Three Ecologies of Practice

An Intra-active Account of Learning by Doing

by

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy

Department of Curriculum, Teaching and Learning
University of Toronto

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Abstract

The thesis presents three methodologies of research-creation that enact ecology in relational ways. In order to move through the text in an ecological way, I attend to a: 1) Propositional Methodology; 2) Diagrammatic Methodology; and 3) Diffractive Methodology. With the use of wearable technologies, the three ecologies of practice produce on-going questions about nature and culture through experimental practices in an urban school. The three methodologies will be discussed in relation to the planning, designing, and engagement with an urban school garden. Concerned with the materialization of practices, the thesis emphasizes embodied experiences and more-than-human relationships that activate critical and imaginative modes of engagement that do not separate matter from perception.

The thesis begins with the concept of ecology, shifting emphasis from learning about principles of ecology to enacting ecologies of practice. In so doing, I draw on feminist new materialist frameworks to develop an understanding of pedagogy and learning as ‘intra-active’
events (Barad, 2007). Intra-actions are ontological and epistemological co-constitutions of material and discursive knowledge. Karen Barad’s (2007) attention to process (or intra-action) is key to the methodology of research-creation and the ecologies of practice, as learning is understood as that which happens in-the-making or through compositions of material environments and discursive practices.

Enacting research and performing learning is at the core of both new materialist research practices and research-creation events. Performance is understood as that which does not solely belong to the performance of the human subject and/or student. Such an understanding requires the enactment of ecologies of practice that are attentive to how more-than-human matter and meaning shape knowledge about environments. From this perspective, performance provokes future practices through ongoing questions and embodied explorations that dismantle limited conceptions of nature and culture as well as deficit approaches to urban schools and environments. Ecologies of practice are pedagogical events of creation that are uniquely specific and that resist instructive models that have already shaped what the student will become and come to know.
With my Mother and Father at a time of endurance and strength.
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Prologue

What’s so ‘new’ about new materialism?

How does one begin a new materialist research event? What would such an event look like? The possibilities of doing such work are many. My experience ‘doing’ curriculum work through a new materialist lens has been that of intensive labour that begins again and again and again. To write 30 pages, discard them and begin again is tough. To write 100 more and then realize that it does not make ‘sense’ is devastating! Yet, to begin again is to work from the middle of messiness, and it is this complex, exhaustive, and affective labour that new materialist work requires.

Performance and/or enacting change in and of a complex and dynamic world is at the fore of new materialist research. New materialist work is interdisciplinary and therefore theoretically and methodologically approached from multiple perspectives (Alaimo & Hekman, 2008; Barad, 2007; Bennett, 2010; Barrett & Bolt, 2013; Braidotti, 2013; Code, 2006; Coole & Frost, 2010; Haraway, 2014; Jackson & Mazzei, 2012; Lenz Taguchi, 2010; Mazzei, 2010; Olsson, 2010; Springgay, 2014; St. Pierre, 2013; van der Tuin & Dolphijn, 2012). New materialism is taken up in the dissertation text in ways that examine practices of research that entangle: 1) matter; 2) relationality; 3) technology; and 4) ecology. Barad (2007), for example, examines ‘how matter comes to matter’ through the more-than-human performativity of nature and culture. Donna Haraway (1991) also writes of the situated body entangled in ‘naturecultures.’ She contends that the subject is always ‘becoming-with’ and/or in relation with more-than-human environments. Rosi Braidotti (2013), furthermore, presents an ecological argument for ‘becoming-earth,’ which
suggests a renewal of subjectivity that is co-constructed with more-than-human actors and technologies. In the thesis, matter, relationality, and technologies are discussed through the concept of ecology and the embodied practices that shape ecologies. Ecology concerns being in the world and also concerns being of the world in ways that account for the more-than-human practices that sustain environments. Ecology is also a feminist concern that is interested in how embodied practices enact change in local and global environments. Therefore, a discussion of ecology as practice is shaped through the feminist new materialist lens of Barad (2007), Bennett (2010), Braidotti (2013), Grosz (2011), and Haraway (1991).

**What is ‘new’ about new materialist research?** The question is a popular one at conferences and in conversation with researchers across the disciplines. This is also a frustrating question as the newness of the materialist event is immanent to its enactment. New materialist research is not so ‘new’ in the teleological sense. I suppose if I were to negotiate the above question, I could borrow a quote from Thrift’s (2006) paper on Haraway and say that new materialist research is “both of and not of its time” (p. 180). I argue that Haraway’s (1991) *Cyborg Manifesto* is ‘proof’ of that! Technological innovation has indeed changed since the introduction of the cyborg. I think this is what Haraway hoped that it would do. Articulations of space-time relationships are not so ‘new’ in new materialist work either, but how the body is thought in relation to new technologies and time has changed. Haraway (1994) paid close attention to historical time, but understood concepts, and I add new materialist research, here, as that which “cannot be reduced to its own history, because it continually wrestles itself from this history in order to create new concepts that fall back into history but do not come from it” (p. 96). Haraway (1994) is not suggesting that histories or genealogies do not exist. In fact, without the histories of Haraway’s thinking and the many contributions of women to thought, then,
thinking and doing from multiple perspectives in the new materialist field would not be something researchers would be grappling with. In feminist research, the ‘body,’ for example, has been of intense focus over the decades, largely emphasizing the discourses and representations of the female body (Alaimo & Hekman, 2008). However, new ways of theorizing the body have been emerging throughout the years (Springgay, 2008; Springgay & Freedman, 2012). **What is now ‘new’ about new materialist research is the renewed feminist concern with relationality in connection with animate and inanimate matter and materiality.** I understand the concern with matter and materiality as an ecological concern that is interested in how embodied practices of natural-cultural production materialize. An ecological concern is interested in *how* embodied practices shape subjectivities and environments. It is thus a feminist concern that is committed to expression and the actualization of alternative ways of learning and doing research in schools (Braidotti, 2012). Claire Colebrook (2009), for example, resists positioning the body as that which is solely a cultural construction. Colebrook, Barad, Bennett, Braidotti, Grosz, and Haraway are just a few feminist researchers that contend that nature and culture never stop interacting. They further argue for an ontology of being that is inseparable from the epistemologies of knowing. Particularly, throughout the years, Braidotti (2012, 2000) has performed a mapping of feminist genealogies of thought that have led to what she has coined the ‘neo-materialism.’ She traces feminist philosophies that have built on ‘embodied and embedded’ materialist thought in the last century, naming Simone de Beauvoir at its fore (Braidotti, 2012). She notes the complexities of feminist thought that have entangled phenomenological theories of embodiment with Marxism. From there, she traces poststructuralist theories and highlights the blurring between bodies and power. Combining critique with creativity, as Braidotti (2013, 2012) says, the new materialisms seek to dismantle generations of
binary thought (i.e., nature versus culture; ontology versus epistemology; woman versus man) in attempts to actively produce alternative practices. Therefore, feminist new materialist researchers foreground matter in ways that are material, political, and ethical, but do so in ‘new’ ways that understand the earth (i.e., nature, culture, discourse, history, technology, science, art) as an agentive force, which is of ontological and epistemological inseparability.

New materialist research should not be the work of proving historical indebtedness. It should neither become the work that ‘proves’ how feminist it is by laying out genealogies of thought through mechanical theorizations that stop at the new materialisms. Cecchetto (2011) suggests that a view of historical events and genealogies traced as objective knowledge in a “historical macro-narrative” is not productive (p. 6). What makes the thesis a feminist new materialist project is its emphasis on matter and relationality, ways of knowing with more-than-human environments, and how being and knowing is a material and discursive process that co-constitutes bodies. This, feminists argue, is an ethico-political project of responsiveness. What makes the thesis ‘new’ is its materialist approach to ecology that intersects environmental science and aesthetic/affective practice in ways that enact critical modes of learning and activate immanent experiences that not only forge interdisciplinarity, but transdisciplinary futures. From this ecological perspective, future knowledge is sustained through innovation, rather than imitation and the commitment to disciplinary structures. New materialist research requires the ‘doing’ of the work. Do the work of the new materialisms – the critical work that risks experimentation and activates questioning through embodied knowledges of practice. Innovate what Stenger’s (2010) refers to as the ‘factishes’ of science that are not void of historicity, but rather learn by ‘doing’ and in so doing, change the histories of thinking that always provide the right answer. This is what I hope the thesis will do.
I begin the thesis with the concept of ecology in ways that shift emphasis from learning about principles of ecology to enacting ecologies of practice. Ecologies of practice examine learning as ‘embodied and embedded’ actions that are situated and contextual. Learning is also a creative, aesthetic/affective practice that is generative of new thought through relational processes that entangle recognition and response to expected and/or unexpected material phenomenon, which cannot exclude more-than-human others such as plants, insects, and animals (Alaimo & Hekman, 2008). The thesis is concerned with how ecologies of practice work, as well as concerned with accounting for ‘how matter comes to matter,’ as Barad (2007) says. Ecology is, therefore, a matter of practices. Ecology attends to processes and/or modes of pedagogy and learning. Such processes entangle aesthetics (and/or affect) and environmental science in making meaning of local and global environments through embodied experiences that are inseparable from nature and culture.1 Ecologies of practice enact social relationships, embodied experiences, immanent ethics, and a complex politics of engagement in schools that does not separate nature and culture. The thesis generates a discourse around the transformative, aesthetic, and pedagogical implications of ecology performed through the embodied practice of gardening in an urban public school in Toronto, Canada.

Research-creation is a methodology of research that is akin to new materialist work. Both frameworks articulate a creative and critical materialist practice that does not separate matter from perception. Research-creation and new materialist research are emerging in interdisciplinary and transdisciplinary modalities that are tied to artistic practice and expression

1An account of ecology as a matter of practices diverges from approaches grounded in environmentalism. The latter approach is often grounded in conservation efforts and ecological restoration. Environmental education discourses similarly focus on sustainability issues by mobilizing practices that foster environmental stewardship.
in the social and environmental sciences, and the humanities. Other fields of research experimenting with research-creation and a materialist practice include: 1) architecture; 2) design; 3) creative writing; 4) visual and performance art; and 5) film. In 2012, the Social Sciences and Humanities Research Council (SSHRC) – a Canadian governmental agency that funds academic and community-based research – formally established ‘research-creation.’

According to SSHRC, research-creation is

…an approach to research that combines creative and academic research practices, and supports the development of knowledge and innovation through artistic expression, scholarly investigation, and experimentation. The creation process is situated within the research activity and produces critically informed work in a variety of media (art forms). Research-creation cannot be limited to the interpretation or analysis of a creator’s work [and/or] conventional works of technological development.² (Government of Canada, 2015)

I approach the research practices enacted in an urban school as a research-creation event.

Situating the creation and/or learning process in the research activity of gardening, the project as an event (of creation and learning), shifts understandings of ecology and interactions in schools toward ‘intra-actions’ (Barad, 2007). Barad refers to intra-actions as ‘doings.’ Intra-actions are ontological and epistemological co-constitutions of material and discursive knowledge. Barad (2007) adheres to an onto-epistemological framework of new materialism – referred to as ‘agential realism’ – to understand how matter and meaning are entangled. Barad (2007) is quick to point out that experimental practices often do go wrong. To ignore this point, she says, is also to ignore what the process of experimentation is ‘doing.’ Barad’s (2007) attention to process (or

intra-action) is key to the methodology of research-creation and the ecologies of practice because learning is understood as that which happens in-the-making, or through compositions of material environments and discursive practices. Interactions, on the other hand, are commonly understood as linear productions of knowledge enacted by human subjects. Enacting research and performing learning is at the core of both new materialist research practices and research-creation events. In the thesis, performance is understood as that which does not solely belong to the performance of the human subject and/or student. Such an understanding of performance requires ecologies of practice that are attentive to how matter and meaning (i.e., perception) shape knowledge about environments. From this perspective, performance provokes future practices through ongoing questions and embodied explorations that dismantle limited conceptions of nature and culture as well as deficit approaches to urban schools and environments. Ecologies of practice are, therefore, pedagogical events of creation that are uniquely specific and that resist instructive models that have already shaped what the student will become and come to know.

Particularly drawing on Barad’s (2007) notion of intra-action, the thesis will follow an ecologically embodied epistemology of knowing that is inseparable from the ontologies of being embedded in an urban public school in Toronto, Canada. The thesis does not represent the human, but is rather concerned with material environments and the discursive practices that co-constitute knowledge in urban schools. I, therefore, shift the focus from representational practices that humanize environmentalism toward ecologies of practice that enact knowledge-making with the more-than-human world. Focusing on the embodied process of gardening through a new materialist lens, I examine how knowledge comes to matter in an urban school,
arguing that the ‘constraints and conditions’ (Barad, 2007) of urban environments are more-than-human productions.

How knowledge comes to matter in urban schools and environments is a feminist, ethical, political, and social justice matter. For instance, one of the central concerns in feminist new materialist research is the production of ethical intra-actions and agency. The ways in which ethics and agency are understood in new materialist research differs from traditional approaches to research, such as ethnography. Ethnographic approaches and/or case studies undertaken in urban schools often locate agency in the body of the student. Agency tends to be relayed through documentary filmmaking and protest. The latter often takes shape in elementary schools through letter writing to local or national political leaders. The new materialist research event rather locates agency in ecologies of practice that shape events. What this suggests is that agency is an intra-active event in and of which nature, culture, animals, insects, and technological objects are understood as forces of onto-epistemological agency. The human in relation with the more-than-human world thus becomes an ethical way of learning by ‘doing.’ Ecologies of practice as ethical practices do not extend experience, but rather new experiences emerge from embodied practices that must be accounted for in ways that understand the impossibility of neutrality.

Barad and Haraway’s feminist materialist approaches to research highlight the ethical and political dimensions of practices, particularly noting the connections between science, technology, and the human (Alaimo & Hekman, 2008). For instance, the ways that technologies are used have political repercussions, such as the use of the sonogram (Alaimo & Hekman, 2008; also see Barad, 2007). Drawing on Barad, Alaimo and Hekman (2008) explain that the invention and use of the sonogram to study the fetus has political repercussions for women, as it redefines ‘life’ and ‘rights.’ As another example, Haraway’s (1991) theorization of the cyborg – at that
time in history – enabled a thinking of the body as mobile and in relation with technology. Code (2006) argues that Haraway’s mobile positioning of the subject was and is about negotiating empiricism. The subject as mobile worked to reconfigure material boundaries and the historical and political limitations inscribed on bodies. Environmental politics have also been approached from a new materialist lens. Current debates about climate change and the denial of scientific evidence (that the earth is warming) affects political decisions and public perceptions of how environments can and should be used in relation to technology (Alaimo & Hekman, 2008). From a feminist materialist approach, Catriona Sandilands (1999) proposes a more-than-human politics that understands the earth as an “active Other” (in Alaimo & Hekman, 2008, p. 9). As a non-discursive participant, the earth, plants, and invertebrate animals like worms can be seen as co-constituting materialities that shape politics and environments in ways that change how environmentalism is perceived and how technologies are used.

Pioneering the use of wearable technologies in educational research and in the research event of gardening in an urban school, I inquire into how matter and meaning are co-produced. Wearable technologies such as the GoPro video camera (that was worn by the researcher, teacher, and students during the research event) enable a recording of matter and meaning as it is produced between students and teachers, and in relation to urban environments (in and of which the school garden was created). Focusing on the process of learning and/or on the materialization of practices, I argue that wearable technologies are part of the performative production of learning. This is quite different – as I will point out in detail in the thesis – from understanding the video camera as a tool for ‘data collection.’ During the research event and during the process of gardening, I argue that wearable technologies performed as co-constituting apparatuses of bodily production. Drawing on Barad (2007), I address wearable technologies as
‘apparatuses’ that generate and take into account the material movement of bodies as well as the materiality of movement as it relates to urban environments.

Beginning the research process with theory is one of many ways to ‘begin’ new materialist work. As a philosophically informed thesis text, I particularly work the concept of ecology through new materialist theories and the philosophies of Deleuze and Guattari (1987). New materialist educational researchers often draw on Deleuze-Guattarian thought (Hultman & Lenz Taguchi, 2010; Jackson & Mazzei, 2012; Lenz Taguchi, 2010; Springgay, 2014; St. Pierre, 2013). Barad and Haraway rarely draw on the works of Deleuze and Guattari. Barad (2007) mentions Deleuze’s (2006) work on Foucault in, Meeting the Universe Halfway, and Haraway (2008) agonizingly critiques Deleuze and Guattari, emphasizing her love and anger toward their prose. In Species Meet (2008), for example, Haraway takes Deleuze and Guattari’s (1987) notion of ‘becoming animal’ to task by accusing them of not attending to actual animals. Braidotti, on the other hand, has a long-standing relationship with Deleuze and Guattari, which can be seen in her work throughout the years as well as in her latest book, The Posthuman (2013). Braidotti (2012) is drawn to Deleuze and Guattari’s works for their materialist emphasis on process, dynamic interactions, and their porous boundary-making and re-making practices. Braidotti (2012) particularly notes that Deleuze’s work is relevant for feminism, explaining that he is committed to issues of difference, sexuality, and transformation by investing the ‘site of the feminine’ with a positive force. My engagement with Deleuze and Guattari, and particularly with Guattari’s book, The Three Ecologies (2000), echoes the many ways in which Braidotti has used their concepts to not interpret meaning, but to rather create new thought (also see Manning, 2013a; Manning & Massumi, 2014). I use Deleuze-Guattarian concepts in ways that make new connections with other concepts, theories, and practices offered by readers and non-readers of
Deleuze and Guattari. I, however, argue that Barad (2007) and Haraway’s (1997) diffractive reading methodology (which they co-developed) resonates with Deleuze and Guattari’s philosophical interests in ways that resist a close reading of a text. A diffractive reading entails reading different insights through one another. The point of a diffractive reading is to experiment with different concepts by putting them in relation so as to create new thought, or a different concept. In the thesis, I discuss how a diffractive reading was performed in relation to journal writing as well as detail how a diffractive methodology was performed with the use of wearable technologies.

