always in play.

Neither do I want to give the impression that there is one way to engage with early iterations, or to get to a sense of pattern etc. Like my approach to jigsaw puzzles, people begin with what they can see, and work their way out from that point. The educational stakeholders I had conversation with all have different pieces to begin with: Tracy* has her research, other people draw on storytelling (C. Laflamme*), decolonizing activities (F. Elliott*; H. King*), or ideas of deep relationship (B. Dobbs*; G. Henkleman*) to good effect. But the educational stakeholders who see the beauty of the whole, who seem to have some sense of *māramatanga*/effulgent coherence, who remember to remember and find comfort in the discomfort, appear to be those people who begin with and remain grounded in place.

'One may become so engrossed in [possibilities and 'connections'] that they outplay one, as it were, and prevail over one. The attraction … that the game exercises on the player lies in this risk' (Gadamer 1989, p. 106). This is the source of the great counsel regarding the cultivation of practice and the reason for many cautions regarding finding a teacher (Tsong-kha-pa 2000, pp. 69-92) who will not simply stimulate adventurousness–'the leap'–but also insist that there is value in spending time in the old place, value in returning there, nesting and nestling, that doubled helix of making a place whilst finding one's place, composing oneself in the fleshy composition of the world. (Jardine, 2014a, p. 29, emphasis in original)

The dog had his pants. Soldier had Gabriel's jeans stuffed in his mouth, the legs dragging along behind him.

"Cute."

Soldier stuck his hind end up in the air like a stubby flag, his body alive with energy.

"How about we drop the pants."

Instead Soldier exploded off the deck, the pant legs flapping around his head, as through he had somehow caught an ill-tempered albatross.

"Bad dog."

For a moment, Gabriel thought the dog might just roll about in the ferns and the underbrush until he got tired or bored, but, instead, Soldier turned and trotted up the trail.

Towards the headlands and the reserve.

Gabriel shook his head. He wasn't about to play the game. He had all day. He would just sit on the deck and wait for Soldier to come to his senses and slink back full of remorse and apology.

His wallet.

His wallet was in the jeans.

For the first kilometer or so, Gabriel tried to pretend that he had signed up for one of those health-and-fitness vacations where speed walking after an opinionated dog was part of the spa's daily exercise offerings. He hadn't expected to be so short of breath, was not at all pleased with the sensation. The trail was pleasant enough, and as he struggled along, Gabriel tried to push past the discomfort by humming in time with each stride.

Trees, rocks, ocean, sky. Trees, rocks, ocean, sky. Trees, rocks, ocean, sky.

…

Gabriel took a last look at the water and began the climb to the reserve. He felt foolish traipsing about in just a shirt, a pair of socks and shoes. At least the underwear was clean.

It wasn't a charitable thought, but he found himself hoping that he would find Soldier around the next turn, lying in the dirt, dying of exhaustion, sorry that had started this nonsense in the first place. (King, 2014, pp. 94-96)

Part IV:
Seeing the Beauty of the Whole
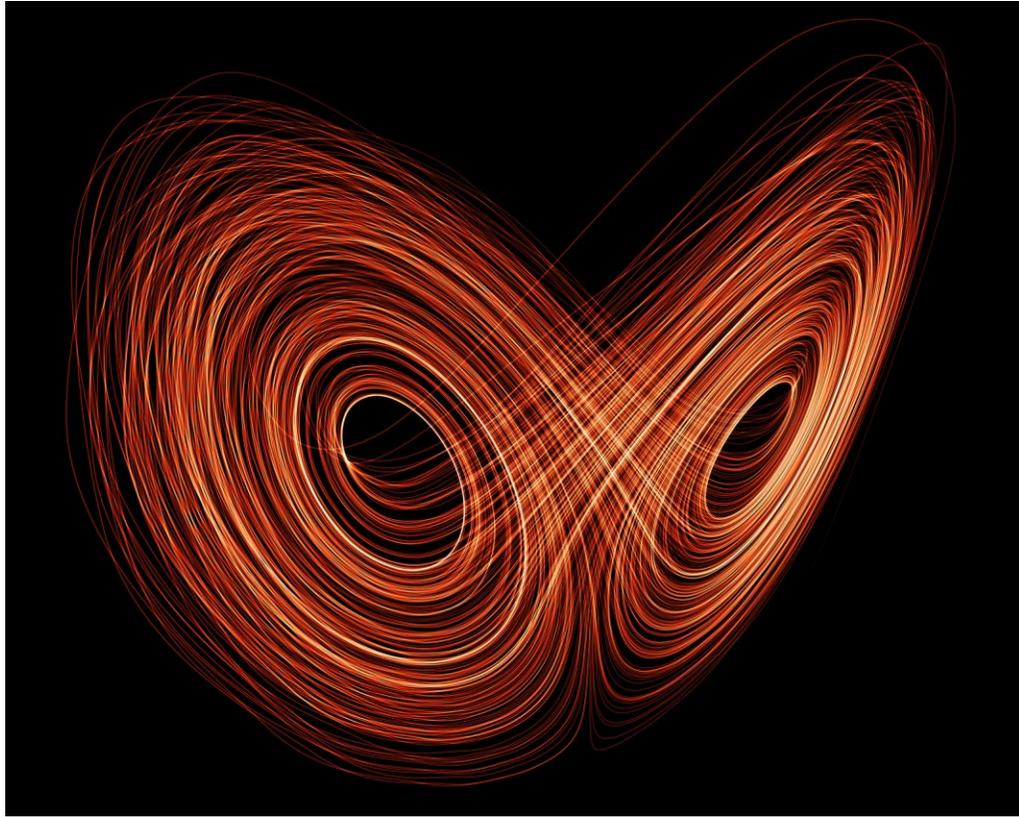
[Image credit: Zentilia, Bigstockphoto.com, see Appendix D]

In which I Sit in/with Place and Remember to Let Things Be

Hot air rises, cools, falls down again. Hot air rises, cools, falls down again. Hot air rises, cools, falls down again. "Trees, rocks, ocean, sky. Trees, rocks, ocean, sky. Trees, rocks, ocean, sky" (King, 2014, p. 95). Getting a sense of pattern does not do away with the tension and discomfort. It does not do away with the inarticulable. It does not necessarily lead to knowing. It does, however, appear to allow for some easing of the tension, for finding some comfort in the discomfort, for coming to understand that despite the remaining discomfort and tensions engaging with Indigenous perspectives is–if not completely articulable–"totally doable" (student comment, May 8, 2012). In understanding that engaging with Indigenous perspectives in science curricula is doable, something seems to open up that allows people to move from getting a sense of pattern to becoming caught up in the flux.

Still the process is messy, but getting caught up in the flux is the messiness of life and living. What Darren McKee* might call becoming competent, which is both about science *AND* not at all about science. The irony is that in getting caught up in the flux, in giving over to play, in embracing the messiness, it seems to become possible to "mak[e] a place whilst finding one's place, composing oneself in the fleshy composition of the world" (Jardine, 2014a, p. 29). It becomes possible to see the beauty of the whole.

Part IV is about how seeing the beauty of the whole becomes possible by beginning in place and letting things be. It might perhaps be considered an extended ending to the conversations at play in these pages–as opposed to a conclusion. I could have stopped at the end of Part III, but because I take seriously the idea of return, of ritual, of remembering to remember, of recursion, it is important to acknowledge and demonstrate I have learned something, to honour and respect those people with whom I had conversations for this work, but also to honour and respect those people who inspired this work with the statement "I don't even know what this looks like". Perhaps the following chapters provide some sort of illustration of the potential inherent in the very conditions of engaging with Indigenous perspectives in [science] curricula, the potential of sitting with all our relations and doing something in particular places.

The following chapters are stories of people in their own ways and places caught up in the act of living with their relations in the communities in which they find themselves and their engagements with Indigenous and Western ways of knowing, being,

and doing circulating together in science curricula. The first chapter focuses on my conversations with Steven Daniel* and Jim Kreuger*, and their work in NT and NU respectively. The second chapter focuses on the Indigenous Teaching and Learning Gardens in the Faculty of Education at UA, and my work in the urban context of Edmonton, AB. The two chapters resonate with each other, and considered together might finally provide some direction in terms of the questions in which I am/have engaged. And so, Part IV serves not only as an extended ending to the dissertation, but also as a means of returning to the middle and beginning again.

"The lessons ... present themselves". (J. Kreuger*)

Chapter 13: Acts of Living With: Conversations at Play in Northern Canada

This chapter focuses on conversations with Steven Daniel*[391] and Jim Kreuger*[392]. While neither Steve nor Jim spent the early parts of his life in northern Canada, each has lived and worked there for many years, teaching science (and mathematics), administering schools, developing programs, raising their families, building relationships, and learning in, with, and from Aboriginal people, peoples, and communities and the land. In their current positions, both Steven and Jim deliberately build communities of teachers, parents, Elders and students, who live with each other in teaching and learning to understand what K-12 science curricula looks like in northern Canada.

This chapter is a somewhat different from the ones that precede it. There was a quality to the conversations with Steven* and Jim* that extends beyond those with educational stakeholders who are getting a sense of pattern and beginning to grasp the emerging complexity of simultaneously following and laying down tracks. In the conversations with Steven and Jim, while tension and discomfort still exist, relationships are interwoven, interconnected, and interdependent. At times, the stories they shared take on an almost poetic timbre, not in terms of the language, but in terms of a resonance the occurs within the whole of the practice as described at every level. In the two territories, there is some evidence of *māramatanga*/effulgent coherence in place and action. The reading and rereading of their transcripts was an interesting process because while Steven and Jim each present distinct stories of practice in different places, they seem to be having conversations with each other. The conversations are so interconnected that there were moments where Jim and Steven were not just talking to each other, but seemed to be finishing each others sentences, as if they we caught up in the same process and

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[391] Steven is the Sciences and Secondary Education Coordinator in the Northwest Territories DECE. He has worked in the NT as a science and mathematics teacher, school administrator, and curriculum developer for almost 30 years.

[392] Jim is a program consultant for the NDE. Jim lives in Baker Lake, NU, where he taught science for many years, and founded the Kivalliq Science Educator's Community (KSEC), an organization that supports science teaching and learning in the Kivalliq region of Nunavut through professional development, land-based science-culture camps, science Olympiads, territorial science fairs and other programming.

describing the workings of a rather similar whole. Given the fluidity of the conversations and the resonances of their work, I have not broken this chapter into labeled sections but chosen to have it resemble the conversation emergent from the transcripts.

It might be easy to assume that what occurs in northern Canada with respect to bringing together Indigenous and Western ways of knowing, being, and doing in science curricula is facilitated by a large number of First Nations, Métis, and Inuit, or, at least, northern teachers: people with a good deal of understanding and experience of Indigenous and/or local ways of knowing, being, and doing in place. On the contrary, according to Steven and Jim most of the teachers they work with are non-Indigenous, young, new to the territories, and in their first or second year of professional practice. The teachers find themselves in a new context that differs significantly and fundamentally both physically and philosophically from the ways of knowing, being, and doing with which they are familiar. Steven says, "It would be no different than them going to Mongolia … they have no idea" what they are getting into, and so "they're all drawn like moths to a flame towards any kind of a collective that would support them" (J. Kreuger).

In both NU and NT, the policy and programs of study in place (see Appendix B) support initial teacher engagement within their new context[393]. As Jim points out the explicitness is extremely helpful in moving teachers beyond a focus on content to process in their local contexts. Steven echoes Jim, saying that what appears in the policy and program of study documents is "not 100 per cent of the mechanics" primarily because ultimately "It's not the content, it's the process" (J. Kreuger) that make the difference. Given that the policy, resources, and understandings that frame curricula in the territories stress the importance of elements such as community and intergenerational learning, and learning in and from the land, in both NU and NT significant efforts are focused on teachers being in[394] the land alongside students, colleagues, and/or Elders.