Using the concept of ‘ecology’ and particularly ‘urban ecology,’ the thesis examines how practices operate ecologically in an urban school garden, thus exploring how students engage, affect, think about, and learn from the experience of gardening. The thesis emphasizes what practices ‘do’ (i.e., how practices affect bodies). Rather than develop interpretations of what ecology ‘is’ or what environmentalism could mean, the thesis presents three methodologies of research-creation that enact ecology in relational ways. These three methodologies are both the ‘in-act’ of research-creation in the school garden and an ‘incipient’ mode of analysis (Manning, 2013a). It is crucial to note that in mobilizing these three ecologies the research will tend away from concepts and terms like method and analysis that have normative understandings of capture and representation. In order to move through in an ecological way, I attend to a: 1) Propositional Methodology; 2) Diagrammatic Methodology; and 3) Diffractive Methodology. The three ecologies of practice produce on-going questions about nature and culture through experimentation and exploration with the more-than-human earth. Therefore, each methodology will be presented as an ecology of practice. These methodologies will be discussed in relation to the planning, designing, and engagement with the school garden,
again terms that seem reductive, but perhaps necessary when writing a dissertation. As an ‘event,’ the research process is concerned with the materialization of practices. It emphasizes embodied experiences and more-than-human relationships that activate critical and imaginative modes of engagement that do not separate matter from perception in urban environments. Furthermore, an understanding of research as an ‘event’ activates embodied experiences of learning that cannot be pre-planned and thus resist instrumental lesson plans and representational practices. Therefore, research as an ‘event’ offers alternative futures for research and practice in schools. Alternative futures are co-constitutive of creative differences through learning by ‘doing’ in the more-than-human world.

The thesis does not document student lives in urban schools and environments in ways similar to ethnographic methodologies. Much of the existing research on school gardens has been produced from the position of the academic researcher, a position that is often not in relation. For instance, the researcher undertakes a position of observation that observes participants in their surroundings and conducts traditional face-to-face interviews. Such a position has the potential to overwrite embodied knowledges of practice. Green and Duhn (2015), for example, further argue that the child’s perspective of their own learning is still largely missing from school garden literature. A new materialist research event is enacted differently in that multiple perspectives are explored through the embodied lens of students in relation with environments. Experimenting with new modes of research, such as wearable technologies and mobile interviewing, I understand ‘data’ as that which takes shape in the bodily movements of practice. Student embodied perceptions of their learning will not serve to represent research practices, but rather video images are understood as material and discursive phenomena that co-constitute knowledge that is not found in the image. For instance, Dahlberg and Moss ask: “What
are the consequences if we start viewing pedagogical practice from a perspective in which learning and knowing occurs in the inter-connections that take place in-between different forms of matter making themselves intelligible to each other?” (in Lenz Taguchi, 2010, p. xv). With the use of wearable technologies worn by students, teacher, and researcher, I argue that embodied technologies open up the pedagogical gaze to a multiplicity of perspectives that do not represent truth. Moreover, the wearable camera dismantles the anthropocentric gaze due to its immersion in material environments and its lack of a viewfinder, thus creating ‘body-vision’ (Manning & Massumi, 2014). The video images wearable cameras produce offer a moving image that accounts for the material movement of bodies and the materiality of the more-than-human world. The images emphasize “how children and non-human entities create the conditions for each other’s existence” (Duhn & Green, 2015, p. 9).

Approaching images in this way, I use Guattari’s (2000) concept of ‘transversality’ to propose a transversal ‘analysis’ of ‘data.’ Guattari describes transversality as a relational enactment that moves “counter to the ‘normal’ order of things” (p. 30). As a form of analysis, transversality understands subjectivity as: 1) not solely a biological and cultural determinant of the anthropos; 2) not based on transcendent reason; 3) not linked to the dialectics of reason and recognition; and 4) based on immanent relations (Braidotti, 2013). In approaching data transversally, I argue that this experimental form of analysis in educational research encounters data in ways that do not represent past truths, but rather activate future knowledge. What distinguishes this research event from other projects intersecting environmental science and aesthetics is the attention to pedagogy and intra-active modes of learning, as well as the attention to ‘data’ as a (material and discursive) co-constituting force.
I admittedly struggle (or perhaps stutter) with language in the thesis. My writing is performed with and through the body. The thesis is thus a performative text in which I put feminist new materialist theory to work in relation to data generated from the research event, and through a rhizomatic style of writing that is inspired by Deleuze and Guattari. Through their writing, Deleuze and Guattari resist the creation of ‘book-trees’ that have thick and firm roots and that become cemented in the soil through an aborescent reading (Boundas, 1993). An entangled and/or rhizomatic style of writing is performative. Writing performatively is an active process of creating “lines of transformation, stuttering, and flight, or for preventing its canonization” (Boundas, 1993, p. 22). Therefore, the text is not that of a vertical order; it experiments with concepts, affects, percepts, as well as accounts of the constraints and conditions that are co-produced in embodied processes of learning in an urban school. If the new materialist dissertation is going to provoke thought, then it must work to seriously reconsider theoretical, methodological, ontological, and epistemological estrangement, and further puncture the binary modes of thinking, reading, and writing that are in place in educational research and in schools.
Introduction

Beginning With a Concept of Ecology
Moving Toward Practices that Matter

The research process ‘began’ with a concept of ecology, which draws on the philosophical dimensions of thought put forth by Deleuze and Guattari (1987). As a philosophical concept, ecology concerns complex systems and dynamic structures that are natural and built; material and discursive; matter and meaning; actual and virtual; subject and object; mind and body; theory and practice; social and cultural; local and global; ethical and political. Dualist structures that maintain binary modes of thinking are dismantled in ecological thought. This, however, does not mean that these structures disappear; they are entangled. McCormack (2015) argues that “[c]oncepts are recreated every time they are thought with. Concepts are put to work in a way that makes a difference to worlds but also, importantly, in a way that reshapes the concept, edging it with other kinds of potential” (p. 100). The strength of the ecological concept is just that – it activates multiple meanings. Ecology also has the potential to become more than its textual signification, which can be seen through Guattari’s (2013) work as a psychotherapist and his practice at La Borde, a hospital in France. Before I briefly discuss Guattari’s work at La Borde, it is his earlier work titled, *The Three Ecologies* (2000), in which Guattari develops a concept of ecology that is not tied to notions of environmentalism that associate ecology with images of ‘nature’ and qualified specialists. Grappling with humanizing scenarios of ecology, Guattari (2000) introduces *The Three Ecologies* as a way to think about the social, cultural, political, and economic systems that co-constitute environments. I will note that Guattari as well as Deleuze do not propose a conservative or ‘molar’ politics by any stretch of the imagination. They do not engage in a direct analysis of discourse as is often the case with environmental justice.
movements that place emphasis on the human body as the sole steward of ecological learning, agency, and change. Deleuze and Guattari rather propose a ‘minor’ politics that foregrounds the affective forces of more-than-human agency that co-constitute ecologies.

Guattari’s (2000) concept of ecology operates along networks of actual and virtual connections and disconnections. He suggests that there are three ecological networks: 1) environment; 2) social relations; and 3) human subjectivity. Notably, these networks are open to ontological dimensions that are never separate from the epistemologies of knowing. Guattari (2000) further notes that it is important to move in-between the ecologies as a way to resist habitual modes of being. Moving in-between ecologies, or what Guattari (2000) refers to as ‘transversal movements,’ requires engagement with matter, material practices, and affective forces. To that extent, it is his final publication, *Schizoanalytic Cartographies* (2013) in which Guattari links the concept of ecology – through transversality – to the actual practice of psychiatry. Guattari’s (2013) work as a psychotherapist and in a hospital-setting at La Borde helps in thinking about the school as an ecology of practices that is shaped through material-discursive and affective practices that are not limited to representations of ‘nature’ grounded in molar environmentalist movements.

Guattari (2013) resisted psychoanalysis as a method. He experimented with psychoanalysis as a theoretical technique. He understood technique as a material practice that was always in relation with the environment of, for instance, the hospital, which he conceived of as a self-organizing ecology (i.e., hospital-ecology). Guattari (2013) was curious about how relations unfolded in the hospital-ecology. Throughout the years, questions he posed included: How is the subject produced? In what ways might the
subject become “ecologized” (Guattari, 2000, p. 51)? Guattari (2013; 2000) understood subject formation as the production of an ecology of practices grounded in the social and cultural immediacy of environments. Guattari (2013; 2000) resisted the idea of relations as that which were pre-given by refusing methodologies of implementation. He further refused scientific knowledge grounded in a positivist analysis seeking to represent environmentalism on a humanizing scale.

Guattari nor Deleuze would call their concepts methods. Nor would they stake claim in the development of a methodology. I suggest that their concepts materially exist as propositions and/or platforms for experimentation that activate thought, thus provoking a shift in thought. New materialist researchers in the educational field often draw on the ontologies of Deleuze and Guattari to develop alternative methodologies to research. Mazzei and McCoy (2010), for instance, use their concept of the ‘rhizome’ to rethink data in a nonlinear manner that is generative of new thought. Researchers and teachers need to activate nonlinear modes of engagement in order to disrupt habitual practices and address complex social and cultural issues. To ‘activate’ practice suggests a mode of engagement that is not mechanical. As Grosz (2011) writes, practices are “never simply a question of expanding the range of available options so much as it is about transforming the quality and activity of the subjects who choose and who make themselves through how and what they do” (p. 151). Practices are a matter of activating potential through creativity and the exploration of alternative modes of learning and unexamined angles to research that affectively provoke new ways of knowing in urban schools.

To that extent, the research event examined how the event of gardening shaped student (material and affective) experience in an urban school. Ecologies of
practice are not limited to practices of gardening. Rather, through gardening, I emphasize the ecological orientation of research-creation, which is an orientation attentive to material processes and affective experiences of students in relation with environments. In the thesis, ecology and the ecologies of practice refer to ‘embodied and embedded’ experiences of learning that are not grounded in environmentalism. Rather, students in relation with the more-than-human world are foregrounded in the learning process. Learning as process-oriented and/or ecological emphasizes embodied practices and the urban environment of the school as co-constituting (material and discursive) forces of knowledge production. The school as an ecology of practices suggests that practices not only shape experience, but that practices are shaped in relation with material environments and aesthetic experiences. Therefore, school ecologies of practice are understood as always in a state of becoming and/or learning through processual change. Becoming is understood through the Baradian lens of intra-activity, which, again, suggests that humans are always in relation with the more-than-human world and thus, learning is an intra-active event of relation with animate and inanimate material and discursive forces.

In what follows is a select review of school garden research and pedagogical practices relating to urban environments in a North American context, with exceptions pertaining to a European and two Australian contexts. The following is discussed below: 1) school gardens; 2) urban school gardens; 3) urban ecology; 4) ruderal ecologies; and 5) intra-active gardens. A brief review of the above research themes works to shape an understanding of the ecologies of practice as an intra-active mode of learning that co-shapes urban school-ecologies.
School Gardens

In recent years, the practice of gardening and the building of school gardens have gained prominence in educational research. School gardens are built for many reasons that focus on: 1) environmental sustainability; 2) stewardship; 2) food and nutrition; 3) health and exercise; 4) academic engagement and/or achievement; 5) community engagement; and 6) environmental literacy. Historically school gardens have been a way to promote environmental stewardship, which creates a sense of value, awareness, and care for the ecological systems that sustain life (Upitis, Hughes, & Peterson, 2013). Fostering a sense of environmental stewardship in students is grounded in Friedrich Froebel’s pedagogy that emerged in the 1800’s (Upitis, Hughes, & Peterson, 2013). In the 20th century, advocates for outdoor learning linked science education to gardening practices and (more broadly) to experiential learning processes (Upitis, Hughes, & Peterson, 2013). The 1970s and 1980s were the first decades of environmental education and since then environmental sustainability and its relationship to education has become an increasingly important issue (Sauvé, 2005). Particularly in the 1970s, support for school gardens emerged and a focus on social and environmental justice were key issues in relation to school gardens and environmental education (Upitis, Hughes, & Peterson, 2013). As such, there continues to be a growing concern to develop curricular connections that engage students with the outdoors in ways that address environmental issues in schools and communities.

The Gaining Ground (Dyment, 2005) initiative is just one example of a large-scale garden project that brought researchers, teachers, students, and parents together to foster ecological literacy, sustainability, and stewardship in Canadian schools and
communities across the country. Emphasis on ecological and curriculum literacy is also an important aspect of garden-based learning. For example, Pascoe and Wyatt-Smith (2013) highlight the importance of school gardens as learning environments in which literacies in relation to the basic principles of ecology (i.e., interdependence of life systems) can be approached in a cross disciplinary manner. The Toronto District School Board (TDSB) is currently encouraging teachers to approach curriculum in a ‘cross-curricular’ manner and/or to teach using an ‘integrated learning’ approach. Interdisciplinarity is especially encouraged through the integration of Science, Technology, Engineering, Math (STEM) curriculum (Herschbach, 2011). ³ School garden projects are often encouraged as they complement STEM curriculum. Gardens are envisaged as interdisciplinary spaces for students to explore and to learn about their environments in a ‘hands-on’ way or inquiry-based approach, which is an approach to learning that STEM curriculum foregrounds. More recently, the development of Science, Technology, Engineering, Arts, and Math (STEAM) curriculum has emerged (Guyotte, Sochacka, Costantino, Walther, & Kellam, 2014). STEAM encourages the integration of artistic practices in learning about science and environmental sustainability. Although STEAM is an emerging approach to learning in public schools, the integration of science

³The Toronto District School Board (TDSB) has been providing Board-wide professional development workshops for teachers that are interested in teaching through STEM. The classroom teacher that I worked with attended these workshops on a monthly basis. As a ‘general’ classroom teacher and not a ‘core science’ teacher, he participated in these workshops out of curiosity.
and art in schools is not so new. However, it is often approached through representational practices. For instance, eco-art – the bridging of ecology and art – is an example of a practice that often focuses on the production of decorative pieces that ‘beautify’ school environments. Aesthetic practices in schools are regularly transformed into representational practices, producing objects that satisfy interpretive models. School garden projects often become contained objects of knowledge that serve assessment purposes for art and science education (Zarger, 2008). Container gardening, although it is useful to grow food in the limited space of an apartment balcony or urban home, is an example of a practice that is often found in elementary classrooms for the purpose of satisfying science curriculum requirements. In a Canadian context, for example, the Grade 3 Science Ontario Curriculum encourages understandings about life systems. A popular way to foster such understandings is through the planting of lima beans in paper cups. Students fill a cup with soil, plant and water the bean, watch it grow, and then it dies. Often, lessons do not extend beyond this scenario and this is problematic. It becomes limiting when lima beans keep popping up in classrooms, year after year, and decade after decade, serving as mere props. It seems that lima beans have become ecological objects within public school classrooms. They have become artifacts proving ecological commitments grounded in curriculum expectations. It is hopeful that the effort is being made to think and teach about the more-than-human earth, however, mechanical practices linked to curriculum expectations are rarely meaningful and generative of new thought. Static practices like planting the lima bean in a cup affect the ways that school-
ecologies operate. For instance, when ecology is transformed into a habitual practice it creates the assumption that ecology is a natural system and that it is universal. Static definitions of ecology further stress scientific approaches to understanding environments by relying on Darwinian theories of survival and by using diagrams, such as the ‘web-of-life’ to explain the interdependency of ecological systems in producing life (Martusewicz, Edmundson, & Lupinacci, 2011). The natural sciences approach to ecology that is implemented in Canadian elementary schools often sustains circular systems theories that favour concepts and practices based on scientific solutions. Moreover, definitions of ecology tend to focus on the individual by popularizing concepts such as the ‘human ecological footprint’ (Martusewicz, Edmundson, & Lupinacci, 2011). This concept metaphorically and anthropocentrically refers to one’s habits, modes of production and consumption, and the impact of one’s living on the earth. While it fosters a sense of responsibility in young school-aged children, the concept positions the individual as capable of ‘saving’ the earth through the alteration of habits and the reduction of consumption levels. Furthermore, concepts like the ‘ecological footprint’ irresponsibly claim to be able to measure something that is immeasurable (i.e., environmental degradation) on an individual basis. Such concepts and ways of teaching about ‘the environment’ are well intentioned, however, these concepts and practices do not activate learning through embodied practices of knowledge. The theories, theoretical underpinnings, and practices associated with theorizing about ‘the environment’ continue to think and write about the earth as if it is One being that needs to be understood or repaired. Russell (2010) argues that STEM education must change to reflect student needs. Gough (2002) further argues that environmental education, more generally, must
respond to student needs. Gough (2002) explains that learning with the environment requires a culturally and socially relevant approach, which in turn requires a shift of attention. It requires a “shift from seeing ‘environment’ as a focus for the consideration of science concepts to seeing STEM [and environmental] education as one which…seeks to help students understand environmental issues in the context of their lives, and their lives in the context of environmental issues” (Dillon & Scott, 2002, p. 11-12).

Marcia McKenzie (2008) similarly emphasizes the intersecting role of social and ecological issues in students’ lives. In the article, *The places of pedagogy: Or, what we can do with culture through intersubjective experiences*, McKenzie (2008) extends David Gruenewald’s (2003) ‘critical pedagogy of place.’ She argues that socio-ecological learning is an intersubjective experience that occurs in between thought and what is sensed. Although McKenzie (2008) does not focus on school gardens and more broadly discusses the pedagogical potential of thinking about environmental education as socio-ecological, her work is an excellent example of how school garden research can extend to expressions and experiences of friendship, art, cultural difference, and community building (McKenzie, 2008). McKenzie (2008) urges researchers to consider socio-ecological learning as a movement toward new pedagogical landscapes that occur in-between the “lived and articulated” and in-between the “feelings inhabited and those imagined” (p. 369). She understands learning as a culturally embedded production that can thus become a material site of learning, such as a school garden, as well as a space-place *in* and *of* lived experience that is created collectively with people, places, and species. McKenzie (2008) states:
Learning located in the space between being sensate and making sense is attempted in order to imagine, inhabit, or restore something or somewhere better. In contexts of oppression and unsustainability, this indeed suggests pedagogy that hopes to be transformative, and yet clearly should not be understood only as a site of critique. (p. 365-366)

Doing pedagogy in the ways suggested above, and as Bowers (2001) and Gruenewald (2003) have suggested throughout the years, is to engage with “out-of-classroom” spaces and places that are unfamiliar, culturally diverse, and complex (McKenzie, 2008, p. 366). It is these unfamiliar spaces and places of “difficult knowledge” (Britzman, 1998) that provoke alternative modes of learning that are never individual, nor neutral. The socio-ecological pedagogy at work, here, is one that enables youth to engage in collective, intersubjective experiences that are not predetermined (McKenzie, 2008). Such a pedagogical strategy supports de-familiarization and cultural formation by creating the conditions for initiatives that are political and that resist normative discourses (McKenzie, 2008).

**Urban School Gardens**

There is a vast amount of research on school gardens and particularly in relation to urban schools and environments in Canada. However, research on urban school gardens is largely science-based and concerned with measuring health benefits and the nutritional components of cultivating one’s own food. Research findings from Dyment’s (2005) Canadian study indicate that gardening promotes physical activity, health, and safety.
Findings conclude that the greening of school grounds provide healthier and safer environments for students. According to the participants in the study, “after a school ground has been greened there are more shade spaces, fewer accidents, and fewer incidents of crime” (Dyment, 2005, p. 35). Student behaviour is another research finding that the study reported on, indicating that green school grounds encourage positive student behaviour. According to Dyment’s (2005) research findings:

Study participants reported that when students were learning and playing on a green school ground, they were being more civil (72%), communicating more effectively (63%) and were being more cooperative (69%). These improvements were noted not only among students’ interactions between students and teachers were also enhanced (69%). (p. 26)

While the impact of school gardens in urban schools and environments varies and is, of course, debatable, the problem with approaches to garden-based learning is that these approaches focus on measurable outcomes, as well as emphasize instrumental practices and western ideologies about food, nutrition, health, safety, and behaviour in urban schools and environments. Gardens are positioned as instrumental objects of practice and a ‘natural’ response to meeting the needs for sustenance, security, and meaning in urban schools (Williams & Brown, 2012).

More recent studies of urban school gardens in Canada include Gaylie’s (2011) west coast study and Upitis, Hughes, and Peterson (2013) garden project in southeastern Ontario. Gaylie (2011) similarly points out that the school garden typically rewards science curriculum. She undertakes an in-depth historical perspective of school gardening and notes the many ways that urban gardening has been approached in schools. She
illustrates this through connecting gardening to learning, food, land, culture, history, economic production and survival throughout the centuries and years. Gardens have served many purposes, including the exploitation of child labour on the factory lawns of institutional gardens where students labored to fulfill national economic visions of sustenance and survival (Gaylie, 2011). Gaylie’s (2011) commitment to social justice, land, and community connections – by learning about sustainability through gardening – is evident. She focuses on student narratives to explore the themes of land, justice, and community. Gaylie (2011) addresses the complexities of urban environments and argues that hands-on learning is linked to responsible stewardship. Gaylie (2011) further argues that popular visions of ‘saving’ urban youth, over the course of one hundred years, have shifted toward concerns with saving the planet. “Instead of an entrenched, binary focus on either economic concerns, or moral ideologies, the rise in urban agriculture and sustainable practices closer to the turn of the 21st century has shifted to support and nurture the practical value of sustaining the planet” (Gaylie, 2011, p. 171). One of the main findings in her study was the role of the community in supporting innovation.

Rather than the urban school and community becoming an object of observation and/or ‘saving,’ Gaylie (2011) emphasizes the active role of students, teachers, and communities in changing stereotypical assumptions about urban schools and environments. She argues that the value of a garden will be found in the community ideals that will in turn inspire more involvement. She contends that the value of a garden will emerge in non-linear and informal ways determined by the students and communities themselves (also see Kellett, 2005; Cutter-Mackenzie, 2009). Positioning school gardens as solutions to ‘saving’ generalizable populations or solving large-scale problems like climate change is not the
pedagogical point of an urban school garden. For Gaylie (2011), learning in an urban school garden enables students to define and re-define their learning through embodied, collective practices that are generative of unique experiences of local environments. The school garden thus becomes an invitation to imagine ecological learning “as a site of possibility, vulnerability and fragility” (Alsop & Fawcett, 2010, p. 1027). Such an invitation, Alsop and Fawcett (2010) suggest, troubles “pedagogical epistemic desires of normative closures,” making room for more questions and more work to be done (p. 1027).

Upitis, Hughes, and Peterson’s (2013) article, *Promoting Environmental Stewardship through Gardens: A Case Study of Children’s Views of an Urban School Garden Program*, begins with the swear word ‘fuck!’ “Don’t touch that fucking fence!” is what one student exclaimed (Upitis, Hughes, & Peterson, 2013, p. 92). The student’s response was toward a group of high school students that decided to destroy the fence surrounding the school garden that he had built with his classmates. The student’s desire to protect the fence and garden, according to Upitis, Hughes, and Peterson (2013), signals toward a sense of responsibility and stewardship toward the earth. They argue that environmental stewardship is vital to sustainability in a time of climate change and limited natural resources. The authors highlight the impact humans had and have on the earth, noting scientific evidence warning humans of their excessively worsening consumption levels. Upitis, Hughes, and Peterson (2013) argue that an understanding of human impact on the earth, along with the development of stewardship habits can be achieved through a school garden program. One of the key connections to stewardship, they insist, is the sense of satisfaction in knowing that one made something with others,
cared for it, and helped it grow (such as a garden). Learning by actively engaging in a local context, similarly to Gaylie (2011), is thus a practice Upitis, Hughes, and Peterson (2013) encourage. The authors explain that students must become ‘active agents,’ shaping their environments. Borrowing from Chawla (2008), they argue that another element of fostering stewardship is by “learning to see: learning to see communities of plants and animals, details of their individual existence and interactions, and patterns of their ever changing habits” (p. 98). They contend that the urban school garden is a context for “learning to see” (Upitis, Hughes, & Peterson, 2013, p. 95). Findings from their research study not only suggest that curriculum foregrounding the relationship between gardening and student experience has grown, but interest in this relationship seriously takes into consideration the student’s determination of what gets valued and what gets left out. For example, Cutter-Mackenzie’s (2009) study of multicultural gardens makes a similar point, emphasizing the capacity of students to determine the research process. The large-scale study (including five schools) was situated in culturally diverse migrant and refugee communities in Melbourne, Australia. Throughout the 2-year study, students were invited to be researchers through the collection of data via journal-writing, photo-taking, and interviewing teachers, parents, and community members (Cutter-Mackenzie, 2009). Students were part of a research training process in which they learned data collection skills related to documenting interviews, observations, and images (Cutter-Mackenzie, 2009). Part of the research process also required students to share and discuss their research, which involved taking responsibility and further investigating their own practices and choices in relation to other students, teachers, and community members (Cutter-Mackenzie, 2009). The study encouraged garden-based learning through student
direction and everyday experience. Similarly to Upitis, Hughes, and Peterson’s (2013) study, Cutter-Mackenzie’s (2009) project makes an important point that suggests that when students are engaging in practices rather than following instructions, then environmental stewardship and sustainability takes shape through the many unique ways in which living is expressed and perceived everyday in urban schools and communities.

**Urban Ecology**

Urban ecology is a developing field of research that emerged in Berlin, Germany in the 1960s under the research focus of Herbert Sukopp (Endlicher, 2011). Along with his research team, he developed two definitions of urban ecology. The first definition is grounded in biology, addressing biological and environmental processes in urban areas. The first definition reflects the eco-systems approach, which is tethered to biological understandings that are deployed in schools through diagrams, such as the ‘web-of-life.’ The second definition of urban ecology is connected to the first; however, it focuses on human perceptions of the environment and how the environment can optimally function for the human. The second approach is implemented in schools through diagrams and definitions, such as the ‘human ecological footprint,’ which entails a human-centred understanding of sustainability.

During 2002-2012, a new concept of urban ecology emerged, which focused on the entangled relationships of ‘nature’ and social, cultural, economic, and political systems of daily urban living (Endlicher, 2011). For example, researchers became interested in the relationship between humans, nature, culture, and cities (Endlicher,
Focusing on the human in relation with urban environments – understood as natural and cultural productions – urban ecologists resisted thinking about urban spaces and the bodies that inhabit them as derelict and in need of eviction or management. Just within the last fifteen years in North America, urban ecologists have directed their attention to urban decay and the ‘potential’ of decaying spaces. The city of Detroit, Michigan is often of intense focus in the literature concerning vacant land and abandoned homes and commercial buildings (Jorgensen & Keenan, 2012; Woodward, 2012). Urban decay is, however, a vague term and it is often used to describe unmanaged spaces, which materialize in the form of weeds and vegetation across vacant lots, asphalt, chain link fences, and abandoned buildings. Unmanaged spaces are seen as a threat to ‘nature’ and urban ecologists contend that this concern has recently coincided with environmental awareness (Gobster, 2012; Jorgensen & Keenan, 2012). The concern with unmanaged spaces can be traced to 19th century discourses surrounding urban parks.

Examining 19th century urban parks, ecologists explain that parks were created as a means to provide a ‘civilized’ landscape in which ‘civilized’ people could engage in heteronormative behaviours (Thompson, 2012). Children would play ‘appropriately’ and in confined areas. Adults would similarly engage in designated places, taking up tennis or cricket if they were wealthy (Thompson, 2012). Specifically in North America, urban parks were quite large and were composed of woodland areas and informal spaces where wildlife roamed and vegetation sprawled. Informal spaces were seen as in need of taming, suggesting that parks would be used for criminal activity and sexual encounters (Mortimer-Sandilands, 2005). Urban parks were inevitably privatized through the imposition of park rules and codes of appropriate behavior. Eve Tuck (2013) argues that
settler colonialism works in this ‘civilizing’ way; it mythologizes an empty North American continent waiting to be rescued by the development of an “untamed wilderness” (p. 13). Similarly, urban schools that have been identified as ‘inner city’ are often mythologized in this way. Urban schools are marginalized through discourses of fear, danger, criminalization, helplessness, and surveillance. The ‘inner city’ school and surrounding community is often seen as in need of ‘tidying up,’ and the students are often spoken about in terms of needing intense behavioural management (McCready & Soloway, 2010). Opportunities for outdoor exploration and experimentation are immediately shut down by justifications that students cannot explore the school grounds due to the risk of broken beer bottles, for instance, and the accumulation of trash.

According to urban ecologist, Jennifer Foster (2014), creative and ecological opportunities thrive when spaces are not disciplined through regulations, codes of behaviour, and western aesthetics. However, common sense assumptions about unmanaged spaces are often negative due to the perceived risk that they inhabit. Perceived risks include: 1) fear of accidents; 2) racist and physical assault; 3) moral injury; and 4) strangers (Thompson, 2012). Foster (2014) explains that fear and/or the unsafe appearance of unmanaged space is rooted in concepts and practices that ‘Other’ individuals who inhabit spaces in ways that disrupt regulation.

In a 2005 article, Foster explores the notion of ‘landscape narrative’ in relation to the restoration of unmanaged spaces in Toronto, Canada. She focuses on the renowned Don Valley Brick Works in downtown Toronto. The Brick Works is a former quarry and industrial space gentrified into an outdoor environmental centre featuring ‘naturalized’ spaces, a farmer’s market, and a café. The space underwent a restoration process in the
early 1990s. Foster (2005) wonders who might this restoration have been for, as the plans for the project differ from its current use. She questions the authenticity of the massive ‘naturalized’ area, suggesting that the space has become a dog-walking park and consumptive activity for wealthy downtown neighbours (Foster, 2005). She further argues that ‘outsiders’ – she gives the example of ‘at risk’ students from ‘distant’ neighbourhoods – as those who perform the restorative work, but never go back (Foster, 2005). Foster’s (2005) articulation of landscape narrative offers an understanding of nature and culture as co-produced. She explains that “landscape narrative relates to the stories enacted and revealed through landscapes. The concept is predicated on the view that humans are a part of nature, but that identities, values and preferences may be expressed through landscape practices” (Foster, 2005, p. 333). While embodied practices such as restorative gardening have the potential to influence identity formation and values, they could similarly reflect larger power structures, and to put it simply, a means-to-an-end mentality. The point being made is that methods of learning in schools and embodied practices are never neutral. For instance, Foster (2005) particularly notes that field-trip opportunities for ‘at risk’ students as rarely productive. Trips often reinforce the constraints and conditions of power by unfolding as a ‘one-time-thing’ that rarely fosters connections with students and schools. Urban ecologists still maintain that there are indeed benefits to organized outdoor activities in parks and environmental centres like the Brick Works. They, however, argue that unstructured and unsupervised learning outdoors is often of most benefit to students (Thompson, 2012).
Ruderal Ecologies

Ruderal ecologies are unmanaged spaces of exploration and continuous change. The size of ruderal ecologies varies. For instance, the protruding growth of ruderal species can inhabit the jagged cracks on sidewalks and old buildings (Rotas, 2015; 2014). Ruderal ecologies can be quite large, colonizing parking lots, derelict train tracks, and sections of schoolyards. Ruderal ecologies are also referred to as: 1) wildscapes; 2) terrains vague; 3) urban wastelands; 4) green ghettos; 5) ambivalent landscapes; 6) urban voids; and 7) found spaces. In her research, Foster (2014) uses the term ‘terrains vague’ to refer to the unmanaged, ruderal ecologies in Paris, France. She describes terrains vague as land “peripheral to mainstream, dominant urban experiences” (Foster, 2014, p. 124). Foster (2014) uses the term to describe the Petite Ceinture, a railway that transported industrial materials through France. She writes that the derelict railway is socially and ecologically invisible to Parisians, yet it provides ecological connectivity. As a terrain vague, Petite Ceinture offers a different experience of urbanity that enables “different types of mobility, novel aesthetic encounters, and social engagement outside urban surveillance infrastructure” (Foster, 2014, p. 124). Stohmayer and Corre (2012) further Foster’s (2014) point through (what I perceive as) as a new materialist tone that describes Petite Ceinture as a space of potentiality where “everyday space is both near and far, familiar and unfamiliar, bearing traces of past and present uses that never were designed to co-exist” (p. 6). In relation to social and environmental justice, ruderal ecologies and/or terrains vague can be conceived as ecologies that enable collective practices of urban revaluation, thus differing from dominant definitions and histories of urban environments (Foster, 2014). However, echoing Stohmayer and Corre (2012), art historian, Christopher
Woodward (2012), argues that unmanaged spaces must be re-imagined beyond the local, and I add, in relation with the more-than-human world. He suggests that “[o]ne of the imaginative leaps this challenge presents us with is to move beyond the boundaries of individual wildscape sites, and to think instead of a network of wildscape opportunities on a landscape scale” (in Jorgensen, 2012, p. 7). Such an approach to unmanaged spaces affirms the biodiversity and relational agency of these spaces, rather than the agency of people in these spaces. Urban ecologists insist that unmanaged as well as managed spaces like the school garden need to be approached as living spaces that respond and/or intra-act with changing social, cultural, and environmental conditions. Unmanaged spaces challenge human-centred frameworks, foregrounding the dynamic element of these spaces. Challenging human-centred frameworks through urban ecology and foregrounding the agentive force of animate and inanimate space coincides with feminist new materialist research that puts the relational matter of embodied practice in focus. Entangling urban ecology with new materialist frameworks is a move that similarly to the urban ecologist accounts of the past as well as leaps at the chance to engage with spaces in new and relational ways that matter.