Jim explains how considerable shifts occur in the land within relatively short periods.

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[393] Like SK, NT has also worked to develop textbooks (Campbell et al., 2009; Campbell et al., 2012; Campbell et al., 2008) where Indigenous and Western ways of knowing, being, and doing come together. These resources serve as an additional support for teachers.

[394] Steven (personal communication, May 5, 2015) notes that in northern Canada the term used is generally *on the land*. Given that I have used in the land throughout the writing, I maintain the wording here.

It, it taps into something that's in all of us I think, for some of us maybe it's harder to find but, you take people out on to the land and you camp for four, five, six days, and you just treat people differently. A whole different social dynamic develops, and the teacher/learner dichotomy is gone. We all become learners. We all become teachers. And at a science camp you can see students teaching teachers how to light a Coleman lamp, you can see students teaching Elders how to use a GPS, Elders teaching students how to drum dance, Elders teaching teachers how to cache meat, and teachers teaching, you know, everyone how to, what, how to exit a kayak –everyone teaches. It's just sharing, it's natural.

It is the kind of learning through living together that Darren McKee* describes from his own upbringing (see Chapter 3).

In order to become familiar with NT's *Experiential Science* programs of study (DECE, 2006) teachers and Elders spend a week in the land together, learning what students will learn. From experience, Steven knows he will have to remind teachers to focus on the doing before they ask questions about theory and knowing.

Everybody's learning from that experience. So what we do is like, for instance, say we were going out and doing a study on a creek for its water chemistry. Prior to that, about two-thirds of the teachers that I have are not subject-matter experts in that area. So they're nervous going out to do this. But I said, 'You know, let's just go out and do the activities … you're going through and see this, some parts will work for you better than others and you can try and retry. But I'm not going to tell you anything, any expectations about what you're going to find or anything like that. After, we'll talk about the theory'.

Because anytime a theory question comes up, I say 'let's just put this on hold and you guys got the activity to do first. Go through the experience of learning it. Like you know the way the Elders teach kids'. And then, after the fact, we go through and we sit down and we do a debrief time.

The people that went through that program, they saw it. It's like click. By day 3 you can see their whole mind frame changing. That was a huge epiphany for people–all of a sudden going out in the field and dealing with Elders and doing these experiments that may or may not work because they're not necessarily experiments. Because experiment says you get [reproducible results]. You should be able to replicate the outcome.

What the learners–students, teachers, and/or Elders–engage in during *Experiential Science* is much closer to field science than what is generally taught in high school. In fact, students doing the invertebrate studies unit in *Experiential Science*, are partnered

with researchers at the University of Prince Edward Island (UPEI). Students pull samples from local riverbeds according to research protocols as part of their school work and send them to UPEI for analysis.

> What we're getting out of it is an electronic identification key. So it would be a visual key that we'll be able to use in the communities. People will be able to put it on their iPads or whatever and when we go out in the field, kids will have their iPads with them. (S. Daniel)

In this work a reciprocal relationship between the students, the researchers at UPEI, and the communities where the students live is developed where everyone teaches and learns. Steven points out that the university researchers often only come on site for a few weeks over the summer, and so in many ways the students and community members know more about research locations because they live with them year round. As such they are the subject matter experts.

In another unit, students catch fish. Here Steven describes how Elders, students, and teachers work together for learning across multiple areas

> When we're pulling up the fish out of the nets, the kids are actually taking measurements of the fish. They're taking the otolith[395] out, they're taking scales out that they're going to use in their classes later on. They're checking for external parasites, they're checking for internal parasites. The Elders know that there are parasites,

and that the parasites cannot be eaten. The Elders show students how to properly remove the parasites so that the meat becomes edible. Working alongside the Elders and the teacher, students come to see "the seasonal variations within the parasites so it allows us take the mathematical concepts that they've learned on dealing with data graphing presentation and bring it into the science classroom". In this case, classroom science circulates together with Elders' knowing, community contributions of food, and mathematics learning, "So we've tried to wrap it all up in to one package".

The package includes paying close attention and learning to listen to particular places, moments, language, and the ways of living in northern Canada. As Jim notes,

> There's a rhythm to life that, you know, whether you like it or not, it's there, and it kind of, you know the, it flows through ... you know a school and a community. And some of those things are ... I guess affect how, how

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[395] Otolith are calcium-based small structures found behind the brains of bony fish that help determine species and age of fish (UAS Fisheries Technology Program, n.d.).

you teach I guess, if you listen to them. I think at first maybe you don't hear them, but if you… after a while that's pretty much all you do hear.

Place in this context is not solely the locational construct presented in place-based learning (see Chapter 6), but *Land* both as first teacher and as pedagogy. Both Jim and Steven talk about how in their contexts, the challenge is not so much the Indigenous perspectives but supporting teachers in being prepared to let go and work with the uncertainty of what can happen in *Land* conceived in this manner.

> Like I say, it's pretty hard to mess up a land-based activity, unless you get way too focused and anal about plans and objectives and goals–because if you truly value the land and the environment the weather is part of that, and it changes, and you have to adapt. And then the Elders are always telling us, you know, 'We're not doing that, we're doing this'. Like a blizzard will produce snow, that means the lesson is now snow, it's not caribou. And, so as long as you are able to be flexible and receptive I guess to the lessons that present themselves. And sometimes that means letting go of something that you planned, or sometimes adjusting it, and doing it in a different way. Yeah, I think you can, for people who are really up tight and not flexible it can be very frustrating. But, ... but if you're patient and you listen, I think you'll hear what needs to be done. (J. Kreuger)

Because the Elders and the *Land* lead teaching and learning in these cases, Steven suggests that hearing what needs to be done requires teachers with a solid grounding in their own understandings of the relationships and processes in science and the programs of study[396]. It is only through such grounding that they will be able to recognize the moments and make meaningful connections when they arise.

> Any of the professional development that I've been doing with teachers that's what I've been focusing on with them. …When you're out in the field or when you're dealing with Elders and what not, is you have to be so familiar with your curriculum document as to jump in and take advantage of those teachable moments.
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> And [I tell them] 'Don't be scared if you're doing a section in geology and you're out and there's a rock face there and it has specific significance to local people'. Then why not use that to talk a bit about the geology of the land? Because when you come back to it later on–[maybe in your curriculum plan] you're not talking about it for another three months–is instead of ignoring it, [you're] embracing it and use it as a teachable moment to talk about this because now the kids have an experience where they've heard from the Elders, they've heard from you,

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[396] For science and other subject areas, because in taking this approach to teaching and learning it is about honouring what arises in the moment.

and then three months from now, you now have an anchor point to go back to.

So it doesn't matter really what it is, it can be a whole smattering of things depending on what grade level you're at. But if you're in Grade 6 and you're doing the weather unit, when you're out in the field there's no better time to talk about weather because you know when you look up at the clouds, you know it's soon going be time to get your raincoat out or you're gonna get wet. Or how to dress appropriately for the climate.

These kinds of explorations open up learning for everyone, because the Elders are "just as inquisitive about the way you see things from a science perspective as you are from the perspective that they see it … that's a critical thing I think, is looking at it from two world views and accepting it for what it is on both sides (S. Daniel). Here, Steven articulates part of what I think many of the other educational stakeholders I spoke with are struggling with, that integration of Indigenous perspectives in science curricula is a poor descriptor for the process at play. What he describes is not a piecemeal integration of one way[397] of knowing, being, and doing in another, but the co-existence of two ways of ways of knowing, being, and doing circulating together and having conversations (or not) as they might. Both Jim and Steven point to how this approach also opens learning for students who have not necessarily engaged in science (or school) before.

Steven tells the story of a young man who flummoxed his teacher by consistently showing up an hour late every morning. After learning that the student spent most of his time in the land with older people from the community, Steven suggested that the teacher bring her class outside to do a field study at the time she knew the student would be heading towards the school.

> Sure enough, that's exactly what she did. He sees the whole class with all their gear that they're going out to study their study site. And he goes from walking to running to come out there. Once they get out to the study site, one of the things that they were going to look at was weather, just as a site, because every time you go out you always take weather measurements and yada, yada, yada.
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> So I said okay, 'When you go out in the field and you're talking about weather, there probably will be clouds or something around, … engage him on that level'. And she did. And this was a kid that was very quick to tell her where to go, but as soon as he had a purpose within that class, he just gave so much information out that she was just dumbfounded by how much he knew about local weather patterns and that. And he was

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[397] Not that either way is singular.

starting to make predictions, you know, and get a little cocky and stuff like that. And they were writing it all down.

Sure enough, the stuff that he saw he was able to interpret, and he would make little weather forecasts and tell them what was going to happen as the day progressed. And he was bang on, because he's actually experienced that and he's internalized it. [The teacher] hasn't because she was only in the community for a short period of time. So she doesn't know the nuances [of the land].

Now, what ended up happening is he became the local weather guy in a sense for the class. So what I said to her is 'use the protocols for weather where it's done twice a day', so it has to be done at 8 o'clock [in the morning] and at 2 o'clock in the afternoon.

So guess who's there at five to 8 every morning, doing that, comparing it with the Environment Canada stuff? He was more accurate locally than Environment Canada was. And he went from being a kid who was, as she put it, a pain in the backside, to a kid who is now engaged (S. Daniel)

As Jim says creating an environment where Aboriginal students understand that what they learn from the *Land*, from their parents and grandparents, from Indigenous languages is incredibly important[398]. He and Steven both underline how in letting what is present lead the science arises in relationship to other learning.

So if it's berry-picking time, that's where you take your class. Take your class our berry-picking and be patient, because it will take time. You don't start the whole event. It may take multiple events for things to get the [science] information out. It's not like you and I sitting down, having a conversation about specific things where you're drilling me, right? Can't do that. That doesn't work well.

So instead of just learning your colors, your numbers, all of that [in isolation], you can actually have an authentic conversation in the First Nations' language while you're out in the field doing your science stuff.

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[398] Jules Lavellée* also spoke about learning from his grandmother. She was very knowledgeable about plants and took him out in the land with her often.

One of the things that lived with me for a long, long time, she used to ask me to smell the medicine and she used to ask me to taste it, to taste the medicine, to smell and to taste the medicine, with the instruction that when you taste and smell what you're learning about, you will never forget. Well I went–I took a course, right, on how to–I guess it was called the different principles of teaching pedagogy. … And I was thinking about my Grandmother as I looking at all of those principles of learning and I was thinking to myself, there is no principle there that has to do with smelling. Like to be able to actually smell and taste what you're learning about, okay, there was nothing in there. But anyhow, I'll be wandering through a field looking for some medicine some day and I do that quite often and I'll smell a medicine that I smelled in 1946.

So it allows kids to see that, 'you know what? Things have different names but they're the same sort of things'. So we deal with the Latin component of it, English common names, and then we deal with the Aboriginal names. They're in there as well.

Because with the Aboriginal names comes knowledge about how that specific root was used or that sort of thing. So it takes it to a whole new level and instead of our language instructors having to have a difficult time to come up with lesson plans, now they work with the science teacher and it's already done for them. (S. Daniel)

The language and the science live together out in the land, in the berries, in the caribou, in the snow. And when the students, teachers, and Elders go out there together, to teach and learn from each other, understanding emerges in and from place. Jim made an interesting observation about such approaches to teaching and learning: "These are things that I think work anywhere. They worked when I taught in Africa. They worked when I taught in Saskatchewan. But it's only since I've moved to the North and I've learned the vocabulary". In northern Canada, in place, it seems the inarticulable finds voice, and when it does, it tells us that what we are engaged in goes well beyond integration to acts of living with; with each other, with the *Land*, with young people, and with different ways of knowing, being, and doing. This is what becomes possible by seeing the beauty of the whole, engaging with the flux, sitting in place, and letting it be.