**Intra-active Gardens**

New materialist research is approached in many different ways (as noted in the preface) and it is expanding in the humanities as well as in educational research where an attention to methodologies and data production are of concern (Honan, 2014; Hultman & Lenz Taguchi, 2010; Jackson & Mazzei, 2012; Lenz Taguchi, 2010; Mazzei, 2010; Mazzei &
McCoy, 2010; Phillips & Larson, 2012; St. Pierre, 2013). For example, Eileen Honan (2014) disrupts the face-to-face interview by not privileging the semiotic content of the interview transcript. She suggests that by focusing on the research, the researched, and the writing process as an assemblage produces thought that cannot be coded for data analysis. She understands an assemblage as a collage of evolving practices. Mazzei and McCoy (2010), as another example, work with the Deleuze-Guattarian concept of the ‘rhizome’ in order to rethink data ‘with Deleuze.’ A rhizomatic form of thinking is nonlinear in that such thought never knows what it will connect with. Rhizomatic thinking can be, for instance, visualized as that which is similar to the unruly growth of weeds, or the entangled growth of couch grass. However, Mazzei and McCoy (2010) resist the concept of the rhizome as a metaphor and rather put the concept to work in relation to research data, generating unthought questions and ways of knowing. Phillips and Larson’s (2012) new materialist methodological approach is yet another example. They examine writing practices in schools. Based on data collected from student-teacher writing conferences, Phillips and Larson (2012) suggest that the writing process itself produces ‘invitational data.’ They argue that reflective writing, for instance, or memory stories are not static data, provoking researchers to rethink the materiality of data production.

Connecting new materialist frameworks with school and community garden research is fairly new, with only a couple of researchers undertaking such work. Katherine Wright, for instance, is a postdoctoral researcher currently examining Indigenous community gardens in Narwan Village in East Armidale, Australia. She is experimenting with innovative methodologies, examining the garden through the lens of
multispecies ethnography (also see Kirksey, 2014). Undertaking a multispecies ethnographic approach, Wright is examining notions of community through sustainable practices that understand nonhumans, such as plants and insects as community builders. Furthermore, Duhn and Green’s (2015) recent publication, *The Force of Gardening: Investigating Children’s Learning in a Food Garden*, examines student engagement in three school gardens in Tasmania and Melbourne, Australia. Using Hultman and Lenz Taguchi’s (2010) ‘relational materialist approach’ to educational research, Duhn and Green (2015) particularly examine ecological literacy by foregrounding children’s engagement with nonhuman life. A relational materialist approach to research understands the student as emergent in a relational field “where non-human forces are equally at play in constituting children’s becomings” (Hultman & Lenz Taguchi, 2010, p. 525). Understanding learning as ‘becoming’ is rooted in emergent relationships and thus intra-active approaches to learning that do not exclude the nonhuman. Attending to research in school gardens as an intra-active event challenges interactional notions of subjectivity-making, where humans are positioned at the centre of knowledge production. Weston (2004), for example, calls for ‘deschooling’ environmental education by attending to “the human/other-than-human boundary as more permeable than our culture teaches us it is” (p. 45). Intra-active modes of learning resist positioning the human as the enforcer of change by attending to the material and materiality of embodied practices that cannot exclude nonhuman species and inanimate objects as co-producers of school-ecologies. Subjectivity-making is, then, that of a becoming process in and of the more-than-human world. For example, in the research event of gardening, student relationships with material environments, including invertebrate animals such as worms and inanimate
objects like wearable cameras are foregrounded. Therefore, the agentive force, or the intra-activity of environments, and the practices that shape urban school-ecologies are examined from multiple and embodied immersive perspectives. In so doing, urban school-ecologies of practice are accounted for in ways that spark new questions, practices, and ways of knowing. In a pressing time of climate change of which – political and economic positions deny that the earth is warming, or fear what the scaling-back of economies will do – different ways of thinking about practices and relations with nonhuman species, new technologies, and the earth are imperative. The dissertation does not offer a massive solution to climate change. **The dissertation contributes to the educational field of new materialist research methodologies by presenting a unique way of enacting research with the use of wearable technologies, and in ways that are not limited to preserving ‘the environment.’** Enacting learning in an urban school-ecology of practices is a collective yet critical way of learning that is interdisciplinary and open to transdisciplinary fields of intra-action. Rather than ‘fitting’ learning into disciplinary or interdisciplinary practices, transdisciplinarity implies an enactment with matter and materiality in experimental ways that escape a disciplinary account of experience (Manning, 2013b). To put this in another way, transdisciplinarity suggests that practices are never fixed and certainly not meant to be implemented in school contexts in programmatic ways. Manning and Massumi (2014) argue that practices, or what they refer to as ‘techniques of relation’ are reinvented in the process of research.

In the thesis, I will refer to methods as ‘technique-based practices,’ which emphasize a shift from programmatic structures to process-oriented event-potential (Manning & Massumi, 2014). Research-creation events foreground emergent experiences
or the intra-activity of engagement. In other words, events are open-ended enactments of research and creation in and of which techniques engage with the expressive modes that an ecology of practices engenders (Manning & Massumi, 2014). Techniques condition school-ecologies in ways that are open to their own potential, rather than to the fulfillment of preplanned curriculum expectations or research goals. Attending to the intra-activity of gardening in an urban school highlights the taken-for-granted and often overlooked contributions of animate nonhumans and inanimate objects in sustaining the earth (Duhn & Green, 2015). I argue that opening educational thought to more-than-human inquiry – with the use of wearable technologies – activates the possibility of revaluing everyday practices and reimagining social and environmental justice in more-than-human ways.

The more-than-human inquiry that I propose and enact in the thesis text resonates with the concept and practice of post qualitative inquiry that Elizabeth Adams St. Pierre (2011) introduced years ago. St. Pierre (2011) used the term to destabilize humanist approaches to research practices in educational research. Humanist or conventional approaches to research are driven by static methods and data-coding procedures (St. Pierre, forthcoming). St. Pierre (forthcoming), for example, notes the “No Child Left Behind Act (NCLB),” a United States educational policy (implemented in 2002) as that which is entrenched in humanist practices. For instance, although the Act created new funding opportunities for educational research, it also erected a scientifically-based language, grounding research and qualitative methodology in causal structures and goal-oriented truths (St. Pierre, forthcoming). To date, she explains, positivism is still embedded in qualitative methodology, arguing that researchers have probably learned
some methods over the years, but rarely pay attention to epistemologies and ontologies that are necessary in doing post qualitative research.

**Mapping the Thesis**

Committed to more-than-human inquiry, I entangle the ontologies of Deleuze and Guattari (1987) and theories of affect and movement (Manning, 2013a; Manning & Massumi, 2014) with an ecological epistemology of knowing in an urban school. I argue that ontological and epistemological ways of knowing are inseparable. I further draw on the new materialist frameworks of Barad (2011, 2010, 2007), Bennett (2010), Braidotti (2013, 2002), Grosz (2011), and Haraway (2008, 1991) to put new materialist theory to work through the theorization of data (Mazzei, 2010, 2007; Mazzei & McCoy, 2010). Putting theory to work is not merely a theorization of data, but rather transversally moves at the “limits of data” (Mazzei, 2007, p. 116). To attend to the limits suggests that ‘data,’ such as video images and photographic images generated during the research process are not static, but rather overflowing and in excess of their frame (Mazzei, 2010, 2007). For example, the visual images (still photography and video) generated throughout the research process are analyzed in ways that express the research event as productive of past, present, and future knowledge and practice. A transversal analysis of ‘data’ provokes an ‘analysis’ that is committed to non-representational practices that resist finding static meanings in the image. A transversal analysis of the image encounters ‘data’ in ways that require creativity and innovation, as well as an understanding that inanimate objects such as images are ‘alive.’ A transversal analysis of the image as *alive*
further provokes attention toward and a questioning of how matter and embodiment come to matter in the process of becoming and/or intra-action (Lenz Taguchi, 2008; Mazzei, 2007). Therefore, ‘analysis’ is understood as a performative practice in and of which meaning is not found in data, but rather meaning is made in-between material environments and discursive practices. Three methodologies of research-creation were used to think ‘with’ and enact the design, building, and engagement with the school garden. They include a: 1) Propositional Methodology; 2) Diagrammatic Methodology; and 3) Diffractive Methodology.

In Ecology I, I enact a ‘mobile positioning’ (Haraway, 1991) of the self in relation to urban school environments. I draw on Haraway’s (1991) concept in order to express multiple positions of urban school student, researcher, woman, as well as cultural and class-based identities. I note my experience learning in urban schools and through a narrative piece of writing, I perform a becoming process that ‘undoes’ the self (Grosz, 2011). Akin to a mobile positioning, ‘becoming undone’ (Grosz, 2011) is a self-differentiating, expressive process of change that is more-than-human. Grosz (2011) argues that becoming undone is a relation between animate and inanimate (material-discursive) forces. These forces not only influence subject formation, but she argues that the process of identity-making is inseparable from ontological worlds, which Grosz (2011) articulates through notions of durational time. Enacting a positioning of the self, I resist static definitions tied to discursive narratives about urban school children, which are often tied to deficit scenarios. I rather move toward a mobile positioning that “direct[s] itself to change, to changing itself as much as changing the world” (Grosz in van der Tuin, 2011, p. 276). Therefore, I push the limits of ‘conventional narrative’
(Mazzei & McCoy, 2010) and the politics of location by decentering student demographics and contextual information pertaining to the school. I, therefore, wrestle with ‘subjectivity statements’ (St. Pierre, forthcoming) by focusing on practices and the processes of research at the school. Demographic and contextual information pertaining to the school can be found in the Appendix. In Ecology I, I foreground the initial phases of the research process through a discussion of a research methodology grounded in propositions. Drawing on Erin Manning and Brian Massumi (2014), I explain how a propositional methodology activates creative ways of thinking about and enacting learning that is responsive to the social and cultural constraints and conditions of the urban school-ecology. I further discuss the research techniques used and experimented with during the research process, including: 1) student and research journal-writing; 2) digital photography; 3) mobile technologies; 4) mobile interviewing; and 5) wearable technologies.

Ecology II focuses on the design and building of the school garden through a diagrammatic methodology. Drawing on Deleuze and Guattari (1987), they explain that the diagrammatic “operates by matter, not by substance; by function, not by form” (p. 141). Concerned with resisting illustrations and representations of what a school garden should look like, students, teacher, and researcher determined the design of the garden through the emergent methodology of the diagrammatic. Garden design was not preplanned or implemented by the researcher or teacher, but rather co-produced with the students in relation with the urban environment. Experimenting with Android tablets and photographic images, the students employed the following techniques during the diagramming process, which led to the design of the school garden. Techniques included:
1) mapping; and 2) cutting together-apart. Furthermore, the event of diagramming led to other events of relation, such as ‘photobombing’ that took place within the school. The event involved the posting of images in school hallways and classrooms, which enabled a thinking of the images (generated during the research process) as living material that invites further investigation (Olsson, 2012). I will discuss the event in more detail in Ecology II.

Ecology III details student engagement with the school garden. The use of wearable technologies in practices of gardening is of particular focus. Through a diffractive methodology of the apparatus, I use Baradian (2007) and Massumian (2011) theories of nature, culture, and more-than-human perception to examine the agentive force of wearable technologies in practices of school gardening. Attention is also paid to the use of wearable cameras in relation to the ruderal ecology on school grounds. Theorizing ruderal ecologies in relation to technologies further opens up a theorization of matter and perception as entangled.

A transversal ‘analysis’ will be threaded through each of the three ecologies. Putting theory to work in relation to the ‘data’ generated throughout the research process, I propose the transversal technique of ‘mashing.’ The technique demonstrates that a transversal analysis is not a conventional mode of analysis, but rather a collective responsibility enacted by the researcher, teacher, and students in relation with animate and inanimate forces. Guattari (1984) states that transversal thinking “tends to be achieved when there is a maximum communication among the different levels and, above all, in different meanings” (p. 18). When analysis is that which students, teacher, and researcher do in relation, I argue that ‘transverse communications’ are polyvocal and co-
constituting. I use Deleuze and Guattari’s (1977) concept of the ‘partial object’ and Bennett’s (2010) notion of ‘elusive materiality’ to articulate a transversal analysis of the image as that which is partial and provokes future thought.

I close the dissertation with propositions for ecological thinking and new materialist practices in schools. I encourage interdisciplinarity in schools and in research, suggesting that new materialist methodologies are attentive to onto-epistemological ways of knowing that account for what gets valued and what gets left out in practices concerned with more-than-human social and environmental justice. I propose an ethics of sustainable becomings that shifts from conservation-based efforts toward practices of becoming that emphasize creativity and imagination. In so doing, a methodological shift is enacted toward non-representational practices that are committed to “accounting for the material nature of practices and how they come to matter” (Barad, 2007, p. 45). The concluding section of the text is by no means a conclusion or a finale, but rather a proposition to ‘confront the unthought’ through the experimental questioning of methodologies, and through an attention toward rethinking ‘what constitutes data’ (St. Pierre, 1997; Mazzei, 2010). I, lastly, provide a brief epilogue to offer another dimension to the text. It does not recount the details of the thesis, but rather serves as an afterthought and invitation for more work that matters.

In providing a ‘thesis map,’ I do so as an invitational gesture that resists the reading of the text in a closed, or perhaps prescribed manner. I invite the reader to explore and experimentally think with the ‘three ecologies’ in ways that open unto new examples and lines of thought. Mapping akin to diagramming is a process of continuous change that encounters thought with examples. Mapping, Deleuze and Guattari (1987)
write “is entirely orientated toward an experimentation in contact with the real” (p. 12). The ‘thesis map’ is thus not oriented toward navigational routes, nor roots of thought. Rather, ‘mapping the thesis’ accounts for where it has been and what it has done in the hopes of linking up with new ‘lines of flight’ (Deleuze & Guattari, 1987) that perform what the text has yet to think.
Ecology I

Propositional Methodology
To be trained in the language of myth, of Greek tragedy, the 
Oedipal, and of doxa (commonsense) says something about the child 
of immigrant parents who new only of this language in a strange 
place they gave up their citizenship for. I entered the urban public 
school system with this language. I learned English and then 
packaged it all up and transmitted it to my mother who, then, sat at 
the kitchen table and proceeded to make a grocery shopping-list of 
items. I assisted my mother in making these lists throughout the 
years; it was our practice. I explained the trickery of the English 
language and why vowels such as ‘e’ in ‘lettuce’ and ‘y’ in ‘honey 
dew’ produce such silence. I always thought it should be the other 
way around – you know, the mother teaching the daughter the 
mechanics of language and how to make lists; how to make ‘sense’ 
of things in this place. I guess that was not my fate.
Then again, what is fate in the landscape of the North ‘American Dream’ that tells you if you work hard you will achieve that not-so-realistic ‘Dream’ – whatever that may be (i.e., financial success, happiness, etc.). Then again, what is the purpose of the list? Lists, checklists, myths, inevitable tragedies, and this struggling fate of who you are born to ‘be’ keeps me thinking about the function of the list, the purpose of life, knowledge, schools, and practices. The doing of the list further keeps me thinking about why we do the things we do, why we do things to each other, and why we even care. Why should we care when myth, tragedy, and doxa tell you that everything is biblically written? Doxa tells you that the binary of heaven or hell is already set out for you in a hegemonic tradition that has always already decided the woman’s struggling fate.

Antigonian fate is not for the feminist, the fierce inventor that simultaneously redraws the lines of the real with the yet that has yet to be thought.
Micro-Movements

The research event was enacted in an elementary-middle school in a large city in Canada. I refer to the school with the pseudonym ‘Fir Valley.’ The research event was designed with a grade 2 and 3 combined class of 22 students (ages 7,8,9). I worked with the classroom teacher, who I will refer to with the pseudonym ‘Mr. D.’ I also worked with the parenting centre, which is located in the school. The centre provides a place for parents and volunteers to gather and host events, such as book sharing and cooking workshops. Drop-in rates at the centre varied. A group of parents frequented the centre on a daily basis. These parents were involved in the research event. Parents volunteered their time by helping to water and manage the school garden. The parents maintained the garden over the summer months of July and August. Students worked with them during the planning process, especially concerning the selection of vegetables to be planted in the garden. Parents were also involved in other events during the research process, including the exchange of seeds and container gardening.

Mr. D’s interest in new ways of thinking and teaching proved invaluable during the research process. He approached the research event as a joint effort and we co-taught throughout the research process. Mr. D also took it upon himself to record interviews and/or what I refer to as ‘tangents’ by installing a web camera in the classroom. The web camera served as a platform for students to share their learning experiences. The camera was also used to Skype with students who were visiting their grandparents abroad. Mr. D also used wearable technologies as well as took digital photos. The teacher and students were involved with every aspect of the research event throughout the ten-month process.
Mr. D described the research process as “the figuring out of things” with the students and myself. In other words, researcher, teacher, and students grappled with making sense of what was happening, rather than controlling what would happen (Latham & McCormack, 2009).

My intention to enact practices within an urban school and community was one of affirmation of the urban lived experience as well as one of commitment, creativity, and social change. Commitments are never neutral and I perceive of change in ways that work with schools and communities to generate micro-movements on a daily basis. Micro-movements are qualitative differences that can remain untapped, but can also materialize in the smallest of form. For example, a new curiosity about worms and a new relationship with ruderal ecologies are just two examples I make note of during the research event. Understanding change as a qualitative micro-movement is different from articulations that desire change ‘for’ someone and/or a community. To desire ‘for’ another would entail a fixed understanding of that individual and their needs. My research interests and personal concern for urban schools do not lie in deciphering or decoding humanizing experiences (Gregg & Seigworth, 2010). My work in urban schools is grounded in the capacities of students and the event-potential of an ecology of practices, which is in continuous tension with the constraints and conditions of material environments. The event is grounded in an emergent or affective politics that is determined by students in relation with environments. Relationality suggests that the nonhuman cannot be excluded. An affective politics is concerned with social practices that are culturally produced in relation with local environments that are in turn globally implicated. For instance, Jane
Bennett (2010) argues that even worms in their local intra-actions make contributions to culture and history on a global scale.\(^5\)

In *Vibrant Matter* (2010), Bennett asks the very question: “Can worms be considered members of a public…even if a convincing case is made for worms as active members of, say, the ecosystem of a rainforest” (p. 94)? According to Bennett (2010), the difference between ecosystems and publics, political systems and political participation is something to be considered. Attending to her question, it is perhaps obvious that worms do not have the capacity to speak and so questioning their participation in politics through a human-centred framework does not make much sense. Of course worms are not producers of human language, but as Bennett points out, they do communicate and do ‘make history.’ Darwin (1881) studied worms for many years. He observed where they went, what they did, and he particularly paid attention to their spontaneous movements (Bennett, 2010). Darwin was fascinated by worms and insisted on their importance in history. The return to Darwinian theories, here, is, however, not to prove that worms are important because they remain in the histories of thought; nor is it my intention to sustain such theories. The contributions of worms to history and to culture is the ‘unplanned result’ of worms co-composing or intra-acting with other biological and bacterial agents (Bennett, 2010). Deleuze and Guattari (1986) refer to such a process as an ‘assemblage’ and Bennett similarly explains that worm behaviour affects and effects the composition of ecologies. The students at Fir Valley, for example, found worms to be fascinating invertebrate species. They not only wondered about worms, whether they could see, what

\(^5\)A portion of the text within this section of the thesis has been published in the book chapter: Rotas, N. (2014). Ecologies of praxis: Teaching and learning against the obvious. In N. Snaza & J. Weaver (Eds.). *Posthumanism and educational research* (pp. 91-103). New York, NY: Routledge.
they ate, and if they could poop! Students learned to answer their own questions by working with worms in the garden and through a red-wiggler-worm vermicomposting system that they created with the worms. Students, for instance, asked: What do worms do? What do worms eat? If worms eat fruit and vegetables, what else do they eat? How do they poop?

A fascinating point about worms is that they spontaneously respond to the temporality of place, not reducing their action to mechanical instinct (Bennett, 2010). For example, worms do not gather leaves and drag them to their burrows in the same manner each time; they adjust their behaviour in accordance with the situation and the possibilities that could potentialize (Bennett, 2010). Worms do have habits and engage in repetitive movements. It is, however, through the repetition of difference that the worm inhabits “its own qualitative movement, in migratory independence from any given context” (Massumi, 2003). Such an understanding is similar to Manning and Massumi’s (2014) theorization of ‘technique’ as that which reinvents itself in the ‘doing’ of a practice. Understanding technique in malleable and reconfiguring ways resists ‘methods’ of implementation. The technique of the worm, for example, is an embodied practice of repetition as is the embodied practice of gardening. However, the worm’s ever-changing sensorial capacities and its immediate relation to the environment informs its mode of orientation (differently each time) (Parikka, 2008). The point I am making is that worms are intra-active species, which means that their mode of existence is local and learned (i.e., intentional), as well as nonlocal and that of self-organizing matter (Massumi, 2003). The brief note about worm behaviour highlights the dynamic element of intra-activity and the agentive force of an ecologies of practice. Dynamic environments like urban schools
cannot be explained in causal terms of agency (i.e., from point A-B). Affect in an urban school is not solely a local encounter. It is inseparable from nonlocal; that is, national and global constraints and conditions (i.e., effects), such as educational policy, the allocation of funding, and discriminatory practices that produce violence. Theorizations of agency (or change) are often relayed through interventionist methods that ignore the capacities of nonhuman assemblages to affect and be affected (Bennett, 2010). Through the example of worm behaviour in relation to practices, I refuse the notion of process as a ‘natural’ event, as well as human-centred conceptualizations of agency as causal. Worms as a point of reference and other insects and animals encountered during the research event, such as squirrels, blue jays, and bees are interesting species for their resilient power to come up with emergent solutions in their encounters with a differentiating environment that is never free from culture and nonlocal structures of power. Therefore, implementing change was not the ‘goal’ of the research event, nor the goal of the ecologies of practice. The goal of the research event was its process, which opens up an understanding of the research event as an agentive force that does not exclude the nonhuman and the inanimate. From a new materialist perspective, agency is understood as that which is not in objects and subjects; it does not preexist. Agency is rather enacted or performed through material and discursive practices of embodied learning and/or knowledge-making that materialize boundaries and mark territories within phenomena. Agency does not become the goal of the research event, but is a matter of processes of differential becoming in the world. For Barad (2007), in particular, and from where I draw my understanding of agency, agency is not simply a practice of putting the subject as a “knower” in the world “as if the world were a container and we needed merely to
acknowledge our situatedness” (p. 91). Agency, through a new materialist lens, is to understand and account for the differential becomings that the human co-constitutes.

Barad (2007) writes:

[T]he point is not merely that knowledge practices have material consequences but the practices of knowing are specific material engagements that participate in (re)configuring the world. Which practices we enact matter – in both senses of the word. Making knowledge is not simply about making facts but about making worlds, or rather, it is about making specific worldly configurations – not in the sense of making them up ex nihilo, or pot of language, beliefs, or ideas, but in the sense of materially engaging as part of the world in giving it specific material form. (p. 91)

When the goal of a research event becomes its process, it is counter-productive to create research goals. Having no goals is also problematic, as research-creation events do not just happen. In my initial meeting with administration at Fir Valley, they expressed interest in developing ecological literacy at the school. Their goal as a school was to achieve ecological certification through a school-board-wide greening initiative. The initiative encourages ecological literacy through technical approaches to environmental sustainability. Technical approaches to sustainability are linear. They often include solution-based approaches, such as the implementation of a recycling program and/or accountability projects that monitor the usage of electricity in each classroom.6 Speaking with administration, I proposed the idea of creating ‘event-spaces’ of learning, or to use a landscape architectural term – ‘loose spaces’ of learning (Franck & Stevens, 2006).

6Throughout the years, Fir Valley has been approaching sustainability through technical modes of recycling as well as monitoring the usage of electricity.
Event-spaces were thus envisioned as interdisciplinary projects (intersecting environmental science and the arts) that were culturally responsive and indeterminate. In turn, administration proposed the creation of a school garden and in keeping with the indeterminate and ‘loose’ potential of event-spaces, the research event began with these two propositions: 1) create event spaces; and 2) build a school garden.

Propositions I and II

Propositions are quite different from research goals, as they are indeterminate and certainly not fixed. Manning and Massumi (2014) describe propositions as techniques that activate self-organizing potential. In other words, propositions provoke ideas and actions, rather than implement or impose them (Springgay, forthcoming; Truman & Springgay, forthcoming). The ideas that are provoked become “seeds of organization” that in turn become new propositions for action generated by those involved (Manning & Massumi, 2014, p. 151). Manning and Massumi (2014) explain that the activation of the proposition is not solely dependent on human experience. The potential of the event is embodied in the relational (more-than-human) practices that the proposition activates. Thinking with a propositional methodology, I was interested in how the two propositions (i.e., ‘create event-spaces’ and ‘build a school garden’) would unfold. I was not interested in building a garden with students in a goal-oriented manner. When school gardening is approached in a goal-oriented way, school gardens become objects of sustainability that often look and are engaged in programmatic ways. For example, the plot-style garden is
replicated in a countless number of schools in North America. Plot gardens replicate and constrain movement by forcing bodies to surround the rectangular-shaped garden in a predetermined manner. Students rarely inhabit the space of a plot garden in ways that are determined and thus shaped by bodies in relation with environments.

A propositional methodology creates the conditions for the activation of event-spaces (Manning & Massumi, 2014). This means that the proposition to ‘build a school garden,’ for example, would collectively evolve into unforeseen events. Again, this is very different from the conventional, human-centred research goal in that the ‘goal’ aims to follow preplanned paths of knowledge to achieve something already thought of and thought-out for the student. On the other hand, during the research event at Fir Valley, unforeseen events emerged, including ‘photobombing’ and an exploration of the ruderal species on school grounds. In fact, the event of building a school garden became ruderal in itself by grasping the attention of students in other classrooms. Students who were not part of the Grade 2/3 class (formally chosen for the research-creation event) expressed interest in joining the research process, as did parents and volunteers throughout the months. The research event was not limited to the specified (Grade 2/3) class involved.

The research event began in January 2014 and ended in October 2014. The process was 10 months long (including the summer months of July and August). In the winter months of January and February, I was at the school for 2-3 days a week. As the spring season arrived, I was at the school 5 days a week. In late spring and heading into summer, I was at the school on weekends to help with watering and garden maintenance. Volunteers from the parenting centre took full responsibility of maintenance in the summer months of July and August. Four mothers shared in the responsibility of
maintaining the garden. They made a watering schedule amongst themselves, which suited their familial responsibilities. Each mother tended to the garden for two weeks at a time, rotating schedules. The mothers recruited their children to help with the watering. They also created one rule: “Take only what you need”. I also tended to the garden and worked with the mothers over the summer months and on weekends. Students that passed by the school spontaneously joined us to water, weed, pick vegetables, and to enjoy the garden. Through the mothers’ and students’ social networks, parents and community members were invited to pick from the garden. The garden was not fenced in and was visible and accessible to the community during the harvest season. The mobile structure and informal interaction that the garden invited was important to negotiating ‘loose spaces’ of learning.

Thinking with a propositional methodology, I was attentive to an ‘affective style’ of being ‘with’ students, teachers, and parents during the research process. I understand ‘style’ as a relational mode of being and/or that of an ecological approach. In approaching learning ecologically, I viewed my embodied ‘style’ as a researcher in the school and a woman of social, cultural, and class-based experience as inseparable from the research process. Yet, I also understand ‘style’ as more-than the discourses of such positionings, suggesting that an affective style of being is open to non-representational ways of knowing in urban schools. Vannini (2015), for instance, similarly makes note of a ‘non-representational style’ of research that is process-oriented, rather than oriented toward predetermined subjectivities of examination and study. He describes a non-representational style of doing research as a process of “becoming entangled in relations and objects, rather than studying their structures and symbolic meanings” (Vannini, 2015,
I, therefore, understood the research event as a natural-cultural process in and of which the researcher, teacher, and students spontaneously intervened.

Interventions are aesthetic ‘platforms of experimentation’ (Manning & Massumi, 2014) that are triggered by a propositional methodology. Platforms are an aesthetic dimension of the ecologies of practice. They are process-oriented events that enact social change through creative and aesthetic means, rather than implement change. Working ‘with’ students and ‘in relation’ with the constraints and conditions of urban environments, aesthetic platforms provoke new modes of knowledge-making that are open to questions of aesthesis and new practices of relation that are determined by students in urban schools. Approaching social and environmental justice through propositions provokes entirely new terrains of thought and practice that are determined by the students themselves, and as they are encountered. Understanding style and social change as culturally specific, performative, and within the capacity of students and the surrounding community, the research event encountered issues through the lens of embodied movement. For example, with the use of wearable technologies worn by the students, the discourse and practice of social justice work was re-imagined through an embodied and aesthetic approach to social change. Wearable technologies enabled new angles to address complex social and cultural issues pertaining to the urban environment. For example, the prohibition and fear of unmanaged spaces on school grounds were grappled with during the research event. Interventions as aesthetic platforms optimize the capacity of relations in schools, enabling researcher, students, and teachers to operate as affecting bodies that work across disciplines and positionings to grapple with, frame, and un-frame modes of learning and the knowledge that is produced.
Curriculum, Pedagogy, and Enabling Constraints

New materialist educational researchers creatively draw on the philosophies of Deleuze and Guattari (1987) in order to grapple with research practices in schools in non-representational ways. For example, Liselott Olsson (2009) describes the research process as a Deleuzian event that enters into a ‘problematic field’ of relations. Her methodological approach does not seek to find solutions to problems in schools. The problematic field of the school is understood as an intra-active space of learning that wrestles with the constraints and conditions that emerge on a daily basis. Olsson (2009) emphasizes how bodies join the problematic field. She makes the point that if researchers were to look for problems, one would be seeking to solve a predetermined problem with a solution. In urban schools and marginalized communities ‘problems’ are often already framed prior to engagement in the research context (Kumashiro, 2014). In particular, Kevin Kumashiro (2014) grapples with the modes of analysis – the ‘lenses’ – deployed in immigrant communities. He argues that such research often falsely promises mutual benefit in the production of knowledge for researchers, participants, and even society as a ‘whole.’ Olsson (2009) makes the point that learning is not about finding predetermined problems, nor about making false promises. For Olsson (2009), learning is a process of becoming with the constraints and conditions of environments and, in turn, she examines how these conditions and constraints enable processes of learning. Focusing on the capacities of bodies to learn, she attends to what the conditions and constraints of the learning process enable. Manning and Massumi (2014) also view the constraints and conditions of learning (which they refer to as ‘enabling constraints’) as presenting new conditions of emergence. They give the example of gravity as an enabling constraint.
Frost and rain are also enabling constraints, which were encountered during the gardening event. What the proposition does is activate a conditioning of environments. Propositions, for instance, create conditions that are responsive to environments and the social and cultural constraints of urban schools. Propositions do not impose, but rather activate an aesthetic conditioning of urban environments that are determined by its inhabitants. Constraints were approached affirmatively and not as a ‘problem’ that needed to be solved. For instance, the constraints of lack of sleep and the tardiness of students were not seen as a problem that could be solved through gardening, but rather grappled with through the intensities of learning afforded on that particular day. A propositional methodology attends to the constraints of the urban school as that which enables multiple entry points and angles into the daily events of the research process. Constraints were not ignored and did not impede access to learning. The constraints at Fir Valley were rather encountered in ways that enabled new directions responsive to the modes of learning determined by the students. For example, students were responsible for creating their own propositions for action. These propositions operated on varying lines of intensity, materializing constraints, conditions, and new modes of learning. In other words, classroom activities and experimentation were not always generative of ‘results,’ but rather unfolded as ways of being and becoming on that particular day in class. Therefore, responding with students through a propositional methodology suggests that constraints do not impede access to learning, but rather enable and propel learning into new directions that are determined by the students themselves.

Using a propositional methodology, emphasis was placed on the ‘dynamic effect’ (Manning & Massumi, 2014) of constraints, even though weeks of torrential rain seemed
limiting when trying to plant a garden! Weeks of rainy weather postponed planting the
garden. Every morning during spring planting season students were armed with shovels
and the potted plants they had grown throughout the weeks. Eager to plant outside, many
of the days were rained-out and students were faced with the proposition to ‘be creative.’
Students were responsible for creating emergent ‘back-up’ events, and many activities
were generated from such departures including an event titled the ‘Wearable Garden.’
Using twigs and materials gathered from a previous outdoor hiking event, the students
decided to use the materials to create vests, hats, and skirts to hold the potted plants.
Wearing the garden on their bodies, students moved through the school hallways and
from class to class, eager to show the plants they were growing in their classroom. The
students created mobile aesthetic platforms in and of which actual movement and the
durational force of plant growth were foregrounded. Entangling the actual movement of
human and plant-bodies and the virtual force of photosynthetic plant-structures (i.e., light
capture, electron transfer, and energy conversion) opened up a scientific and aesthetic
questioning of time-space relationships. Intersecting environmental science and
aesthetics, students posed self-generated questions pertaining to the growth and
imperceptible change of plants. Students posed the questions: Why do sunflowers face
the sun? How do sunflowers make sun seeds? How does a flower grow to be a flower?
The event was generative in that it activated inquiry into the complex molecular
structures of plants. Student curiosities into what cannot be perceived by the human eye
made their capacities to think and question – in their own terms – evident. Working with
propositions, curriculum and pedagogical activities were thus not designed in a traditional
manner for a particular group of students. Curriculum and pedagogy became an embodied
and aesthetic practice of knowledge creation, which took shape through the aesthetic dimensions of the ecologies of practice that were not limited to the practice of gardening. Learning was enacted through other garden-related practices which included: 1) composting; 2) harvesting; and 3) bird and butterfly-watching. Learning was also enacted through: 1) journal-writing; 2) photo-taking; 3) a running club; 4) a walking practice; and 5) hiking.

Decades ago, curriculum theorist, Ted Aoki (1993/2005) suggested that in-between the “curriculum-as-plan” and “curriculum-as-lived” is the “where” of learning, a mobile space of lingering (p. 207).7 Aoki’s methodology was to actively linger and to respond to what space-time-place called for. Aoki (1993/2005) humbly worked to test the limits of bodies, spaces, and places in order to create new subjectivities, practices, and pedagogies. Playfully and poetically he fostered a pedagogical practice that activated relations, resisting predetermined subjectivities and methodological ordering. He invited experimental practices and ‘attunement’ to the more-than-human ecologies of the classroom, and that of curriculum studies. Aoki’s (1993/2005) life’s work, it seems to me, was perhaps not to build a curriculum or to ‘collect data,’ but rather to ‘touch,’ to ‘stir,’ and to activate a living pedagogy that destabilizes curricular practices and disciplines as a way to contingently rewrite them. Perhaps the question that should be asked is not what kind of a curriculum should the researcher build, but what might a proposition do?