The Gardens were here. They just didn't exist yet. That is the only way I can explain it. Not terribly rational or logical for someone with a background in science and engineering. But there you go. Of course, I have been told that the land in Edmonton speaks Blackfoot and Cree; it is still learning to speak English (and French and Ukranian and, and, and…). Maybe that explains it. I do not speak Blackfoot or Cree, and so when the Gardens spoke, they did so in the only way I could understand them, as a fleeting vision.

Shortly after I began my doctoral studies at the University of Alberta, walking through the grounds surrounding the education building with their impeccable landscape of lawn, grass, trees, plants and water features, I had an instant of something considerably less contained and manicured. It reminded me of what my mother called "the jungle" in our back yard; a place that would not yield to her Scottish sense of order and control.

I–and the cats–loved the jungle when I was growing up. We would spend long summer days hidden by large cedars and ferns; the cats sleeping in the shade of rhubarb leaves, or stalking unsuspecting critters; me turning over leaves and rocks to see what I could find, or following vine'y greens through theirs twists and tangles. It was a whole other world from the neat, labeled rows of the vegetable patch. "The jungle" was a place where things lived, where things happened, where learning occurred.

The initial fleeting vision that I had when I first began doctoral studies did not go away. Instead it grew clearer and more insistent–like Coyote in my dissertation, and a sunflower in other writing (Wiseman, 2010b). (But Coyote, the sunflowers, and the Gardens are all related it seems). Every time I walked through the education quad I could see the Gardens (growing). What's more, the Gardens followed me into classes, sitting in the background (growing), listening to practicing teachers in our M.Ed. and Ph.D. programs as they struggled with the idea of engaging with Aboriginal perspectives (in general) and with Aboriginal perspectives in science (in particular). One of these colleagues insisted on showing me the content "integrated and infused" in provincial science textbooks. I nodded, knowing that the offered integration/infusion, though well-intentioned (I assume), was not it. Corinne and I had been consulted by the publisher on that very text. The consultation had been less than satisfactory from our point of view. (Glen is onto something in the difference between consultation and collaboration.)

Gardens.

Such irony. My science background is in engineering. I know very little about gardens, or plants, or gardening. Certainly, I know very little of them in the way we usually consider knowing in science or science education. But, as Jardine (2007) describes, gardens are not so much places of knowing, but of doing, of being, of cultivating, of enriching, of working. Of growing. Of change. Gardens are places of learning. And life.

So, when the opportunity arose to (re)purpose and (re)claim an unused space within our Faculty, and the entire community was asked for input on its use, I sent an email with my suggestion.

Gardens. Gardens of plants native to this place. Gardens that might find a way speak with both people who understand Blackfoot or Cree and those who do not.

And so, we got to help the Gardens into existence. At first, three storeys up. Not physically connected to the land who spoke them in images. But still connected. Still related. I know because when we opened the Gardens, Alvine, my friend and colleague and our project Elder, looked out to the gathered crowd–a group of mostly English speakers–and said, "I wish I could speak to you in Blackfoot". (Excerpt from a paper not yet finished, June 24, 2012)

Chapter 14: Acts of living with: Conversations at Play in The Gardens

In speaking about my inquiry, in presenting at conferences and other venues, I find it is often easier for people to imagine how a relationship with place can develop in northern Canada or in rural areas, where it is assumed people are more in tune with the land, and the cycles that sustain life and living. Steven Daniel* and Jim Kreuger* demonstrate that people can learn to hear the land through relationships and processes, even when they are displaced from their own places. I am not suggesting that teachers (or other people) from southern Canada (or other places[399]) understand the land as much as the Inuit or Dene (or the Mohawk, Blackfoot, Cree, and, and, and …); relationship in and with place for tens of thousands of years provides a knowing of a completely different order, a fluency of shared language. I, and most of the educational stakeholders I know, am still struggling with the inarticulable. We are pointing to a re/cognizable *that* of living experience for which language often fails us. At the same time, I am suggesting that in being in and with place and engaging with the flux in all of its complexity and beauty there is a substantial shift that occurs in how people come to understand what it means to … have Indigenous and Western ways of knowing, being, and doing circulate together in science curricula. I shift the wording in response to my conversations with Steven* and Jim*, but also in response to my own experiences in and with the Indigenous Teaching and Learning Gardens in the Faculty of Education at UA.

The Gardens have been with me since my arrival at UA, but they began to physically emerge in Spring 2011 alongside the research for and writing of my dissertation. In the simplest terms, the Gardens are three locations around the Faculty where plants indigenous to the prairies grow[400]. Two of the sites are planter-based gardens. The planters are located on the third floor of Education North, one on a west-facing balcony accessible from the main corridor, the other on an east-facing balcony accessible through the Faculty's Digital Services offices. The third site is a substantially

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[399] Given the challenges of teacher recruitment and retention in the northern Canada, schools and school boards often look well beyond Canada for educators.
[400] The one non-prairie plant in the gardens is wild tobacco. It was included because it is a sacred plant for many Aboriginal people, peoples and communities.

larger space, located on the ground in the courtyard between Education North and Education South.

For me, the Gardens are a place[401] where everyone involved can engage with the inarticulable through being and doing together; through the act of living with–conversations that sometimes involve the linguistic, and other times do not, but in which we begin to develop deeper understandings of relationships, processes, and place by learning to hear the *Land* speak. I write "we" here because what follows should not be read as solely my work. It has emerged from and is bound up in relationships, in collaboration, in cooperation, and in conversation with many people and the Gardens themselves[402]. These people–and others–walk alongside me in this writing[403]. In this way, I have found my way back to community in research and the kind of learning that happens in the act of living with, which is always where I wanted the research to be.

My conversations in and with the Gardens are somewhat less poetic than the ones I had with Steven and Jim, but the Gardens and I are still coming to know each other, and so we are not quite at the point of completing each other's sentences. I include the Gardens here because they have had such profound conversations with the other elements of my inquiry, and because they have become a place where I have been able to sit with the beauty of the whole and let it be. I include them also because they are an instance of engaging with Indigenous ways of knowing, being, and doing in science (and mathematics) curricula in an urban context, where people seem to struggle more to connect to place and land.

There is so much I could write with respect to the Gardens, so many stories about how they have supported me, my colleagues, and students in coming to understand what it means to have Indigenous and Western ways of knowing, being, and doing circulate together in science curricula, how educational stakeholders are coming to understand what it means to have Indigenous and Western ways of knowing, being, and doing

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[401] Or have become a place.

[402] Some of the people I must mention because they have been key to what the Gardens have become: Stephanie Appelt, Dwayne Donald, Elaine Holtz, Florence Glanfield, Isabel Kootenay, Alvine Mountain Horse, and Tracy Onuczko. Together we have taught with the gardens, learned in, with, and from them, and presented and written (Lunney Borden & Wiseman, in press; Wiseman et al., 2015) about curricula as lived and living in them.

[403] Thomas King and his writing also walk alongside this work. He seems to live in the *inter esse* in a manner I can only aspire to.

circulate together in science curricula, and what is at play in having Indigenous and Western ways of knowing, being, and doing circulate together in science curricula. Although science curricula is now perhaps a poor descriptor. In the Gardens we do engage with curricula that is nominally about science (and mathematics) and the teaching of science (and mathematics), but we find that the Gardens frequently ask things of us "over and above our wanting and doing" (Gadamer, 1975/1989, p. xxvi). What we find is that we really engage in is a curricula of the Gardens in which science and mathematics are immersed and emerge, alongside many other relations who also call for attention and attending to.

In this chapter, I choose to share some conversations that emerged in different courses and acts of living with the Gardens, that have perhaps, finally, provided me with a word that might describe methodology, and have returned me not just to the beginning of my dissertation, but also to the inquiry I initially brought to UA[404]. Apparently, it really is "turtles all the ways down" (King, 2003, p. 2). Hot air rises, cools down, falls back down, repeat.

The Gardens

I have been amazed by how many of my students will not touch things. We go into the River Valley just north of UA's main campus to remember how the relationships we explore in science curriculum and instruction classes–unifying ideas within Canadian science curricula such as constancy and change, similarity and diversity, and systems and interactions (Council of Ministers of Education Canada, 1997)–are active beyond institutional walls in the places where the relationships actually live. Or at least, that is why I go to the River Valley. Along one of the paths is a fallen tree in the process of decomposing. I stick my hand into the humousy interior to provide evidence of how much it feels like the layered earth we are standing on, with dreams of rich conversations about complex cycles, interdependent relationships, and living recursive processes, but am usually greeted with horrified looks, and exclamations of "Ew. Gross." The Gardens have helped.

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[404] Large parts of this chapter have formed the basis for a paper to be published later this year in the *Canadian Journal of Science, Mathematics, and Technology Education* (Lunney Borden & Wiseman, in press).

The Gardens were developed in response to the provincial/territorial mandates to integrate Aboriginal perspectives across K-12 curricula (e.g. AL, 2002), and calls from the Association of Deans of Canadian Education (ADCE) to conceive "comprehensive teacher candidate and faculty programs that create meaningful opportunities for learning about and practicing Aboriginal pedagogies and ways of knowing" (Archibald, Lundy, Reynolds, & Williams, 2010, p. 6). The Gardens are a place where we are deliberate about doing things differently, and trying to shift the status quo. Within the project we therefore interpret the provincial/territorial mandates to engage with Aboriginal perspectives (e.g. AL, 2002) as asking both Aboriginal and non-Aboriginal peoples to live together as Treaty peoples, to "learn from each other in balanced ways" (Donald, 2013a, p. viii), to honour and listen to the land that we share, and to understand that "the sustainability of human life and living *depends* on the repeated renewal of good relations with the entities that give us life" (emphasis in original, Donald, 2013a, p. viii). So the project is about living with the plants, the Gardens, and each other in science (nominally) curricula, but also about living with the plants and the Gardens on their own terms. In working with pre- and in-service teachers in the Gardens, we thus attempt to balance more structured investigations–such as exploring antibacterial properties of certain plants, or learning how to bundle sage with one of our project Elders–with significantly less structured instances of being and doing–times of planting, building, clearing, and harvesting, or just sitting with the Gardens, where it may appear that not much is occurring with respect to science curricula. In committing to bringing the approaches together we discover how much the Gardens have to teach, or as Florence says how "The Gardens are leading with people to act for them".

In engaging in a living relationship with the Gardens what emerges in curricula reflects that livingness. In the Gardens we have delved deeply into explorations and conversations about patterning, seed collection, plant propagation, policy and programs of study, propulsion, planning, stability and structures, lesson plans, microclimates, thankfulness, volume to area conversion, heliotropism, invasive species, the Canadian Constitution, relationships, programs of study, observation, classification, language, art, story, the quality of sheep manure, residential schools, and, and, and … . We have written how the gardens–which we initially saw in isolation as a means of entering into

conversations about engaging with Indigenous perspectives in science–wind their way into the classes to support all participants' ongoing and developing understandings of what science teacher education and science teaching and learning might be when Indigenous and Western ways of knowing, being and doing circulate together (Wiseman et al., 2015). The Gardens have become a safe place where we can engage with the messiness, and let conversations and explorations take root to grow well beyond neat and tidy borders–disciplinary or otherwise. I suggest that because the assumptions underlying and embodied in the work are based in the deep relationality of Aboriginal ways of knowing, being, and doing, the Gardens open up both to what emerges and what is required in particular moments. The following acts of living with emerged from conversations in, with, and about the Gardens are reconstructed from field notes taken during classes involved in the Gardens.