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In an earlier paper I co-wrote with Stephanie Springgay (Springgay & Rotas, 2014), we approach Deleuze-Guattarian thought with the entanglement of practice. We use image-based methodologies to problematize humanist notions of recognition in arts-based educational research (ABER), and propose a politics of experimentation that is never fully intelligible and known. We argue that the move to non-representational approaches to research requires an untethering of established disciplinary practices of ‘art’ in ABER scholarship. We further argue for a research methodology that destroys as well as produces, emphasizing a Deleuze-Guattarian ontology of difference. Deleuze and Guattari (1987) philosophize an ontology of difference that refrains from grounding what it ‘means’ to be human. Reworking Bergson’s (1998) concept of ‘life,’ Deleuze’s notion of ‘a’ life entails an ecologically immanent understanding. ‘A’ life, writes Deleuze, is a becoming process of learning. Jackson (2013) similarly suggests that a Deleuzian becoming entails “the movement through a unique event that produces experimentation and change; a state of being in-between” (p. 116). A questioning of life through a Deleuzian lens is, then, not an analysis of life, but that of a processual modality and of event potential. In order for a propositional methodology (which foregrounds process-oriented modes of learning) to activate event-potential, it needs to be responsive to the heterogeneous and complex social and cultural conditions of urban school life. In so doing, a propositional methodology requires techniques.

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Techniques of Relation

Techniques are different from methods for two reasons. Techniques: 1) propose initial conditions rather than implement them; and 2) modulate the event rather than control it. Modulation is linked to affect and the bodily expression of durational force. Aoki (1993/2005), for example, used the term ‘attunement’ to express the bodily potential of learning in relation with environments. Modulation thus refers to a self-organizing capacity that materializes in non-neutral ways. The term is also similar to Barad’s (2007) notion of ‘mattering,’ which is a collective learning process that enacts boundaries of exclusion.

An example of one technique in the study of philosophy is a close reading of a text (Manning, 2013b). A close reading is approached in ways in which the reader becomes entangled with the concepts of the text. To become entangled is to generate alternative understandings that are not found in the text. A close reading is not only an exercise in comprehension, but there is a vibratory element, an aesthetic and syndetic dimension of the text that generates future thought. In their many writings, Deleuze and Guattari (1994) encourage the reading of concepts in lively and performative ways. They write: “The concept of a bird is not to be found in its genus or species but in the composition of its postures, colours, and songs…[a] concept is a heterogenesis – that is to say, an ordering of its components by zones of neighbourhood” (p. 20). A close reading is also concerned with thinking an ontological difference rhizomatically rooted in incessant change, or (ecological) practices of becoming. Mazzei (2010) similarly writes of being entangled with data in relation to Deleuze’s (1986/1989) cinematic concept of the ‘image.’ She works to engender an understanding of ‘voice’ as that which cannot be
found in images of data. ‘Voice’ is rather read from a multi-dimensional perspective, which involves rethinking voice in qualitative research as that which is without a predetermined image and thus not rooted in fixed understandings of being. Drawing on Barad (2007), Mazzei (2010) argues that she is not leaving the material world behind, but is rather putting into question how data is read and how images come to matter with theory, and in excess of representational ideals. Deleuze and Guattari’s (1987) techniques of reading as well as Mazzei’s (2010) are concerned with thinking difference in ways that are tailored to the event of reading; or to the event of subjectivity, rather than the determination of the subject. Particularly, for Mazzei (2010), she is concerned with the event of reading data with theory. The point being made is that techniques for reading and for reading data cannot be predetermined. Neither is the subject determinate, nor reducible to a homogenized being (O’Sullivan, 2012). Therefore, inventing techniques of relation in an urban school requires addressing the school as a unique event-space that shapes its own subjectivities in an ecology of becoming. Through the lens of a propositional methodology, learning is understood as a process in and of which techniques work to activate unforeseen modes of knowledge-making and thought, which will be determined by the participants of the event who are always in relation. Manning (2013a), for example, describes the process of creating techniques of relation for one of her research events. Her explanation is helpful in thinking about how techniques differ from methods. She writes:

The techniques would have to be structured, in the sense of being tailored to the singularity of this event, and improvised, taking the desires and expertise of the event’s particular participants into account, inviting their active collusion in
determining how the event would transpire, so that in the end it would be as much their event as the organizing collectives. (Manning, 2013a, p. 92)

Techniques engage participants through creative and aesthetic means. Working ‘with’ the students at Fir Valley, techniques sought to activate event-potential rather than implement, or impose change. A propositional methodology that employs techniques approaches social and environmental justice education from the perspective of students as in relation with schools, which suggests that students have important insights into how they learn and solve problems. The Design Studio for Social Intervention (ds4si), a community outreach artistic hub in Boston, Massachusetts is helpful in re-imagining social justice through a creative and aesthetic lens that is culturally responsive to the social conditions and constraints of urban environments. ds4si is a key partner with the SenseLab, a research-creation laboratory at Concordia University in Montreal that focuses on interdisciplinary and experimental research practices. The SenseLab is particularly committed to alternative research practices and modes of dissemination that foster interdisciplinary research that reaches academic and artistic audiences, as well as communities through open access policies and local interventions in cities. Similarly, ds4i’s approach is experimental and provocative, addressing social justice through aesthetic propositions that provoke entirely new modes of thought and practice that are co-created with students. Through an interactive installation they refer to as the ‘school lab,’ ds4si approaches social justice education from the perspective of students as those

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9The Design Studio for Social Intervention (ds4i) understands students as ‘primary users’ of schools, explaining that students have important insights into their own learning. ds4i’s work in schools is documented on their website: [http://ds4si.org/school-lab/](http://ds4si.org/school-lab/)
who have the capacity to enact change through existing relationships and creative cultural tactics that explore new ways of being interventionists in urban schools. As a ‘creativity lab,’ ds4si invests in the potential of what projects such as the ‘Sea of Pink’ can do in schools. The event challenged the school structure and the practice of bullying by provoking half the school to wear pink. ‘Big Urban Games’ and ‘Mobile Banner’ are another two examples of how ds4si brought issues of poverty and social violence to the fore through interventions that foregrounded dialogue and the surprise of play, spectacle, and delight. Adapting childhood street games like hopscotch to the urban streets, ‘Big Urban Games’ re-imagined social justice education as an unexpected and collectively determined practice that enabled students to engage and inhabit urban environments in ways they deemed fit, and in ways that impacted the larger community of neighbors and the passer-by. Echoing ds4si’s creative approach to social justice and understanding social change as culturally specific, performative, and within the capacity of students and communities, I proposed the technique of journal-writing at Fir Valley.

Journal-writing was one of the initial techniques proposed during the research process. Akin to a propositional methodology and ds4si’s approach to mapping process, which includes accounting for practices and consulting students about their experiences, journal-writing served to generate student response on how they felt about social and environmental issues and how it manifested in the school. Journal-writing also served as a platform for future propositions to take off into directions outside of the classroom and into the hallways and schoolyard where explorations are often minimal and limited. Renowned architect, Peter Eisenman, also influenced the creation of the diaries. Throughout the years, his architectural projects have been influenced by Deleuze’s
concepts. He wrote a book titled, *Diagram Diaries (1999)*, in which he maps his life’s work. Following Eisenman and ds4si’s approach to social justice, students created ‘Garden Diaries’ in which they mapped their experiences during the research event. I conceived of the diaries as a technique of activation, rather than a linear collection of reflections and human-centred narratives. Garden diaries emerged throughout the research process in different ways. Questions and propositions were posed in the diaries alongside daily ideations. These questions and propositions generated new lines of thought and research directions. The classroom door was also covered with brown craft paper and students posed questions, curiosities, and propositions for action on the ‘Becoming Curious’ door. Ideas for pedagogical activities were generated from there as well. Students, for example, were curious about insects and worms, with one student noting his experience with cockroaches in his apartment building. Some of the questions they posed in their diaries and on the door included: How do bugs see? Where do cockroaches sleep? How do worms have babies? How do worms drink? How do butterflies survive in the cold? Why do bees sting?

Among many other activities (which included learning about monarch butterfly migration, cross-pollination, and the breeding cycle of worms), these questions and
curiosities led to the formation of a human swarm that spilled into the schoolyard at recess time. Engaging the bodily becoming-movements of insect-like swarming, non-habitual ways of moving were experimented with. Swarming was not a game of imitation, but rather an experimentation with bodily movement in non-habitual ways. Thinking-in-movement potentialized alternative forms of thought and an activation of future propositions. For example, the event of ‘swarming’ provoked new student-led propositions including: 1) create a happy dance; 2) play like you’re never going to have recess again; and 3) use your opposite [non-dominate] hand to write in your journal. Furthermore, student interests in worms led to the creation of a red-wiggler-worm vermicomposting system.
Working with students, Mr. D built a composting system that housed the red-wiggler-worms. As a former carpenter, Mr. D purchased the wood, nails, and hinges for the compost. Pushing the limits of what is (usually) ‘expected’ in classrooms, Mr. D brought his electric circular saw and cut into large pieces of wood as the students observed from a safe distance. As he built the compost system, Mr. D explained his thought process and presented detailed information about the wood materials he was using. Students helped by handing him nails and offering insights into the structure of the composting system as it was being built. Creating the composting system and caring for the worms enabled students to distinguish between the red-wiggler-worms in the composting bin and the earthworms they intra-acted with while gardening outside. Comparisons were made through oral communication in small and large group formations in the garden. Students also noted the capacity of red-wiggler-worms and earthworms in their diaries, not merely recalling similarities and differences but probing for answers by asking questions as they emerged in the process of gardening, composting, and journal-writing. A propositional methodology is a process-oriented and experimental way of doing curriculum, pedagogical, social and environmental justice work. It is a way to approach learning that unsettles systematicity, behavioural codes, and routine practices in schools (Vannini, 2015). The diaries, therefore, became a way of mapping the intensities of flows of experience, rather than reflecting and recalling memories of experience. Other techniques used during the research process included:
• **Researcher Journal-Writing**

I kept a journal in which I noted daily activities and questions, as well as future propositions. I found the writing process generative. I was committed to writing each day. This often occurred after daily activities at the school. As previously mentioned above, students also kept a journal (i.e., Garden Diaries). At times, I wrote with the students. Both researcher and student journals were used during the research process as a technique to activate questions and propositions. During the thesis-writing process, I diffractively read my journal entries with those of the students. During the research process, students also read my journal entries. Reading insights through one another, the journals served to activate future thought, rather than recall past experiences. Approaching journal-writing as a technique emphasizes the practice or the ‘doing’ of writing. Rather than understand ‘the journal’ as a method of data collection, researcher and student journal-writing – as a technique – places emphasis on the embodied practice of intra-activity in shaping thought in excess of the journal entry (also see Phillips & Larson, 2012).

• **Digital Photography/Digital Images (Digital SLR camera and Android Tablets)**

Akin to image-based research new materialist methodologies emphasize the importance of embodied experience. Researcher, teacher, and students took digital photos during the research event by using mobile technologies (i.e., Android tablets). Student work was also photographed by the researcher and teacher.
Images were used for (3) purposes:

1. Thinking with a diagrammatic methodology, images were mapped and re-mapped to create the design for the school garden. Mapping images enabled the researcher, teacher, and students to experiment with how bodies come together and encounter one another. It also emphasized the movement of images beyond their initial frame. I will discuss the diagrammatic methodology as well as detail how images were used in Ecology II and III.

2. Image-based research and diagramming is based on co-composition. Providing classroom teachers and students with cameras during the research process meant that who performs ‘analysis’ and how ‘data’ gets ‘documented’ is not solely based on the researcher’s decisions.

3. Images of student work were photographed. These images were not used to represent a finished piece of work, or culminating task. Images of student work were conceptualized as propositional and thus were diffractively read through one another in order to provoke new directions for thought.

- Mobile Technologies (Tablets and Web Cameras)

Android tablets were used during the research process. Students used the tablets to: 1) take digital photos; 2) access the Internet for research purposes; and 3) use web-based applications while engaging in research events in the classroom and in
the garden. Desktop computers were also used for research and working with images.

A **web camera** was used in the classroom and in the hallways at the school. During activities students would talk into the camera. Students posed questions and propositions to the webcam. Students also veered off ‘topic,’ discussing an incident occurring in the classroom. This would often unfold in a dramatic performance and/or ‘rant-like’ style of speech, which is referred to as a ‘tangent.’ I describe the tangent in terms of affect/aesthetics and movement. Tangents do not directly intersect with the classroom activity at hand. The straight line of a tangent moves beyond a topological curve that is shaped intra-actively. To put this differently, the tangent reaches a point and/or limit at which it changes direction, exceeding the boundaries of what may have been expected from a practice, or pedagogical activity.

During events the web camera recorded student articulations of classroom relations and their understandings of content knowledge. In particular, the immediacy of student feelings/expressions would not have been accessible (in the same way) after the completion of classroom activities, or later in the research process. Conducting a traditional face-to-face interview after research activities, or after the research process is common practice in conventional approaches to research. However, the web camera not only minimized inhibition, but in-formed the ‘continuum of relation,’ (Manning, 2009) which suggests that the camera intra-actively co-produced relations. Deleuze (1986), for example, refers to the practice of *talking into the camera* as a ‘close-up image’ that expresses ‘faciality’.
The close-up image is not a direct translation, nor a representation of a face.

Faciality is an expressive becoming that can be reflexive and intensive (Taylor, 2013). Student tangents, for example, became expressions of intensity. Deleuze writes that the intensive face expresses micro-movements that the body keeps hidden (Taylor, 2013). He describes micro-movements as qualities of expression and uses William Pierce’s concept of ‘firstness’ to articulate the intensities of the face and faciality. Firstness, Deleuze (1986) explains, is a moment that “expresses the possible without actualizing it, whilst making a complete mode” (p. 96).

Reflections also served to articulate content learned during various activities.

- **Mobile Interviewing**

  In addition to the web camera and tangent interviews, the students, teachers, and principal performed mobile interviewing and/or ‘walk and talks.’ They took place in school classrooms, hallways, and the schoolyard. Social scientists and particularly geographers have performed interviews while in movement (Anderson, 2004; Carpiano, 2009; Evans & Jones, 2011; Ricketts Hein, Evans & Jones, 2008). Evans and Jones (2011), for example, rethink the interview by “engaging with participants ‘on the move’” (p. 849). Conducting a pilot project in an urban environment in Birmingham, United Kingdom, they argue that participants produce data by walking and talking. Evans and Jones (2011) suggest that there is a relationship between what participants say and the place they say it. They argue that the language that materializes is “informed by the landscape” (Evans & Jones, 2011, p. 849). Furthermore, educational researcher,
Eileen Honan (2014), disrupts the face-to-face interview by not privileging the interview transcript. She suggests that focusing on the research, the researched, and the writing process as an assemblage produces thought that cannot be coded for data analysis. Honan’s (2013) approach shifts away from practices of (interview) transcription. She rather grapples with the impossibilities of empirical truth by juxtaposing text and images in attempts to ‘re-present’ knowledge differently.

The use of mobile interviewing at Fir Valley emphasized the materiality of movement. Therefore, the ‘walk and talk’ was an immanent technique that was not shaped by preplanned questions. Conversations emerged and diverged in and of walking movement – in the school hallways, at recess time, afterschool, and on the weekends while tending to the garden.

**Wearable Technologies (GoPro Video Cameras)**

I conceive of the wearable camera as an ‘apparatus’ (Barad, 2007) that moves ‘with’ the material movement of bodies as well as shapes the materiality of movement as it relates to environments. In Barad’s agential realist account, she explains that apparatuses are not tools to be used to satisfy knowledge projects; the apparatus is a technique of relation. Drawing on physicist Niels Bohr’s philosophies, Barad (2014) articulates an interest in the “practices embodied in “apparatuses”” (p. 199). She is not concerned with dissecting what the apparatus is. She is concerned with what the apparatus does and how it works. Barad is also concerned with accounting for what the apparatus produces and constrains. The apparatus is not merely a material object,
but rather part of a material-discursive performance, a process of materialization that is in relation with material phenomenon.

The researcher, teacher, and students wore the camera everyday during school, afterschool events, and during ‘walk and talk’ interviews. At times, multiple cameras were recording. Cameras were worn on students’ head, chest, upper back, and wrist. The recording function was mostly used, which was set by default at a resolution of 960 pixels and 30 frames per second. It created an ultra-wide field of view. The camera has other features such as ‘time-lapse’ and ‘photo-burst.’ These functions were experimented with as well. For example, time-lapse captures a series of photos over second intervals, and photo-burst captures multiple photos in short intervals of time. Another interesting feature about the wearable camera is that it does not have a viewfinder. A traditional camera is built with a viewfinder that enables the user to compose the shot through the finder. The function of the viewfinder enables a point-and-shoot approach. It is often used in visual methodologies and ethnographic studies. The shot is always taken away from the body. The camera is also inserted into specific moments of interaction, or it is placed on a tripod. The wearable camera, however, is always on and in the middle of intra-action. It composes ‘with’ the material movement of bodies, the materiality of breath, and even responds to the sound of one’s heartbeat. The video stream cannot be viewed and/or edited in situ. The wearable camera is an innovative approach to research, as it becomes a material way of the body seeing from the middle and/or milieu of relations. The use of wearable technologies is discussed in detail in Ecology III.
Ecology II

Diagrammatic Methodology
Proposition III: Think Outside the Box

Form follows the design process, far from enclosing it. Far from directing it, form emerges from the process, derivative of a movement that exceeds it. The formal origin is swept into transition. Followed by the architect. (Massumi, 1998, p. 3)

There are rules, rules of “plan(n)ing,” of diagramming…[it] is not random; the continuities, emissions and combinations, and conjunctions do not occur in just any fashion. (Deleuze & Guattari, 1987, p. 70-71)

Thinking about garden design as that which would take shape processually and ‘with’ students and teachers, I entangled propositions with a diagrammatic methodology by challenging students with the proposition “Think Outside the Box.”¹⁰ Students were encouraged to enact the design of the school garden through diagramming, which involved the obvious intention to build a school garden. However, the intention would remain open to its own plan of fruition that would be determined by the more-than-human relations entered into. A diagrammatic methodology does not methodically order relations, but is rather concerned with how relations compose (Zaliwska & Springgay, 2015). There is also the concern with how relations decompose and come to matter in excess of the intent of the architect or artist. Diagramming operates intra-actively in that the diagrammatic process durationally maps the relations between bodily thought and movement. The intra-active dimension of the diagrammatic suggests that students in

¹⁰“Think outside the box” is a popular western cultural phrase, which means to think differently and/or creatively. As a proposition and entangled with a diagrammatic methodology, the phrase activated emergent garden design ideas.
relation with urban environments become ‘intensive participants’ that exceed the predictabilities of practices in schools (Manning, 2013a). The diagrammatic emphasizes materiality and is thus open to durational intensities of thought and movement that are at play in embodied practices of learning. Grosz’s (2011) articulation of durational force is particularly helpful in understanding that relations have the potential to unfold in excess of interactional models and human-centred modes of learning that suggest that matter is solely formed through discursive practices. She describes durational force as that which sustains futurity through “the fracturing and opening up of the past and the present to what is virtual in them, to what in them differs from the actual, to what in them can bring forth the new” (Grosz, 2011, p. 43). Grosz (2011) is referring to matter as that which carries duration and constantly forms and reconfigures. From this perspective, attention is given to the materiality of lived experience, which is to be understood as an embodied experience co-composed of space-time relationships that are indeterminate. These relationships produce qualitative differences that cannot be found in people and in things, but rather make objects and subjects “other than what they used to be” (Grosz, 2011, p. 51). At Fir Valley, a diagrammatic methodology was used as a mode of collective, creative, and dynamic communication. Such communication attends to the emergent play of durational force, which materially and discursively co-constitutes unforeseen realities in schools. It is important to examine ‘how matter comes to matter’ in the material practice of a diagrammatic methodology. In the following section, I use Deleuze’s (1986) cinematic theory of ‘montage’ and Barad’s (2007; 2012a) notion of the ‘agential cut’ to map the events of the diagrammatic as they played out at Fir Valley. I further explain how the diagramming process – as an ecological practice – opens durational and/or
transversal movements and activates dynamic thought that resists technical approaches and solution-based scenarios to thinking environmental sustainability.

Digital Diagramming Event

Thinking with a diagrammatic methodology, students, teachers, and researcher did not know what the garden would look like. Frichot (2005) explains that the diagramming process works to escape from illustration and representation. Diagramming is a “way out of having to tell the same story over again,” she says (Frichot, 2005, p. 73). Resisting the traditional plot-style garden that is coded for linear interaction, the diagramming process would eventually materialize a new design and location for the garden at Fir Valley. Tablets and wearable cameras were used to diagram the school garden in open-ended ways determined by the students in relation with the urban environment. Wearable cameras were worn on student, teacher, and researcher’s head and chest while diagrammatically exploring the school grounds. The wearable cameras entangled with the movement of bodies and the materiality of movement as the diagrammatic relationally shaped experience. The tablets
generated digital images of different locations on school grounds. The images would in turn help in determining the location of the garden. Environmental conditions were also taken into consideration during the diagrammatic garden design process. Environmental conditions were discussed in terms of ‘enabling constraints’ and were not seen as impeding the process of design. Constraints that were discussed included: 1) access to water; 2) plant exposure to sun; 3) plant exposure to shade; and 4) student and community access. Constraints helped to shape the relational force of diagramming, thus determining the location and shaping the design of the garden. Manning and Massumi (2014) argue that relational force ruptures ‘limitative constraints’ that technically format interactions. The diagrammatic rather potentializes a becoming process that is self-organizing and in excess of technical approaches to garden-design. There is a topological and thus durational dimension to the diagramming process that will be discussed in Ecology II through Deleuzian theories of the Leibnizian fold and through Bernhard Riemann’s differential geometry.

In addition to taking photos of specific locations on school grounds that would help determine the location and design of the garden, students took photos of objects, other students, and pictures of themselves (i.e., selfies).\footnote{The “selfie” is a popular (western) cultural term that refers to a self-taken photo that features the close-up and/or human face of one or more individuals.}
600 images were generated in total. After the digital diagramming event, the images that were generated were printed and literally diagrammed on a large and lengthy roll of brown craft paper. Images were cut out, cut into, and pasted together akin to a cinematic montage. In its material form, the ‘paper diagram’ represented a montage of signs and symbols. However, in accordance with Deleuze’s (1986, 1989) notion of film montage, the paper diagram became an exploration of the relationship between the cutting and pasting, or the ‘editing’ of the images together on the paper diagram. Barad (2012a, 2007) also refers to the cutting and pasting action that formed the paper diagram as enacting a ‘cut’ (i.e., cutting together-apart). The cut enacts a material and discursive shift that activates the process of diagramming, potentializing new directions and lines of thought.

Barad (2012c) writes:

…knowing is a direct material engagement, a cutting together-apart, where cuts do violence but also open up and rework the agential conditions of possibility. There is not this knowing from a distance. Instead of there being a separation of subject and object, there is an entanglement of subject and object, which is called the “phenomenon.” Objectivity, instead of being about offering an undistorted
mirror image of the world, is about accountability to marks on bodies, and responsibility to the entanglements of which we are a part.\(^\text{12}\)

A diagrammatic methodology resists thinking of digital diagramming on school grounds as a separate event from the paper diagramming event. Rather, the cut enables an account and activation of the images captured by the tablets, linking the events together in an agentially causal manner, which is non-linear. In accordance with a transversal analysis of the image, I was interested in how the images from the digital diagramming event came together-apart during paper diagramming. Directly below, I further discuss the ‘cut’ in terms of activating new thought as well as in the literal sense of cutting with scissors.

During the digital diagramming event, students generated images of rubber tires that were found on school grounds. It was not until they mapped the images on the brown roll of craft paper that they noticed a considerable amount of the diagram was populated with the rubber tire images. They began to think with the images and how the tires could become part of the garden. Looking at the diagram, students suggested that the tires could be dug into the earth and that vegetables could be planted in them. They envisioned that the tires would form the design of the garden. Over the next few days,

students conducted online research about their plans. The students were responsible for
the logistical aspects of garden design and how, for example, the tires were going to be
embedded to shape the garden. Upon doing extensive research about the materials used to
make tires, the students learned that embedding the rubber tires into the earth eventually
causes toxic materials to leach into the soil. The tire images became an emergent lesson,
activating thought in excess of its frame. To make this point in another way, the tire
images activated thought that was not in the image. Manning (2009), for example, argues
that images move. She explains that the image “extracts the unknowable and forces its
recomposition” (Manning, 2009, p. 106). The image becomes not one of translation, but
rather that of transversal movement, a becoming process that recomposes with bodies in a
co-constitutive manner that problematizes humanist practices and engenders a politics
that is not fully known. Thinking transversally about the rubber tire objects and the
photographic tire-images, it would be impossible to answer the following questions,
which Mr. D. posed: Why were the students drawn to the rubber tires on the schoolyard?
Why were the students drawn to the images of the tires? A transversal analysis rather
poses this question: What did the tires and tire-images do? From this horizontal line of
questioning, it is evident that the durational force of digital diagramming (i.e., photo-
taking) and the cutting and pasting of images (i.e., paper diagramming) operated on a
slow ‘plane of composition’ (Deleuze & Guattari, 1987). What the slow plane of
composition suggests is that many of the students spotted the tires on school grounds and
also that students saw other students taking photos of the tires. It is perhaps obvious to
point out that students are easily influenced by their peers. However, what also needs to
be taken into account in a transversal analysis (of the image and the events of
diagramming) is that the diagram is made in order for something to emerge from it (Frichot, 2005). That which emerges, such as the rubber tires, is not an answer or a solution to a problem, but rather a medium for which new thought, new questions, and new problems emerge (Frichot, 2005). For example, during the paper diagramming event the rubber tires emerged as a problem. Students were confronted with the future problem of toxins leaching into the soil if, indeed, the tires were embedded in the earth. Through thought, research, more questions, and through collective negotiations between students and teachers, holes were dug directly into the ground (instead of embedding the tires). Hula hoops that were found in the school gymnasium helped to form the holes. The holes were outlined with white field chalk and the students started to dig.

The process of diagramming enabled students to map their discursive ‘cuts’ and, therefore, take into account what came to matter. Diagramming also forced students to think in a future tense about the implications of embedding the tires into the ground. Rather than curtail bodies to what is thought, the tires, the images, and the diagrammatic
process of learning opened students to durational movements, provoking a minor and/or affective politics and thus a future-oriented thinking with ‘how matter might come to matter’ if the tires were dug into the ground.

The Minor Politics of Diagramming: Topologies and Folds

According to Deleuze and Guattari (1987), a minor politics operates along lines of experimentation and unpredictability. The diagrammatic is a minor political practice that composes, decomposes, and recomposes ecologies of experience through collectivities of experimentation that are more-than-human. Ecologies and the practices they engender, like the diagrammatic, work when political power structures are put into question and conditions, such as the toxicity associated with rubber tires are problematized.

Writing about mathematics in educational settings, de Freitas (2014) presents Riemann’s topological theory of ‘manifolds’ in relation to Deleuze-Guattarian notions of the diagrammatic. She does so in order to rethink the diagram as a minor political act that is affective, rather than a tool of representation. Riemann’s topological technique (in relation to differential geometry) is important to mention for its emphasis on emergent relations, qualitative measures, and the malleability of a minor politics. His work transformed the ways geometric objects are viewed, by shifting the focus from traditional

scientific analysis to a qualitative study of surfaces, relationships, as well as curvature, which enabled a differential measure (de Freitas, 2014). What Riemann studied was not form, but rather the non-metric relationships and connectedness between figures and the points of a figure (Hilbert & Cohn Vossen in de Freitas, 2014). The surface of, for instance, a polyhedron became the study of a surface open to variation and to contradictory and multiple geometries (de Freitas, 2014). The shift in geometry as topology tested the limits of empiricism, working at an ontological threshold that does not impose judgment or analysis from the outside (de Freitas, 2014). It is particularly the differential measure of curvature that I suggest offers a qualitative understanding of how diagrammatic methodologies operate politically at topological thresholds of understanding that put time, space, place, objects, and practices into question.

de Freitas (2014) describes the curvature of a surface as that which is characterized by different speeds of movement, suggesting that speed may differ from point-to-point on the surface of a figure. Curvature not only suggests that durational force moves at different speeds, but also attends to an ontology that is localized and immanent to the polyhedron. What this suggests is that the polyhedron becomes a space in itself (de Freitas, 2104). Riemann proposes that between the points on its surface is where the figure has the capacity to order itself. Manning and Massumi (2014), for example, explain that movement never stops; it folds back into itself and unfolds, relating to the larger non-localized field in which it returns potentially different.

I have argued elsewhere (Rotas, 2014) that Riemann’s mathematical theories dismiss the embeddedness of relations and the linearity of time (i.e., chronos). For instance, Riemann’s differential measure of curvature risks dismissing the polyhedron as
a material object in math and science that is then used – through human-centred frameworks – to shape math lessons in schools. Furthermore, conceptualizing the object and/or the classroom as a space in itself ignores what is outside of it. After reading Deleuze on twentieth-century artist Francis Bacon\textsuperscript{14} and the Leibnizian topological fold, I realized that I was evoking Cartesian dualism through differentiating between power structures existing inside versus outside of the school, as well as pinning notions of time (chronos and aion (i.e., durational time)) against each other. I also anthropocentrically placed the self (the ego) into the topology of space by evoking such binaries. As Conley (1993) explains, “when the self moves into space, it transforms one of the corners of the square or rectangle of its periphery into the site of a new center, around which new extremities are established, and so forth, until space is conquered” (Conley, 1993, p. xvii). Such thought is reliant on human-centred frameworks in which the representational diagram is evoked through material experiences mapped from the position of the determined subject (Conley, 1993). Pushing beyond the point of the figure and the position of the subject is where the limitations of bodies and the disciplinarity of practices become undone. As van der Tuin and Dolphijn (2012) suggest, new materialist practices push dualisms to an extreme. In reference to Baroque architecture, Deleuze (1993), too, explains that inside and outside – this folding movement – “thrusts the other forward” unto extremes (p. 28). Of course such movement is not without implication, as the diagram can always fall back into the self, which often plays out through practices of application. Riemann particularly grew concerned with geometries of application, discerning which geometries reflected the empirical world (Calamari, 2015). In the

\textsuperscript{14}Deleuze draws on expressionist painter, Francis Bacon for his capacity to paint and think in more-than-human ways (de Freitas, 2015). Also see Deleuze’s (2002) book titled, \textit{Francis Bacon: The Logic of Sensation}.
concluding remarks of his lecture, *Habilitation* (1854), he grapples with the impossibilities of determining the geometry of physical space beforehand, and argues that an application of geometry would remain or fall back into the field of measurable results (Calamari, 2015). That is why, and Deleuze (2002) notes this as well, that practices must materialize while simultaneously remain open to the sensation and durational force that produces thought. Only then, Deleuze (2002) writes, “will something emerge from the motif or diagrams” (p. 92). Therefore, the diagrammatic will only work if it is immanent to its own design.

Throughout the years, educational researchers have used the diagram in many different ways including its use to study practices that control interactions in classrooms (de Freitas, 2014; 2012). Drawing on Bruno Latour, de Freitas (2014) suggests that diagrams could serve to expose the standardization of schools and the linear programmatic of curriculum. She further argues that diagrams can disclose assumptions about urban youth and learning, advancing social justice through qualitative inquiry (de Freitas, 2014). Drawing on Deleuze, she further suggests that diagrams can be used as a “breaching experiment,” which invites “the reader to break with the usual diagram conventions and imagine a new diagrammatic practice that might better address the irregular and asymmetric tangles of interaction” (de Freitas, 2014, p. 589). For Deleuze, ‘analysis’ is not an analysis in any positivist sense of what the word might mean in educational research. He accounts of relations through an understanding of the diagram as a map constructed through differentiating proximities, tactilities, and aesthetic bodily production. He questions what makes the relation within the diagram possible, and how the relationship is constituted. Why the students were drawn to the rubber tires on school
grounds, for example, is not of concern. A transversal analysis asks the question of ‘how?’ How do practices work? What do practices do? It is not a question of what meaning is derived from analysis (as if analysis were external to the event), but that analysis is in and of the event, and thus its working-out, its process of techniques is also of concern.

During the diagramming process at Fir Valley the tires were problematized which in turn posed the question of how sustainability might be thought otherwise. Not embedding the tires in the soil was, however, not the solution. The question of ‘how’ sustainability might be thought otherwise probes the social and cultural conditions and constraints of practices in the school. This is a political act that does not demand solutions to social and environmental problems, but rather creates new conditions and practices of learning that are immanent to the ecological context. As May (2005) writes:

To ask how we might go about living is not to repeat the dreary question of who needs what. It is instead to probe the realm of difference that we are in order to create new and (one hopes) better arrangements for living, in the broadest sense of the word living. (p. 133)

An affective and/or minor politics is significant in re-thinking social and environmental justice as embodied movements of thought that operate relationally and emphasize materiality. Lorimer (2012) contends that environmental justice concerns are conventionally grounded in political philosophies. These concerns tend to “place the human subject at the centre of claims for political status and develop general, rational, rights-based frameworks to guide political and economic action towards Nature understood as resources” (Lorimer, 2012, p. 604). Such a perspective on conservation
and/or environmental justice issues has little to do with nonhuman agencies and the responsibility of the human toward the nonhuman (Lorimer, 2012). Thinking social and environmental justice as immanent shifts curricular and pedagogical practices grounded in ‘political messages’ toward enacting affective and intensive practices that encounter change as well as change with each encounter (Rotas & Springgay, 2013; Springgay & Rotas, 2014).

In Ecology II, I have relied on Deleuze and Guattari’s theories of affect and movement to argue that a diagrammatic methodology works at the thresholds of limits, operating from within, but also ‘with’ the larger social and cultural structures that shape the urban school and environment. What diagrammatic methodologies do is activate collective social and cultural variations that are immanent to the ecologies of practice that materialize realities. Working from the inside and working with the outside in this entangled manner, the diagrammatic provokes engagements ‘with’ matter. Engaging with matter (indeterminately and unpredictably) activates curves of thought, or variations of social and cultural production that are not solution-based, but rather challenge what is imaged by generating ongoing questions that create future onto-epistemologies of thought and practice.