Act 1 – A place for learning

The first class to be involved in the Gardens was a group of pre-service secondary science minors taking their science curriculum and instruction course in Winter 2011. Over the course of the term they were introduced to the project, built a sheet mulch for the balcony gardens, researched and seeded indigenous plants, and developed information resources about the plants. Explorations in the Gardens were accompanied with ongoing conversations involving the course instructor, and other project members including one of our project Elders, Alvine Mountain Horse. Project participants not directly involved in the course, including myself, spent significant time learning with the class beyond work on the Gardens in order to develop a deeper sense of community.

One of the first acts of living with occurred during the first activity in the Gardens, sheet mulching. Given short time lines, Elaine Holtz (our building manager), Tracy Onuczko (the course instructor), and I had pulled together a variety of potential materials which might be layered together, to decompose and (by spring) provide the soil in which we would plants seedlings. As the sheet mulch class started we were aware of a few sticking points in our plans: the newspapers Tracy and I had gathered together the previous day had been removed over night by cleaning staff, it was January and there was no way to turn on outside water to wet the mulch (a key part of the process), and we had

calculated that the amount of gravel required for drainage in our planters exceeded balcony capacity in terms of weight. In this last challenge, an alternative offered itself on the morning of the class when university groundskeepers were pruning trees across campus–we acquired the tree trimmings as a potential drainage material. Nonetheless, Tracy and I both felt some tension about whether the class would come together in any coherent manner.

Once out on the balconies, however, our worries proved fruitless. The class started with a short conversation with Alvine. She explained to our pre-service teachers how, if they had Indigenous students in their own classrooms, in a project such as the Gardens their students might want to acknowledge the teaching of the garden by perhaps saying a prayer and offering a gift to it as a way of giving back and being thankful for the learning. She told the science minors students that as teachers, they did not need to do anything special in this regard, other than to let it happen. Then Tracy and I outlined the challenges at hand, divided them into two groups (one for the east balcony the other for the west), provided some options for how they might proceed with sheet mulching, and let them at it.

In this moment we observed the pre-service teachers engage in a living process of problem solving. They found a means of transporting water down a long hallway in large quantities by acquiring a wheeled garbage bin. They discussed the problem of drainage and the lost newspapers, breaking into teams to rifle through faculty recycling bins for needed materials, and worked out the problem of how to construct a sheet mulch as a group. In the livingness of this experience, to our surprise, some of them also demonstrated a deeper understanding of the Alvine's teaching than we could have imagined. On the east balcony, one of the students stopped the group at one point to remind their colleagues of what the Alvine had said about giving back and being thankful for learning. Their practice as a group was to save compostable materials from lunch and deposit them in the department's worm composter. Instead they gave their materials to the garden as thanks and something that would give back to the Gardens in tangible ways by contributing to the soil. It was a small, but surprising gesture that signalled the Gardens might indeed be a place for learning.

Act 2 – Learning from place: Recursion in observation

In Fall 2011, the balcony gardens were in full bloom. My class of pre-service elementary teachers went to the Gardens to spend some time with a single plant. The intention was to get at the challenges of observation. Paper and coloured pencils were available; students were also invited to use their camera phones or other devices as desired. In the process of observing, one young woman caught my attention. She sat intently with the tobacco for some considerable time then went off to mark something down on paper. She repeated the process at least two more times, with an intensity that I had not seen in her previous work. On returning to our classroom, a lively discussion ensued. Students explained how they tried to figure out what to observe in something as complex as the plant, how their observations included things like patterning of leaves which could also be taken up in mathematics, and how the materials available for noting observations sometimes did not accurately reflect the colours observed (this was true of the available pencils and certain camera phones). A new conversation started from this last point about how technologies might impact the ability to make accurate observations.

Eventually the student who had spent so much time with the tobacco put up her hand. In a run-on sentence of "I looked … and then I looked again … and then I looked again," (field notes, October 2, 2012), she excitedly explained how at first she had just seen the tobacco as a whole, but how the longer she looked the more it emerged, until she felt as though she were almost falling into the plant. In each return to the plant, she looked at it more closely, and saw something new. She was taken and somewhat amazed by how much she could see in just spending time with the plant, how in viewing the detail she somehow gained a better sense of the plant as a whole–and idea she had not considered before.

Act 3 – Place speaks: Recursion in teaching and learning

The story of the student falling into the depths of the tobacco plant and her description of that experience stayed with me. I described it to people on numerous occasions (e.g. Wiseman et al., 2013) because it spoke to me about the kind of richness of experience I always hope students will have with science curricula. It also spoke to me because it seemed that in seeing something both smaller than the whole and much bigger

than it, the student was almost describing an entire world. In the Spring of 2013, co-teaching[405] the course, *Engaging with Indigenous Perspectives in Mathematics and Science*–which was designed around the Gardens–I shared the story with class members.

One of them, a teacher who is Cree, identified with the story because it reminded her of a word in Cree, *kiskanowapâhkêwin*. She explained that the word means something like "a keen sense of observation" (field notes, May 11, 2013). Like the observations of the tobacco plant, however, we had to spend time with the word and live with it in order to understand it both in more detail and more fully. Over the next few classes, she expanded on the word considerably: "It's not really just a keen sense of observation, but also how you are in relation to the observation," (field notes, May 13, 2013) then "The relation to the observation is also about place", (field notes, May 15, 2013) and finally, how the thing observed (whatever it is) is "trying to tell you something. By listening to it, we learn from it" (field notes, May 15, 2013).

Tracy and I had understood the importance of place to Indigenous ways of knowing, being, and doing prior to the course and to learning about *kiskanowapâhkêwin*. It was an understanding, that in retrospect, was quite abstract[406], about which we were trying to feel out a sense of pattern. Still, we engaged with place anyway, planning the course such that place played a significant role. There were readings (e.g. Barsh & Marlor, 2003; Hermes, 2005; Johnson, 2008; Watson & Huntingdon, 2008) and conversations about place throughout, conversations about how place structures and is embedded in programs of study, as well as return to specific places like the River Valley, the Gardens, and a place of each students' choosing at regular intervals. We engaged with doing and being with place before any real knowing became apparent. Through engaging in the process, through the act of living with students (and others) in the Gardens (and other places) when *kiskanowapâhkêwin* emerged it became a way of understanding how and what the Gardens taught, and how learning could emerge from place.

While I am not yet certain I fully understand the extent of *kiskanowapâhkêwin*, when it was spoken aloud and entered our conversations, what the pre-service elementary teacher in the previous course had experienced opened up more fully for me. I began to

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[405] I co-taught this course with Tracy Onuczko. Florence Glanfield and Dwayne Donald also supported the course.
[406] It may still be quite abstract.

wonder if the observation where she fell into the tobacco was somehow indicative of her hearing the plant speak like Kimmerer's (2003, see introduction to Part III) mosses. *Kiskanowapâhkêwin* also helped us to understand more deeply the focus of the Cree teacher in our course. She was remarkably open about her ongoing and long-standing tensions with mathematics. In the Gardens, however, mathematics spoke to her, and so she returned to it for the first time in many years, and began to rebuild and re/cognize her relationships with it (class reflection, May 16, 2013; class reflection, May 21, 2013; class reflection, May 25, 2013; synthesizing reflection, May 27, 2013).

Echoing Moments of *Kiskanowapâhkêwin*:
The Act of Living with Inquiry through Recursion

Peterat and Mayer-Smith (2013) speak about how in their gardens at the University of British Columbia they find special qualities to the learning that occurs that seem to ask for new theoretical concepts, new methods, new methodologies. My involvement with the Gardens at UA makes me suspect the concepts and methods they are seeking are not new, but old, active and belong to the land; something like *kiskanowapâhkêwin* which reminds us to pay keen attention both to what emerges and what is required in moments in particular places.

I have begun to wonder if *kiskanowapâhkêwin* is the answer to my methodological problem–at least in regards to this inquiry. It seems caught up in relationship, process, and place. It appears active and at play in the world. It somehow asks for reflective and ongoing return. Most importantly, it is a word that comes from and allows me to give back to the land where much of this inquiry had been formed and taken place. In *kiskanowapâhkêwin* there is considerable relief from tension. At the same time, as with Coyote, I am wary of claiming the word, it is not mine. Perhaps it is a gift, an invitation to return to the middle, learn more, and begin again. I continue to sit with it, return to it, and try it on in various places.

Whatever emerges in the Gardens seems to open up possibilities, rather than shutting them down (Kovach, 2005). I was reminded of this as I read an email from the teacher who first spoke, *kiskanowapâhkêwin.* "Let's talk soon, I have been thinking about time and place in mathematics quite a bit. I fully blame you...I hear whispers of 'are you

thinking like a mathematician' in the winds as I walk" (personal correspondence, October 28, 2014). She is still engaged in and returning to acts of living with (Converse, 2012) mathematics, more than two years after the Gardens asked it of her. I suspect it is because, in the Gardens, we learn to hear what the *Land*–and the *Wind*, and the *Water*– have to teach, and in learning to hear them, it becomes much harder not touch and be touched by the teaching.

"I think you might enjoy Green Grass, Running Water (King, 2007)*"*
Florence said. So, I read it because I was stuck in an unhopeful moment
and sick of reading academic papers. (Also, because I might be a little in
love with Thomas King's sense of humour.) It opened things up again so
that I might write. Where Coyote had been a physical and metaphorical
skulker before the reading, he now intruded rudely in the writing. I tried
shushing him away, but he wouldn't go. I said, "You don't belong to me",
and he transformed into a preening Hermes, clearly quite fond of the
golden wings. "Better?" he asked. "No," I replied, "That form doesn't
suit you in this place." So, he changed back, huffed "Better get used to it
then" and slunk away.

Months later, not stuck, but after a long day of writing, running, and
worrying about the impact of an impending spring snowstorm on my in-
laws' return from Houston, I stumble across a paper by Margery Fee and
Jane Flick (1999) called Coyote Pedagogy. *I skim it and to my surprise*
they are writing about Green Grass, Running Water *(King, 2007) and the*
"illegal border-crossings" (Fee & Flick, 1999, p. 131) it requires to–for
example–put together three fishermen called Louis, Ray, and Al as Louis
Riel. My first thought is 'it isn't about border-crossings, it's about being
in the inter esse'. I make a note to read it more closely and go off for a
bath.

As I lay in the hot water in the space of not quite here or there, a thought
comes. I see the dissertation from a distance and it finally looks whole. I know
where this is going, and it's right back where I started–but not really. A shadow
passes by the bathroom door. "YOU!" I shout as I leap out of the bath. (Personal
journal, March 11, 2014)

Part IV Redux: Caught Up in the Flux and Letting It Be: Returning to the Middle and Beginning Again

Once you see the beauty of the whole and get caught up in the flux, conclusions–like everything else–become tricky. I am still experiencing the joy of my runner's high, but given that I have returned to re/cognizable, family/iar terrain, I can take a brief pause to consider how the middle–the *inter esse*–looks from this vantage point.

When I teach, there is usually a point in the course where I have to say, "If you came here looking for definitive answers, you've probably come to the wrong place". In undergraduate curriculum and instruction courses, the conversation frequently occurs around lesson planning, when students want to know precisely how I want sample plans laid out. Instead, we have conversations about the intentions of lesson planning, what lessons plans are meant to do, what they usually include and why. We also explore different lessons plans and unpack them together. It would be likely quicker to tell students what to do, but that would be more like disseminating information than learning that is interconnected and intertwined. So, I ask each of them to consider what works for them and why–to struggle, to do something (maybe differently), to be creative, and consider meaning in and via practice–with the hopes that they gain some sense of pattern or perhaps get a glimpse of the beauty of the whole. It is not a process without relationships, guidance, or resources, but it is a process. It is doing and being that (hopefully) results in some knowing, and sets off a rhythm of return.

Given my commitment to *māramatanga*/effulgent coherence, where I practice the teachings and ideas that I am teaching so as to live the ideas I believe in, I find a similar pattern within the confines of my inquiry that has applied at various levels of complexity. In my own coming to understand and that of the educational stakeholders with whom I had conversations there have been early iterations that may be terrible, or seem poorly connected, a developing sense of pattern, and (in some cases) the revelation of seeing the beauty of the whole and getting caught up in the flux. I have played with this emerging pattern, as methodology, in the writing of the dissertation, trying to support readers in earlier parts of the writing through more explicit explanation of what I am doing and why, and, as they get a sense of the pattern, hoping they become caught up in the flux to see the beauty of the whole. Given *māramatanga*/effulgent coherence and these parallel

processes, there should be little surprise that there are no authoritative conclusions here, no direct or definitive answers, no hard and fast rules, but more of an invitation to enter the *inter esse*, get comfortable with the discomfort by doing something (different and creative), and track to your own understandings based one what you can see and where you can start.

Still, I understand the need for some kind of closure, some temporary rest in the activity of creation for reflecting more explicitly about what I have come to/and coming to understand. So, I offer some thoughts I am playing with, some ideas that have addressed me, some observations that might be helpful in terms of keeping the conversation going, the possibilities open. In addition, as a means of considering what I have and have not addressed within the confines of this dissertation, I offer some suggestions for further inquiry, and, describe my own next steps given what I am currently caught up in and tracking.

Considering the Questions that Addressed Me

The essence of the *question* is to open up possibilities and keep them open (Gadamer, 1989, p. 333, emphasis in original).

The possibilities of having Indigenous and Western ways of knowing, being, and doing circulate together in science curricula opened up for me more than twenty years ago with Corinne's seemingly simple question, "You know those science camps you ran for kids as an undergraduate? Do you think we could run them for Aboriginal kids?" The possibilities are still open and I have become immersed in engaging and returning, in re/cognizing tracks laid down/being laid down/yet to be laid down by both myself and many others as we have been/are caught up in trying to understand the ways in which Indigenous and Western ways of knowing, being, and doing might and do circulate together in science curricula, in academic inquiry, in Canada–as a particular place in which wisdom resides.

Corinne's question was tricky. It has transformed many times over the years, and I have followed it, tracked it via acts of living with, doing and being, engaging in the activity of creation emergent from and immersed in my understandings of Indigenous and Western ways of knowing, being, and doing, and the meeting places between them. The

form that lead me to UA was caught up in examining the fertile projects I came to know at NAEP–projects that might be labeled STEM, although I still prefer to avoid such naming–in the places where they were being taken up, to try and tease out what it is about them that seems to work for young Indigenous people and their teachers. At UA, the question transformed again in listening to science teacher colleagues as they struggled to understand what it means to integrate Indigenous perspectives in science curricula, this time to three questions around meaning and play:

> *What does it mean to integrate Indigenous perspectives in science curricula?*
> *How are educational stakeholders coming to understand what it means to integrate Indigenous perspectives in science curricula?*
> *What is at play in integrating Indigenous perspectives in science curricula?*

These questions have shifted and transformed in the process of doing the research, as the word integrate has become a poor fit for what is at play, except perhaps in early iterations:

> *What does it mean to have Indigenous and Western ways of knowing, being, and doing circulate together in science curricula?*
> *How are educational stakeholders coming to understand what it means to have Indigenous and Western ways of knowing, being, and doing circulate together in science curricula?*
> *What is at play in having Indigenous and Western ways of knowing, being, and doing circulate together in science curricula?*

Even now, the questions are still not static, but it does not really matter, I am more interested in what they do, how they act, and what they open up. The focus is–as it always has been–on meaning, coming to understand, and considering what is at play, at risk in the *inter esse*.

Within this particular inquiry–within my work of the last 20 plus years–the whole is in the parts, and the parts are in the whole. What answers there might be to the questions that addressed me in this inquiry lie in the instances of doing and being I have shared. Despite their differences, each of the instances are what it means to have Indigenous and Western ways of knowing, being, and doing circulate together in science curricula *AND* are how educational stakeholders are coming to understand what it means

to have Indigenous and Western ways of knowing, being, and doing circulate together in science curricula *AND* are what is at play in having Indigenous and Western ways of knowing, being, and doing circulate together in science curricula. Part of the answers to the questions, is that it means to struggle, to experience tension and discomfort, and to do something despite the struggle and tension *AND* that in the struggle, the experience of tension, the doing it is possible to come to understand, or–at least–become comfortable with the discomfort. From early iterations (K. Denning*; C. Laflamme*), to getting a sense of pattern by doing differently (B. Dobbs*; K. Ealey*; F. Elliott*; G. Henkleman*; R. Herrmann*; H. King*; T. Onuczko*; S. Taylor*), to getting caught up in the flux (S. Daniel*; J. Kreuger*), each iteration of recursive practice undertaken by the educational stakeholders who informed this inquiry in some ways addresses provincial/territorial mandates regarding the integration of Indigenous perspectives in science curricula.

As the educational stakeholders engaged with iterations of doing and being– "see[ing] what we could do" (B. Dobbs*), "try[ing] lots and lots of things" (T. Onuczko*), reconsidering, revisiting and reframing "discouraging experience[s]" (S. Taylor*), recognizing "dogmatic" (F. Elliott*) or ruttish teaching practices (J. Kreuger*; K. Elliott*) and attempting to step outside of them, move beyond them (N. Blood*; S. Daniel*; P. Garrow*; G. Henkleman*; R. Herrmann*; H. King*; J. Lavallée*)–they began to recognize what is at play, at risk, at stake, in having Indigenous and Western ways, of knowing, being, and doing circulate together in science curricula.

What is at play is broad–it includes the authority of individual educational stakeholders in their own contexts and the personal sense of *māramatanga*/effulgent coherence for each. Also at play are the authority of the program of study, of the stakeholder's understanding of science, of science, of Western ways of knowing, being, and doing. Perhaps Tracy* summed it up most succintly when she spoke about how acknowledging that humans have reciprocal relationships with abiotic elements of the environment could lead to significantly different choices about how those elements are understood. She and I are agreed, children taught that they have a reciprical and mutually sustaining relationship with the *Land*[407] might not be so quick to exploit it solely for

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[407] This teaching is not inconsistent with scientific understandings of the world and the way it works.

economic gain as adults. The Elders I spoke with, Narcisse Blood*, Peter Garrow*, and Jules Lavallée* hinted about how such changes take hold, and shift thinking about relationship between people and peoples, between the human and the other-than-human. As Darren McKee* said, "It's a revolution" and revolution means struggle. While the educational stakeholders with whom I had conversations are struggling with what such conversations might look like and imply in terms of science curricula, for those who are getting a sense of pattern or seeing the beauty of the whole, there is tremendous potential and opening up in the tensions as well. There is questioning of the assumptions underlying science curricula that leads to iterations where they are creative, try to do things differently, and in some cases begin to let go of authority because of what is opened up in doing so. In letting go of some authority, like Greg Henkleman* in the national park, they come to learn alongside their students and acknowledge science curricula as just one part of a larger living experience of learning and what it means to be human in relationship to all our relations. In these cases, as in policy and programs of study developed in collaborative processes where provincial/territorial governments cede some genuine authority to Indigenous people, peoples, and communities, integration begins to become an inadequate word for the processes at play and there is a possibility for a return to *māramatanga*/effulgent coherence.

The livingness in learning Greg Henkleman* noticed alongside his students in the national park resonates and comes alive in projects such as the Gardens and those in NU and NT I discussed with Steven Daniel* and Jim Kreuger*. These projects begin in *Land* and from place. They involve communities where everyone teaches, everyone learns, a genuine sharing of authority that is accepted for what it is on both sides, a letting go of some control to attending to what emerges in place and the lessons that present themselves. Lessons that force you to acknowledge and honour great cycles and be flexible about curricula, because there is no way to consider budding plants in a garden still covered snow. In the attending, the acceptance, the honouring, the letting go and letting be–in getting caught up in what is present, it becomes possible to see the beauty of the whole, to hear the *Land* speak, and listen to what it teaches. In the Gardens, when the *Land* speaks some times it asks us to attend to science, sometimes to mathematics or technology, or engineering, and other times to the experience of residential schools, the

planning of lessons, the stories of Elders, or the bundling sage. None of these lessons are mutually exclusive, sometimes they arise at the same time, and we sit with the difficulties they present.

> What we have found in the garden … is that the tensions around engaging with Aboriginal perspectives have become generative (Aoki, 2005). In working with the students, we acknowledged that the tensions exist, but we focused on the tensions as differences that open up possibilities, rather than shutting down possibilities (de Mallac, 1989; Joshee, 2006; Smith & Carson, 1998). By transforming our practice, by doing things differently, by choosing to engage with Aboriginal perspectives in an ongoing community …, by literally planting our conversations in the ground, preservice science teachers (and teacher educators) had time to let thinking, ideas, and questions germinate and grow. In so doing, we have begun to reframe our own practices and understandings of science teacher education just as our preservice teachers have begun to reframe their understandings of science education; all of us have been amazed by the new possibilities that have opened up. Content, pedagogy, philosophies, epistemologies, and ontologies have wound around each other into a whole, where each was still identifiable but also mutually engaged. … It has not done away with the anxiety and vulnerability involved in becoming a teacher—the preservice teachers are still deeply concerned with what to teach, how to teach it, and in what manner they might consider planning, preparation, and so forth (as are we)—but, in the words of one of our preservice teachers, engaging with Aboriginal perspectives, like building a lesson plan, has become "totally doable" (personal communication, May 8, 2012)" (Wiseman et al., 2015, pp. 246-247).

What I have learned, or perhaps remembered, in undertaking this inquiry and spending time in the Gardens is the importance of letting go, of sitting with the difficulties, reveling in the tensions between Indigenous and Western of ways of knowing, being, and doing, and getting comfortable with the discomfort. I have learned/remembered that doing and being precede knowing and that this idea from my Indigenous friends, colleagues and family, extends way beyond integrating Indigenous perspectives in K-12 science curricula. Letting go opens up science curricula, science teacher curricula, curricula, to living experiences where life and learning are one and the same. Letting go opens up to the complexity of doing science, becoming competent, becoming teachers, becoming human. In such letting go, we are therefore also letting be– letting the Gardens be, letting our students be, letting ourselves be, letting Indigenous and Western people, peoples, and communities be who and what we are, and in doing so

perhaps creating or generating the conditions by which we can learn what it means to live together. Here perhaps we can begin to inhabit the ground for reconciliation.

Thus, after more than two decades of living (or trying to live) in the *inter esse*, the Gardens are the place where I have come to see the beauty of the whole (as far as I am capable). I speak about them enthusiastically and often because the teachings they offer are so rich, and so frequently unexpected. When I speak about the Gardens, people push me to label them. They suggest ideas such as project-based learning, place-based learning, best practice, or STEM. I understand where they are coming from in each of the suggestions, but I am wary of them, because, as it stands, the manner in which the suggestions tend to be framed is solely in assumptions based on Western ways of knowing, being, and doing, whereas the Gardens are not.

In the Gardens we focus on learning, on coming to know, on relationships, on process, on place. As such, we have made deliberate choices to try and keep the Gardens as open as possible, to let them be what they are, to try not to frame or bracket anything out. It is a little messy, but life is messy, and one of the things we are looking for is life and livingness in teaching and learning. In the Gardens, we–and our students–find that life and livingness. We learn to hear the *Land* speak, sometimes only in whispers, sometimes by falling into the plants and finding a whole world in them. So, I resist putting labels on the Gardens, or projects like them. The most I will concede is that the Gardens are an ongoing, living project or exploring; they are an act of living with. I resist the labels because I want to be able to hear what else the Gardens might say, what else they might teach, what else they (and I) might become, as we engage in this ongoing recursive process of living together.

Possibilities Emerging from the Inquiry

In engaging with the flux and letting things be as they are, many possibilities opened up and asked to be addressed. Within the limits of a single inquiry not all tracks can be followed. So, within my considerations of policy, practitioners, and practice there is much work left to do, many questions left to explore.

Given that I did not manage to have conversations with people from BC or YK for this inquiry, conversations with educational stakeholders in those jurisdictions could

broaden and add to the understandings emerging from the questions I have considered. In addition, while my ethics allowed for conversations with K-12 students, these opportunities did not emerge in the process of doing the research. Kanu (2011) has had some brief interactions with students around engaging with Indigenous perspectives in social studies and language arts, but there is still much to explored in this regard across K-12 curricula. As Jim Kreuger* pointed out, the exemplars in place in NU seem to support educators in coming to understand how Indigenous and Western ways of knowing, being, and doing might circulate together in science curricula. More studies examining specific instances of implementation and classroom practice across jurisdictions would thus support developing understandings among science educators about possibilities for having Indigenous and Western ways of knowing, being, and doing circulate together in science curricula. Although I caution against treating such exemplars as best practices, I understand the importance for people to have some sense of "what this looks like". In all of these cases, I would suggest that people resist trying to label exemplars within pre-existing frameworks. It is still early days, where it is more important to gain a sense of pattern, to learn what it means to get caught up in the flux, and to get comfortable with the discomfort that can cause. Tell me what exemplars do, tell me how they act, what they open up, what is created in their use; relationships to curricula and specific programs of study can flow from process.

There is certainly room for more focused considerations of policy and programs of study and the manner in which they frame how Indigenous and Western ways of knowing, being, and doing might circulate together in science curricula. While Aikenhead and Elliott (2010) have documented and considered the development and initial implementation of science programs of study that address engaging with Indigenous perspectives in Saskatchewan, and a recent article by Kim and Dionne (2014) examines the significant variation in the presence of Traditional Ecological Knowledge (TEK) in grade 7 and 8 science programs of study across Canada, there is little other work that examines policy and science programs of study in depth with regard to how Indigenous and Western ways of knowing, being, and doing might circulate together. A number of interesting studies suggest themselves from within my brief look at policy: a comparison of jurisdictions where policy and programs of study are immersed in and

emerge from collaborative processes and those where they are immersed in and emerge from consultation; a deeper consideration of the collaborative processes in SK, NU, and NT individually or together; the manner in which emerging competency-based approaches to programs of study in AB and BC might impact ways in which Indigenous and Western ways of knowing, being, and doing might circulate together in science curricula.

In addition, while I have pointed to difficulties around language in relation to my questions, and have let language out to play within the confines of the inquiry, there are many explorations around language to be considered. As I have noted (see Chapter 9), given my experience of the last 20 plus years, one area that interests me is how in instances where Indigenous and settler people come together they can mean quite different things in using the same English word. I have begun a consideration of language around unifying ideas and defining features within science programs of study in this regard. I have also begun to think about how Indigenous languages (or understanding about Indigenous languages), might support teaching and learning in science. Here, I am interested in how concepts explored in the sciences, such as energy, which are really processes of ongoing transformation, might be more effectively understood through verb-based languages rather than noun-based languages.

There are no doubt other lines of research to consider, other tracks to follow, given that a body of work with regard to how Western and Indigenous ways of knowing, being, and doing might circulate together within curricula is only beginning to emerge. There is much work left to do.

What I am Tracking

Unsurprisingly, what has spoke to me most deeply in the inquiry–besides my struggle with methodology–has been the Gardens and similar projects in northern Canada (S. Daniel*, J. Kreuger*). Despite how some of my earlier statements might be read, I am not claiming that everyone learns to hear the *Land* speak by engaging with place. I am claiming that the conversations I had as part of this inquiry and evidence from the courses that have occurred in the Gardens strongly suggest that that developing relationships with place significantly impact educational stakeholders' understandings of how Indigenous

and Western ways of knowing, being, and doing might circulate together in science curricula.

Place in this sense is a fluid concept. For people with little understanding of Indigenous ways of knowing, being, and doing, place may just be a location in which they are comfortable, but–because of that comfort–more able to enter into conversations in which Indigenous and Western ways of knowing, being, and doing circulate together to get at some sense of pattern. For people more familiar with Indigenous perspectives, place may be an intimate relationship with and belonging to specific geographical places, *Land*, that allows people to hear and understand what places have to teach (J. Kreuger*), where they might see the beauty of the whole.

The research we have undertaken in conjunction with courses in the Gardens indicate that on going, living projects, such as the Gardens facilitate a deepening relationship with place for both Indigenous and non-Indigenous, pre- and in-service teachers (Wiseman et al., 2015). Research by Lisa Lunney Borden with similar types of living, inquiry projects, shows similar results for K-12 Mi'kmaw students in mathematics (Lunney Borden, 2010; Lunney Borden & Wiseman, in press). Given the synergies between our work, we hope to come together, possibly with Jim Kreuger* and Steven Daniel*[408], to try and tease out more thoroughly what is at play in approaches to curricula that begin from place or perhaps *Land*.

So, in some ways, I find myself back where I had intended to begin when I arrived at UA, with an interest in exactly the kind of fertile projects I came to know at NAEP. But now I know these are not STEM projects, just ongoing, living explorings embedded in and emergent from the *Land* that might teach and ask interesting questions about science, technology, engineering, and mathematics (Lunney Borden & Wiseman, In press), but also about language, living, living together with all our relations, and, and, and … . So, I am not really back at the beginning, just in a family/iar place very close by and related to it somewhere in the middle. I bring more understanding to it now having become caught up in the flux and seeing the beauty of the whole.

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[408] And the people already involved in the Gardens.

A Penultimate Thought

In some other version of this dissertation–some other story–I might have moved from consideration of policy, through the conversations with educational stakeholders, to the Gardens as an example of practice, making the case that each element built on or responded to the previous elements in some manner, and moved inexorably along a pre-established methodological path I was following towards some particular theory and/or a checklist of recommendations for practice, thus solving the problem at hand[409]. That other story assumes some kind of linearity and identifiable causality at play; it assumes I am in control. My process/method, however, is not the reactive *currere* described by Wallin that follows along a well-worn rut. It is rather an active process of exploring and trying to understand the emergence of new (and simultaneously existing) territory, by engaging and returning, by re/cognizing tracks laid down/being laid down/yet to be laid down by both myself and many others as we have been/are caught up in trying to understand the ways in which Indigenous and Western ways of knowing, being, and doing might and do circulate together in science curricula, in academic inquiry, in Canada–as a particular place in which wisdom resides. Perhaps I might name this process *recurrere* or *kiskanowapâhkêwin*–they are both old words emergent from *Land*, and somehow fit what has occurred in actually doing the inquiry. Maybe methodology is a conversation between these two old words–a return to the past in the present that opens up the future creatively. But that is an exploration that needs more reflection, more conversation, more living with, more time in place and with the *Land*. In this moment, I can live with and in the tension and discomfort[410] of the inarticulable, which has asked me to focus on doing and being–both my own and that of others. As such, this story assumes recursion, interrelatedness, and interdependence. This story assumes I tracked and followed Coyote–or his dog/ged relative, Soldier–into and through the Gardens, while chasing a pair of jeans–or a trio of questions–that in and of themselves may not be/have been that important in any way, other than as a means of coming to see the

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[409] Or at least giving the impression that there is a problem in the first place.

[410] I acknowledge here that during my dissertation defense I was made aware of Boler's (1999) work on the "pedagogy of discomfort" (p. 175). As explained to me, her term seems to act in a similar manner to what I have described as "becoming comfortable with the discomfort". While I have not yet explored Boler's work in detail, I acknowledge that it may come to inform my own as I move further into the work.

beauty of the whole–*māramatanga*/effulgent coherence–finding a way to reconsider older questions, and returning to the beginning again somewhat transformed.

62. We call upon the federal, provincial, and territorial governments, in consultation and collaboration with Survivors, Aboriginal peoples and educators to:
i. Make age-appropriate curriculum on residential schools, Treaties, and Aboriginal peoples' historical and contemporary contributions to Canada a mandatory education requirement for Kindergarten to Grade Twelve students.
ii. Provide the necessary funding to post-secondary institutions to educate teachers on how to integrate Indigenous knowledge and teaching methods into classrooms. (Truth and Reconciliation Commission of Canada, 2015, p. 294)

I am looking for India, says Jacques Cartier. Have you seen it?
*   Coyote makes a happy mouth. And that one wags her ears. Forget India, she says. Maybe you want to play. (King, 1992, p. 29)*

Afterword: Tracking Coyote to a Closing Thought
that Opens Things up Again

As I bring this writing to an end by returning to the some of the questions I arrived with at UA, I wonder about this story I have told, I wonder about the questions I have asked. I look back on the whole of the work, and think of a Blackfoot word shared by Narcisse Blood*, *aokakiosiin*–the concept of being "wisely aware of where you're at…Of things that you see–not just things you see, but things you don't see. That is very important, one component of pedagogy", and I think Coyote (or perhaps in Narcisse's case it is Naapi) may be playing with me again/still. I can see this story from where I am, from where I sit in the *inter esse,* and I can see that there are many other paths near to the one I have tracked, perhaps just ahead of me in time, perhaps a long way off, but close to where I am right now–I have learned/am learning that the past, present, and future are not necessarily linear. I am reasonably sure that the path in which these other stories are immersed and from which they emerge, is the same one I am on–but deeper into the complexity–maybe on another related layer. I cannot be certain. Still, I sit with the thought/vision and let it be. In doing so, I begin to hear another story circulating that might be told. A story built from what Lear (2006) names as radical hope, an idea he comes to through an exploration of Crow nation Chief Plenty Coups who in 1921 (p. 33) deliberately laid down the very items that symbolized how his people knew themselves, so that they might continuing being. Lear writes that radical hope "is directed toward a future goodness that transcends the current ability to understand what it is. [It] anticipates a good for which those who have the hope but as yet lack the appropriate concepts with which to understand it" (p. 103). It is inarticulable, just a feeling, the sense that there is something to track, perhaps a way to find a sense of pattern, or find a way back to pattern. In the radical hope version of this story, the policy, curricula, educational stakeholders etc., still play a role, but their impetus is not from policy put in place by settler governments, rather from a long-term plan laid out by people Indigenous to this place who, in the face of genocide, held on to radical hope and the sense that we are all related to understand that it might be possible one day for settler people, peoples, and communities to become, through conversation, through acts of living with–if not human to this place, more human. Perhaps what I have examined in this inquiry is just a

beginning to that process. But who says a story needs a beginning, middle, and end?

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Appendix A: Research conversations dates

Narcisse Blood, March 15, 2012

Steven Daniel, April 4, 2012.

Kathy Denning, December 3, 2011.

Bill Dobbs, January 31, 2012.

Ken Ealey, February 1, 2012.

Frank Elliott, January 26, 2012.

Peter Garrow, April 13, 2012.

Randy Herrmann, December 3, 2011.

Greg Henkleman, January 28, 2012.

Haley King, March 26, 2012.

Jim Kreuger, December 3, 2011.

Caroline Laflamme, April 9, 2012.

Jules Lavallée, December 3, 2011.

Darren McKee, December 2, 2011.

Tracy Onuczko, November 22, 2011.

Sherry Taylor, Skype on April 4, 2012.

Appendix B: Policy and Programs of Study Examined

Policy

Working from the definition of policy provide by (Abele et al., 2000, p. 3) that policy "is what any government [or other institution] decides to do or not do" (p. 3), I include within policy explicit policy documents, agreements that touch on the need for integration of Aboriginal perspectives in provincial schools where there is a significant enrolment of Aboriginal students, and action plans and implementation/integration documents from which the existence of some policy regarding integration of Aboriginal perspectives across curricula can be inferred

Explicit policy documents

- AB: *First Nations, Métis and Inuit Education Policy Framework* (Alberta Learning, 2002c)
- NT[411]: *Aboriginal Student Achievement Education Plan* (Department of Education Culture and Employment, 2011) and *Education Renewal and Innovation Framework: Directions for Change* (Department of Education Culture and Employment, 2013b)
- NU: *Inuit Qaujimajatuqangit* (IQ): *Education Framework for a Nunavut Curriculum* (Nunavut Department of Education, 2007)
- ON: *First Nations, Métis, and Inuit Education Policy Framework* (Ontario Ministry of Education, 2007b)
- SK: *Building Partnerships: First Nations and Métis People and the Provincial Education System* (Saskatchewan Learning, 2003)

Agreements
- BC: Educational enhancement agreements (in general see British Columbia Ministry of Education, n.d.; or for a specific example School District #23 Central Okanagan, 2006; School District #23 Central Okanagan, 2014)

Action plans and implementation/integration documents
- BC: *Shared Learnings: Integrating BC Aboriginal Content K-10* (Aboriginal Education Enhancements Branch, 2006) and *Exploring Curriculum Design: Transforming Curriculum and Assessment (British Columbia Ministry of Education, 2013)*

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[411] The NT documents are so new as to be in advance of changes to programs of study that reflect their intent. However, Aboriginal perspectives have been at place in NT curricula for some time.

- MB: Aboriginal Education Action Plans (ME, 2004, 2008) and *Integrating Aboriginal Perspectives into Curricula: A Resource for Curriculum Developers, Teachers, and Administrators* (Manitoba Education and Youth, 2003a)
- ON: *Aboriginal Perspectives: A Guide to the Teacher's Toolkit* (Ontario Ministry of Education, 2009a)
- YK: *A Handbook of Yukon First Nations Education Resources for Public Schools* (First Nations Programs and Partnership Unit, 2013)

Programs of study

AB
- *Elementary Science* (Alberta Education, 1996)
- *Science 7-9* (Alberta Education, 2003)
- *Science 10* (Alberta Education, 2005)
- *Science 20-30* (Alberta Education, 2007d)
- *Biology 20-30* (Alberta Education, 2007a)
- *Chemistry 20-30* (Alberta Education, 2007b)
- *Physics 20-30* (Alberta Education, 2007c)

BC
- *Science K to 7: Integrated Resource Package* (British Columbia Ministry of Education, 2005)
- *Science grade 8: Integrated Resource Package* (British Columbia Ministry of Education, 2006e)
- *Science grade 9: Integrated Resource Package* (British Columbia Ministry of Education, 2006f)
- *Science Grade 10: Integrated Resource Package* (British Columbia Ministry of Education, 2008b)
- *Biology 11 and 12: Integrated Resource Package* (British Columbia Ministry of Education, 2006a)
- *Chemistry 11 and 12: Integrated Resource Package* (British Columbia Ministry of Education, 2006b)
- *Earth science 11 and geology 12: Integrated Resource Package* (British Columbia Ministry of Education, 2006c)
- *Physics 11 and 12: Integrated Resource Package* (British Columbia Ministry of Education, 2006d)

ON
- *The Ontario Curriculum Grades 1-8: Science and Technology* (Ontario Ministry of Education, 2007a)

- *The Ontario Curriculum Grades 9 and 10: Science* (Ontario Ministry of Education, 2008a)
- *The Ontario Curriculum Grades 11 and 12: Science* (Ontario Ministry of Education, 2008b)

MB

- *Kindergarten to Grade 4 Science: Manitoba Curriculum Framework of Outcomes* (Manitoba Education, 1999b)
- *Kindergarten to Grade 4 Science: A Foundation for Implementation* (Manitoba Education, 1999a)
- *Grades 5 to 8 Science: Manitoba Curriculum Framework of Outcomes* (Manitoba Education, 2000b)
- *Grades 5 to 8 Science: A Foundation for Implementation* (Manitoba Education, 2000a)
- *Senior 1 Science: Manitoba Curriculum Framework of Outcomes* (Manitoba Education and Training, 2000b)
- *Senior 1 Science: A Foundation for Implementation* (Manitoba Education and Training, 2000a)
- *Senior 2 Science: Manitoba Curriculum Framework of Outcomes* (Manitoba Education Training and Youth, 2001)
- *Senior 2 Science: A Foundation for Implementation* (Manitoba Education and Youth, 2003b)
- *Grade 11 Biology: A Foundation for Implementation* (Manitoba Education, 2010)
- *Grade 12 Biology: A Foundation for Implementation* (Manitoba Education, 2011)
- *Grade 11 Chemistry: A Foundation for Implementation* (Manitoba Education Citizenship and Youth, 2006)
- *Grade 12 Chemistry: A Foundation for Implementation* (Manitoba Education, 2013)
- *Senior 3 Physics: A Foundation for Implementation* (Manitoba Education and Youth, 2003c)
- *Senior 4 Physics: A Foundation for Implementation* (Manitoba Education Citizenship and Youth, 2005)

SK

- *Science 1* (Saskatchewan Ministry of Education, 2011a)
- *Science 2* (Saskatchewan Ministry of Education, 2011b)
- *Science 3* (Saskatchewan Ministry of Education, 2011c)
- *Science 4* (Saskatchewan Ministry of Education, 2011d)
- *Science 5* (Saskatchewan Ministry of Education, 2011e)
- *Science 6* (Saskatchewan Ministry of Education, 2009a)
- *Science 7* (Saskatchewan Ministry of Education, 2009b)
- *Science 8* (Saskatchewan Ministry of Education, 2009c)
- *Science 9* (Saskatchewan Ministry of Education, 2009d)
- *Science 10* (Saskatchewan Ministry of Education, 2005)

- *Science: A Curriculum Guide for the Secondary Level - Biology 20/30* (Saskatchewan Education, 1992a)
- *Science: A Curriculum Guide for the Secondary Level - Chemistry 20/30* (Saskatchewan Education, 1992b)
- *Science: A Curriculum Guide for the Secondary Level - Physics 20/30* (Saskatchewan Education, 1992c)

The territories

Whereas provinces are imbued with constitutional powers with respect to certain areas of governance such as policing, resources, social services, health care and education, "the territories only exercise delegated powers under the authority of the Parliament of Canada" (Privy Council Office, 2010, para 2). The Canadian government was thus responsible for all governance issues in the territories until the initiation of a slow program of devolution of administrative powers to territorial governments in the 1970s (Aboriginal Affairs and Northern Development Canada, 2013; Privy Council Office, 2010). Until recently, territories adopted programs of study from the provinces, often those they abutted. Currently, the situation with respect to programs of study in the territories is quite varied and reflects change in process. In all cases, where programs of study used are from other jurisdictions there appears the use of supplemental resources developed locally. These additional resources often reflect local Aboriginal nations, languages and understandings.

YK. YK uniformly uses BC programs of studies across all subject areas; they are "frequently adapted to reflect local needs and conditions" (Yukon Education, 2012, para. 3).

NT. NT relies heavily on AB programs of study across most subject areas. In the sciences, NT has developed its own K-6 program of studies (Department of Education Culture and Employment, 2004b), and uses AB science programs of study from grades 7-12 (S. Daniel, personal communication, May 17, 2012). The territory also has a locally developed *Experiential Science* program (Department of Education Culture and Employment, 2006) which runs through grades 10, 11 and 12. *Experiential Science* courses are "academic course[s] with post-secondary articulation" (S. Daniel, February 15, 2013), the equivalent of AB's (AE, 2005, 2014) Science 10-20-30.

NU. As the country's newest territory, the situation in NU is more varied. It too draws heavily on AB programs of studies, but also accesses programs of study from SK, MB, and NT (Department of Education Culture and Employment, 2012). The territory is moving towards development of it own programs of study based on the tenets of IQ (Nunavut Department of Education, 2007). For the sciences, NU currently uses the NT program of study K-9 (Department of Education Culture and Employment, 2004b). Where high schools offer science, they use AB programs of study from grade 10-12. However, the physical realities of isolated, remote communities combined with small, local school populations at the high school level, few students pursuing science at that level, and limited availability of qualified teachers mean that science is not offered at the high school level in every community or school in NU. As such, in high school, students who wish to pursue studies in the sciences frequently take courses at a distance, either online on via correspondence; the courses are offered by many provinces (J. Kreuger*).

Appendix C: Part and Chapter Summaries

A note to readers

Given that I have chosen to push at the boundaries of what a dissertation looks like in order to more accurately present and re/present my inquiry, I begin with a note to readers that outlines the intentionality of the manner in which this writing is structured, why some expected elements are not present, why others are displaced, etc. While the reader might skip this section, I note that it begins on page 1, indicated by an Arabic digit not a Roman numeral, and thus is per most academic conventions the place at which reading is intended to start.

Part I: The whole world in a dot, in which I consider a place for beginning in the middle

Part I begins to layout some of the relationships at play in the inquiry and provides some framing for what follows. It includes an introduction to what is at play in the whole and a background to the manner in which the questions emerged. It then examines the difficulties and slipperiness of the questions, and finally some outline and discussion of structure and structuring for what follows. In between, and throughout, I take time to remember the relationships at play, to let them out to play, always in order to track my way back to the middle. The are four chapters in Part I.

Chapter 1 – The whole and the parts at play. In Chapter 1, I let ideas that circulate around and throughout the writing out to play. It begins with the questions with which I have engaged, and includes a collection of quotations, excerpts from journals and field notes, and pieces of writing I return at later points in the dissertation. No clear links appear among the various pieces and this is intentional, as the individual parts might be ordered and considered in different ways by different readers.

Chapter 2 – Recursive beginnings: Tracking to the questions. In Chapter 2, I start directly into the writing to outline the work that brought me to UA and the questions for my inquiry. It sets up several ideas that runs throughout the writing:

- the difficulties of engaging with research that honours both Indigenous and Western ways of knowing, being, and doing, are some how parallel to and reflective of the move to integrate Indigenous perspectives in K-12 (science) curricula.
- Tensions and struggle are important to learning and meaningful change
- Recursion and return are also important to learning and change

Chapter 3 – The questions at play. In Chapter 3, I interrogate the question in which I have engaged. I look at the questions more deeply, to tease out ideas and relationships active within them. My goal in this chapter is not to carefully define and pin the questions down, but rather to consider what is at play in them, and–perhaps–what they put into play, how they are active in the world. To begin, I consider play, flux, and my troubling relationship with Coyote.

Chapter 4 – The messiness of letting things out to play: The importance of being and doing. In a more traditional dissertation Chapter 4 might be named "methods" because in this space I introduce what I did in doing the research. I say "introduce" because I return to method in different parts of the writing without labeling it as such. The chapter includes a discussion of the three primary locations where I engaged in research: a review/analysis of policy; conversations with practitioners, and engagement with practice. It ends with a brief consideration of how the inclusion of practice–which I had not specified within my proposal–shifted the work considerably so that I might view it as a whole.

Part I redux: Playing with structure/the structure at play and a thought about hope. In returning to consider the preceding chapters I take up the idea of wholeness introduced at the end of Chapter 4 to think a bit more about how the work is structured. I then skip an outline of each chapter, as the experience of reading is

important to understanding the whole of the writing. At the same time, I provide a rough guide to each of the four parts within the dissertation, in order to foreshadow and prepare readers for the experience. I end Part I with a short consider of events at play during the writing of this work, that pushed and pulled it throughout the process, and the means by which I have chosen to push back.

Part II: Initial conditions and early iterations, in which I engage with all my relations and become decidedly uncomfortable

Part II focuses on contextualizing the work with respect to all my relations. I call it "Initial conditions and early iterations", because while the relationships, commitments, and sensibilities I describe within it are all related, how those relationships would play out as a whole within the dissertation, was unclear to me. I had to sit with the relationships, commitments, and sensibilities, and significant uncertainty and discomfort, "watching to see until it bec[ame] clear to [me]" (Atleo, 2008, p. 221) as I undertook the research. What I learned, or perhaps remembered, in the uncertainty and discomfort is that once you have a starting point the whole is already present even if you cannot see it. There are 4 chapters in Part II.

Chapter 5 – What my relations put into play: Who I am and where I come from as a means of locating the research. In Chapter 5, I return to how I came to this work by considering who I am and where I come from as means of locating the research. In the first part of the chapter, I introduce people who are literally my relations, and how their experiences prepared me for walking through the door that opened when Corinne asked her question about running summer camps for Indigenous students. From there I return to the *inter esse* as the location for this inquiry, and consider the difficulties of it as a metaphorical instead of physical place. I end the chapter by laying out some of the assumptions and limitations I bring to the research that emerge from who I am and where I come from.

Chapter 6 - Relations, process and place at play: Framing inquiry in *Māramatanga/*effulgent coherence. In Chapter 6, I examine theory as one of my

relations to consider how theory and related sensitizing concepts act within research. I then reconsider theory in light of cautionary tales about the dangers of fundamental contradictions within theories and theory applied too broadly. Finally, I explain how I came to frame the research in *māramatanga* or effulgent coherence as tracked by relationship, process, and place.

Chapter 7 – Relationships at play: Broad contexts from which the research emerges and in which it is immersed. In Chapter 7, I look more closely at the historical relationships which lead to the contexts from which my questions emerge and to which they respond. In the chapter there is a heavy focus on policy, intertwined with personal experience, as well as academic discussions and analysis. I identify the *White Paper on Indian Policy* (Chrétien, 1969) as a key juncture from which Indigenous peoples in Canada began to significantly shift relationships with the various levels of governments in Canada, and lay out some of the impacts on First Nations, Métis and Inuit education. I then examine parallel events and conversations in science education, Indigenous education, and academic thinking through the 1980s and 1990s where ideas from multiple contexts and ways of knowing, being, and doing began to circulate together. In relation to these events, I introduce and consider the thinking of a number of scholars with regard to how ideas can hover to effect long-term change (Weaver, 1990), and how to think about difference and multiplicity (e.g. Aikenhead, 1997, 1998a; Aoki, 2005b; Bell, 2006; Cajete, 1994, 2000) in practice. I conclude the chapter by suggesting that Indian Control of Indian Education (National Indian Brotherhood (NIB), 1972) began a revolution that lead to context form which integration of Indigenous perspectives in science curricula has emerged.

Chapter 8 – What is at play in the contemporary context of integration. In Chapter 8, I examine the current context of integration, providing both a an overview of an emerging body of literature with regard to integration, and a summary of the manner in which the different jurisdictions take up integration within broad policy and K-12 science programs of study. I conclude the chapter by suggesting that, in relation to integration, some jurisdiction's broad policy and certain scholars approach to research

assume the need to do something significantly different than the status quo. In these cases, what policies open up and results of research suggest is that "integration" as a descriptor of process somehow becomes inadequate to the ideas taken up. I ally my own work with these attempts to break from the status quo.

Chapter 9 - Track the inarticulable at play through considerations of methodology. In Chapter 9, I begin an interrogation of methodology by laying out my discomfort with methodology and exploring how researchers who work in contexts similar to my own engage with methodology in their own work. I outline three approaches to methodology I have noted frequently amongst people who conduct research in contexts similar to mine: the remix or mash up of Western methodologies, the eliding of methodology, and the naming of responsive (or responding) methodologies. While the exploration of these methodological approaches provides a general context for research in the *inter esse*, within the context of my dissertation the exploration also serves as a means of considering and elucidating the manner in which I have come to understand the inarticulable and how it is at play.

Chapter 10 - Methodological starting points: Playing with and creating possibilities. In Chapter 10, I continue my exploration of methodology by presenting the methodological starting points for the inquiry, Indigenous/Indigenist Research methodologies (IRMs) and ecological interpretations of hermeneutics. I begin the chapter by clarifying my understandings of IRMs and hermeneutics. I then explore how an ecological turn can position hermeneutics more fruitfully in relation to IRMs so that a dialogue emerges in terms of identifying what to attend to within the flux. I end the chapter by explaining how the methodologies were so generative that they lead me to recognize in the processes, places, and relationships of doing my research what was actually occurring in terms of methodology.

Part II redux: Initial conditions and early iterations: Being uncomfortable and doing it anyway To close Part II, I briefly consider the difficulties, discomforts, and tensions that emerge from all my relations as described to find within them a thread about

doing, and doing differently, even in the absence of knowing and the presence of the inarticulable.

Part III: Getting a sense of pattern within the flux, in which I engage with process and remember to be comfortable with the discomfort by chasing Coyote's tail

Part III focuses on the learning emergent from the act of living with the discomfort and uncertainty of the *inter esse*, engaging with process, being and doing. I call it the, Getting a sense of pattern within the flux, because it was through doing and being with the research and listening to the doings and beings of educational stakeholders that I was able to recognize the rhythm of return that has been key to findings. It is ultimately about finding a sense of pattern by getting caught up in process and doing before understanding or knowing where the process would/will end up. There are two chapters in the Part III.

Chapter 11 - Recognizing parallel struggles: Tension, the rhythm of return, and setting things in motion. In Chapter 11, I present two instances of educational stakeholders bumping up against the inarticulable in their attempts to integrate Indigenous perspectives in K-12 science curricula, and how they engage in return in efforts to relieve the resulting discomfort and tension. I step back to a broader consideration of conversations to explain how these individual returnings are reflective of similar practices evident among many of the people I spoke with as part of this inquiry, and how that recognition was helpful to my own thinking. I then return to my conversation with Darren McKee* to explain how he positions the role of tension and discomfort as generative within the mandates to integrate Indigenous perspectives across K-12 curricula. I conclude the chapter by describing how these instances allowed me to recognize a larger process at play in my research that helped me to clarify the emerging methodology of my inquiry.

Chapter 12 - Methodology emerging: Hunting, tracking and letting the inarticulable be. In Chapter 12, I follow my seeing and reading through (Ihde, 1996, 1998) from IRMs and hermeneutics to mappings of recursive equations of complex

processes active in the world as a means of thinking about active methodology emergent from and immersed in all the relations of my inquiry. While, I draw the in the postmodern sensibilities of Deleuze, I temper the potential flightiness and deterritorialization of postmodernism by finding ways to remembering my location in the *inter esse* where Western and Indigenous ways of knowing being and doing circulate together, and provide examples of other scholars engaged in similar processes. In the end, while the methodology remains nameless, I explain what it helps to attend to within the inquiry, how it reflects the places, processes, and relationships of my inquiry, and how it allows me to find comfort in my general discomfort with methodology.

Part III redux: A process emerging from and immersed in the relationships at play. In returning to consider what has emerged in Part III, I consider more deeply how the Lorenz attractor works as a means of seeing and reading through the processes and relationships at play in my inquiry and the importance of recursive processes in coming to understand. In Part III, I begin to move towards endings and provide some broad thoughts about meaningful considerations of integration, or having Indigenous and Western ways of knowing, being, and doing circulate together in curricula and research.

Part IV: Seeing the beauty of the whole, in which I sit in place and remember to let things be.

Part IV is about how seeing the beauty of the whole becomes possible by beginning in place and letting things be. It might perhaps be considered an extended ending to the conversations at play in these pages–as opposed to a conclusion. Her I acknowledge, I could have stopped at the end of Part III, but because I take seriously the idea of return, of ritual, of remembering to remember, of recursion, it is important to acknowledge and demonstrate I have learned something, to honour and respect those people with whom I had conversations for this work, but also to honour and respect those people who inspired this work with the statement "I don't even know what this looks like". There are two chapters in Part IV. Each are stories of people in their own ways and places caught up in the act of living with their relations in the communities in which they find themselves and their engagements with Indigenous and Western ways of knowing,

being, and doing circulating together in science curricula. Each provides some illustration of the potential inherent in the very conditions of engaging with Indigenous perspectives in [science] curricula, and the potential of sitting with all our relations and doing something in particular places. The two chapters resonate with each other, and considered together might finally provide some direction in terms of the questions in which I am/have engaged. And so, Part IV serves not only as an extended ending to the dissertation, but also as a means of returning to the middle and beginning again.

Chapter 13: Acts of living with: Conversations at play in northern Canada. Chapter 13 focuses on my conversations with Steven Daniel* and Jim Kreuger* and their work in the Northwest Territories and Nunavut respectively. This chapter is a bit different than the ones that precede it. There was a quality to the conversations with Steven and Jim that extends beyond those with educational stakeholders who are getting a sense of pattern and beginning to grasp the emerging complexity of simultaneously following and laying down tracks. In the conversations with Steven and Jim, while tension and discomfort still exist, relationships are interwoven, interconnected, and interdependent. The conversations are so interconnected that there were moments where Jim and Steven were not just talking to each other, but seemed to be finishing each others sentences, as if they we caught up in the same process and describing the workings of a rather similar whole. Given the fluidity of the conversations and the resonances of their work, I have not broken this chapter into labeled sections but chosen to have it resemble the conversation emergent from the transcripts.

Chapter 14: Acts of living with: Conversations at play in the Gardens. The second chapter focuses on the Indigenous Teaching and Learning Gardens in the Faculty of Education at UA, and my work in the urban context of Edmonton, AB. In this chapter, I choose to share some conversations that emerged in different courses and moments in the Gardens, that have perhaps, finally, provided me with a word that might describe methodology, and have returned me not just to the beginning of my dissertation, but also to the inquiry I initially brought to UA.

Part IV redux: Caught up in the flux and letting it be: Returning to the middle and

 beginning again. Here I return not only to consider of Part IV, but to consider the whole of the writing in order to bring it to some (temporary) ending. I explore the questions that addressed me and what they have opened up, other research possibilities emergent from the inquiry, and what I am currently tracking in terms of further research. I conclude with a brief reflection of the manner in which the questions I asked acted within the inquiry, to wonder if they were really that important at all.

Afterword: Tracking Coyote to a Closing Thought that Opens Things up Again

At the end of Chapter 1, I lay claim to the story about to be told, and acknowledge that there are multiple ways to tell it. Here, very briefly reflect on another story that might be at play in the work I have undertaken.

Appendix D - Standard Content Usage Agreement, Big Stock Photo

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