**Images: Destroy! Destroy!**

Destroy, destroy…a complete curettage. Destroy Oedipus, the illusion of the ego, the puppet of the superego, guilt, the law, castration. (Deleuze & Guattari, 1977, p. 311)
In Ecology II, I have called attention to a diagrammatic methodology that does not impose movement. It cannot be repeated, nor can the diagrammatic predict the specificities of the event. It is an expressive process. Deleuze (2002) compares the diagrammatic to postimpressionist artist Van Gogh’s paintings, arguing that diagrams are compositions of durational force, of intensity. Diagrams are vibratory; they are rhythmic. Van Gogh’s diagrams “twist the trees,” he says (Deleuze, 2002, p. 83). The twisting motion is one of productivity and constraint. It is tension-ridden, which suggests that learning is never a matter of neutrality; it is a process to be grappled with. This twisting motion also calls attention to virtual intensities that co-constitute material environments.

In *Cinema I and II*, Deleuze (1986, 1989), for example, studies film and the images they produce through ontologies that put the optics of the human eye into question. Working with images of movement and time-images, he experiments with qualitative surfaces, frames and/or borders. He does so in non-interpretive ways that emphasize the capacities of still-images that perhaps to the human eye seem like they do not move. Drawing on Deleuze, Kramp (2012) explains that the artistic and/or creative challenge, and the challenge of research-creation events is to disrupt the mechanisms of empirically positivist and thus human-centred approaches to learning. Following a Deleuzian logic, one of many ways to approach a more-than-human inquiry is to destroy the diagram and/or the frame of the painting that marks human desire.

Deleuze’s cinema theories resist the organizing effects of the image by creating malleable concepts that disrupt the narration or representation of the image. Deleuze resists the homogenization of the image into a collection of what researchers refer to as ‘data.’ Kramp (2012) explains that Deleuze “repeatedly questions “official” data; he
presents creative works as challenges to dated empirical encounters that have been transformed and organized into archived authorities” (p. 2). Specifically in Cinema II, Deleuze (1989) contends that “truth is not to be achieved, formed, or reproduced; it has to be created” (p. 146). Thinking with Deleuzian cinematic concepts, I challenged methods of ‘data collection’ during the research process by posing the proposition: “The percept is out there” (Manning, 2011). After the digital diagramming and paper diagramming events, a large brown roll of paper lay across the classroom floor. Presenting the student’s with one of Manning’s (2011) propositions, I endeavoured to activate a rethinking of the relationship between the human eye and the image. I was curious what would happen to the paper diagram.

Thinking about the proposition – the percept is out there – students made suggestions about what to do with the diagram, which included: 1) posting the large diagram outside the classroom door; and 2) posting the diagram in my home so I could admire it. Both suggestions, I must admit, made me laugh, as it became evident that the students were proud of themselves and desired my affection and that of their peers. Also, this is what students usually do when they complete an artwork as object – they either post it in the school hallway, or bring it home and stick it on the refrigerator. I resisted thinking about the ‘paper diagram’ and the many events throughout the research process as representations of truth and/or finalized pieces of work.

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Interested in continued experimentation with the diagramming process (in a different way), students literally cut into the large craft ‘paper diagram.’ Committed to the students’ idea of showing their work to other students and teachers, the images cut from the diagram were ‘photobombed’ around the school. Photobombing is a playful practice of popping into and/or appearing in the background of an image, without the knowledge of the individual(s) of which the photo is being taken. Photobombing can be seen as a popular (western) cultural practice that is simultaneously comical and that which ruins an image. It is also referred to as a pop-cultural practice enacted by school-aged children, teens, and young adults interested in ‘capturing the moment’ (Messitt, 2014).

There were no instructions or any direction as to where the photobombs should go. Zigzagging through the school hallways, students posted photobombs. Many students selected locations that are often prohibited or rarely frequented. The staff lounge, the principal’s office, and the vice-principal’s door were just a few of these places. The boys’
and girls’ restroom was another popular and curious location. Students explained that the school prohibits the posting of text and/or images in the restroom. After the photobombing event, I was told by the school operations staff that posting in the restroom is a form of vandalism. The staffer that informed me of this also laid out a definition of vandalism for me. His misinformed articulation (of vandalism) reinforced the privatization of spaces in schools, reducing bodies and the place of the restroom to modes of anti-production and human waste. Furthermore, students in the school approached me in the hallways and during recess time to ask if “we were the ones who photobombed the school.” The photos also became a topic of conversation amongst the teachers in the school. For example, teachers stopped me in the hallways to share a story about a student that had photobombed them. One teacher noted the intense excitement that students expressed in their movements into the prohibited staff lounge.

As an experimental practice the photobombing event was not about the feelings or reactions that the images evoked, but is rather about the intensities and expressive movements it actualized. This is not to say that feelings, understood, here, as the
actualization of affect, are not important in a classroom of 22 eight and nine year olds. I can assure you and the students will, too, that feelings are always already important in the everyday operations of the school. In fact, Colebrook (2002) explains that images are often experienced from the subject position of meaning. The photobombing event rather emphasized the materiality of the process. The practice of literally cutting the paper diagram into over a hundred frames not only resisted a static data wall, but also created a qualitative change of the image through the photobombing event itself. Attentive to the materiality of the process, the event forced students and teachers to encounter the images differently (deFreitas, 2015). Not reading narrative interpretations into the images, the photobombing event foregrounded the dynamic movement of bodies, which is oriented toward “the temporality of knowledge” (Vannini, 2015, p. 12). Vannini (2015) argues that non-representational practices “are much less interested in representing empirical reality that has taken place before the act of representation than they are in enacting multiple and diverse potentials of what knowledge can become afterwards” (p. 12).

Manning (2009) makes a similar point about representation, explaining that “[e]xpression and representation are at two ends of the spectrum” (p. 94). Representation is what is formed (i.e., data) after the event has been constituted, and expression moves “with the very act of perception” (Manning, 2009, p. 94). The photobombing process activated affective forces that transversally moved across classrooms (deFreitas, 2015). Always oriented toward a future not yet realized, emergent methodologies such as the diagrammatic and practices like photobombing cannot always answer what exactly was learned. Often, practices in schools focus on the meaning that emerges. What I would like to point out through the diagrammatic is that process-oriented activities operate on a
qualitative level; that is, in the act of perception. Such an approach challenges conventional approaches to teaching, researching, and learning because they do not elicit specific behaviours, invest in determinate meaning, and necessarily satisfy predetermined learning goals. Thinking in the act of a diagrammatic methodology and photobombing practice obliges students, teachers, and researchers to put ontologies of movement back into the constituent of images (or data) and practices of research and learning. Such creative and collective practices provoke students, teachers, and researchers to problematize representational and thus human-centred research practices by working ‘with’ matter in contingent ways. Therefore, working with students and teachers in relation with images of ‘data,’ a diagrammatic methodology does not control who makes the ‘cut’ in events of research, but rather understands the material and discursive practices of the event as an ongoing implication and provocation to think again, and to think in a future-oriented tense that makes and re-makes new temporalities of thought and practice (Barad, 2014).
Ecology III

Diffractive Methodology
Wearable Technologies: A Diffractive Apparatus

Through a diffractive methodology, I attend to wearable technologies as agential apparatuses that are in relation with material phenomena or knowledge, which suggests that knowledge is not a direct action of the human. Drawing on Barad (2007), I understand a diffractive methodology as that which attends to the intra-active patterns of more-than-human movement. Barad (2007) theorizes diffraction through understandings of physics, calling attention to encounters of light with material structures. The encounter creates what Barad (2007) refers to as ‘diffraction patterns.’ Barad (2007) gives the example of oceanic waves encountering rock structures as an instance of diffraction. She pays attention to the point of diffraction at which the wave (upon its contact with the rock) becomes a smaller version of itself. Or, imagine simultaneously dropping two stones in a pond. Barad explains that the “overlapping concentric circles” or mini-waves that emerge are diffraction patterns (in van der Tuin and Dolphijn, 2012, p. 60). Or, think of an echo. It occurs in-between the distance of two surfaces of which it bounces from (Massumi, 2002). Diffraction and/or ‘resonation,’ as Massumi (2002) notes, is not on the walls, “[i]t is in the emptiness between them. It fills the emptiness with its complex patterning. That patterning is not at a distance from itself. It is immediately its own event” (p. 14).

Diffraction patterns are not to be read as reflective images. Each diffraction pattern carries with it unique traces of relations that constitute material objects (Kirksey, Schuetze, & Shapiro, 2011). For example, x-ray diffraction techniques and ultrasound machines are used by scientists and technicians to generate a probable health-related
cause and/or to see how the body is functioning (Kirksey, Schuetze, & Shapiro, 2011). What is also important to pay attention to is ‘how’ x-ray techniques are used, ‘how’ the ultrasound machine is angled and experimented ‘with.’ Paying attention to modes of ‘doing’ (i.e., ‘how’ and ‘with’) suggests that diffraction patterns are multiplied and stitched together through interpretive patterns of thought (Kirksey, Schuetze, & Shapiro, 2011). Diffraction techniques are thus composed of many patterns that result in ‘tentative descriptions’ and complex understandings of how phenomena work (Kirksey, Schuetze, & Shapiro, 2011). “There is no direct visualization of any object, all seeing is a practice of seeing with” (Kirksey, Schuetze, & Shapiro, 2011, p. 140). The notion of ‘seeing with’ that Kirksey, Schuetze and Shapiro (2011) highlight is important and not only a matter of science, but also a matter of ontology. I particularly highlight the ontologies of the social, which are shaped in relation to the methodological measure and/or what Barad (2003) refers to as the material “apparatus of observation” that is used (p. 815). In thinking through a diffractive methodology in relation to wearable technologies as apparatuses, I firstly, probe into how Barad (2007) uses the term ‘apparatus.’ Secondly, I entangle Manning and Massumi’s (2014) notions of perception to challenge humanist modes of seeing as well as to question what might wearable technologies as apparatuses enable. Questions I examine in Ecology III include: How do wearable technologies intra-act? What might wearable technologies as apparatuses do to perceptions in urban schools and environments? What might be learned from the images wearable technologies generate, and what might this suggest for visual methodologies in new materialist research? Finally, in what ways might images generated by wearable technologies undo representational notions of data?
Becoming-Brittlestar

Barad’s (2007) agential realist account of the apparatus concerns embodied practices of materialization that are enacted in relation with matter. Apparatuses are not merely technological objects. She perceives the apparatus as living matter that shapes ecologies of knowledge through materiality, discursivity, agency and space-time relationships that are co-causal. Barad (2014) offers the fascinating example of the brittlestar to help in articulating an agential realist account of the apparatus and its capacity.

The brittlestar is a brainless and eyeless echinoderm that is related to other sea urchins, such as the starfish and sand dollar (Barad, 2014). What makes the brittlestar fascinating is that its skeletal system is also its visual system, which means that the brittlestar’s skin sees (Barad, 2014). It is as if tiny lenses are built into the brittlestar’s body. The architecture of its body has caught the attention of scientists and high-tech industry that are interested in the capacity of the brittlestar to reconfigure its body and the boundaries of its environment (Barad, 2014). Particularly interested in the brittlestar’s capacity to see from a 360 degree-view, scientists liken the species to the pixelization process of the digital camera (Barad, 2014). The brittlestar creates images through the absorption of light which corresponds to its nerve bundles, enabling the brittlestar too see all around its environment and protect itself from danger (Barad, 2014). The five-segmented brittlestar even has the capacity to shed its segments, which could be an instance of self-fertilization or a mere distraction for its predator. Upon shedding, the brittlestar regrows its segments.
Through embodied practices of intra-activity, the brittlestar “differentially responds (not simply in the sense of responding differently to different things that are out there but) in ways that matter” (Barad, 2014, p. 233). What Barad suggests is that the brittlestar comes to know through its body and is differentially constituted in relation with the oceanic environment. The brittlestar is not only living in the ocean, but is of it in the sense that it spatiotemporally reworks its bodily boundaries (Barad, 2014). In other words, the brittlestar is not passive matter, but rather performs sight. In Barad’s (2014) words:

The brittlestar does not have a lens serving as the line of separation, the mediator between the mind of the knowing subject and the materiality of the outside world. Brittlestars do not have eyes. They are eyes. That is, it is not merely the case that its visual system is embodied. Its very being is a visualizing apparatus. The brittlestar is a living, breathing, metamorphosing optical system. (p. 227)

The brittlestar challenges humanist notions of spatiality, visuality, and agency through its diffractive capacity to see ‘with’ its body. Its micro-lenses indicate that the brittlestar body sees via diffraction, which suggests that the smaller the lens, as is the case with the brittlestar, the greater the diffraction effect. The brittlestar’s quality of imaging and thus its sight resolution is diminished as a result of diffraction. Its diminished sight in turn suggests that its boundary-making practices and perceptions of boundaries are always fuzzy. The brittlestar’s fuzzy vision and its resilient capacity to evolve lends Barad to thinking that humans give sight to much credit. Representational practices, Barad (2014) explains, play with the “wrong optics,” which are grounded in “the wrong set of epistemological and ontological assumptions” (p. 234). Visuality grounded in human-
centred optical models of reflection evoke dualist frameworks. Dualist thought includes understandings of the subject as having the capacity to see through the object of the eye; or the researcher having the capacity to see through the object of the camera lens. These examples foreground the representational eye by evoking subject-object binaries. Barad’s (2014) neat example of the Brittlestar, on the other hand, puts dualist thought into question and problematizes representational practices of seeing that adhere to ontological and epistemological estrangement. In particular, the brittlestar enables an understanding of the eye as that which is in matter. The embodied eye that is the brittlestar, therefore, marks the limits of determinacy through its diffractive mode of being and becoming in relation with its environment. A separation of ontological and epistemological worlds is impossible for the brittlestar, as its way of being is simultaneously its way of knowing and becoming. What this further suggests is that fuzzy observations cannot be separated from the apparatus of observation. I should note that this fuzzy ‘cut’ of vision does not signal toward a post-modern return that celebrates the blurring of boundaries (Barad, 2014). Quoting Haraway, Barad (2014) explains that diffraction is “not about originals” (p. 221). Diffraction is a performative dimension of an apparatus that works with the intensities of turbulent waves and in turn examines how intensities are lived out.

I understand Barad’s (2014) example of the brittlestar as a matter of practices that make a qualitative difference in the world. Accounting for the qualitative differences of embodied visuality (or perception) and spatiotemporalities (or virtualities) of thought and practice are quite the task. It is impossible to employ a positivist measure of qualitative differences of perception. A positivist measure is impossible because ‘seeing with’ is an intra-active way of seeing that is co-composed of virtual dimensions of bodily movement.
The brittlestar, for instance, moves at nanospeeds, far too fast and at depths the human eye cannot perceive. However, what the brittlestar-body does point out is that the virtual dimension of its body is not phenomenological, but rather enveloped in the material (actual) mode of its perception and/or experience. The actual and the virtual dimension of bodily movement intra-acts to form perception. To put this differently, perception is formed through an ecology of micro-perceptions that are inseparable from the act of perceiving and the form of perception. In educational research what is often measured is the formed percept and/or the meanings students make. What is different about the new materialist research event is the understanding of perception as an ecological process of micro-perceptual movements that cannot be reduced to content (Manning, 2009). Perception is understood as more-than sensorimotor. Perception is a complex and embodied image that emerges and, therefore, is not fully contained in an individual human body.

In the following pages, I engender an understanding of more-than-human perception through the theorization of wearable technologies as apparatuses that merge ‘with’ bodies and lived experience. For example, through student engagement with the garden, I was interested in examining how the body sees in the movement of gardening. This approach is quite different from visual methodologies grounded in ethnographic research that understand the camera as an object of research and separate from the human body. I particularly focus on the event of gardening to experiment with a new materialist agential interest and more-than-human inquiry into how matter not only merges ‘with’ experience, but also how matter is ‘of’ experience. I call attention to gardening (with the use of wearable technologies) as an embodied practice of becoming that puts perception
into matter. To attend to this dimension of gardening is to focus on the actualization of the practice as it becomes, rather than focus on the practice of gardening as it should be. I argue that wearable technologies focus on processes of learning and enable more-than-human dimensions of perception that do not separate matter from perception. In approaching perception in this way, I hope to engender an understanding of perception as that which is composed of multiple micro-perceptions (proprioceptive movements) that form ‘body-vision’ (Manning & Massumi, 2014). In so doing, I problematize representational thought by provoking a conversation that attends to the onto-epistemological dimensions of new materialist research-creation techniques that enable new ways of seeing. The discussion will close with the concept of ‘sustainable becomings,’ (Braidotti, 2013) which will lead to the concluding section of the dissertation in which I rethink relationships to environmental sustainability through experimentations with ‘data’ generated during the research process. Directly below, I discuss student, teacher, parental, and community-engagement with the garden.

**Movement-Doing-Intra-action**

There was an initial newness to wearing technology and students expressed their desire to wear the camera at least once during the research process. Each student had a turn (at least more than once). I purchased a camera for myself and rented additional cameras.

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throughout the research process for the students and teachers. Students often peered into the camera lens, some keeping their distance and other students curiously asking questions such as: What is that? What is it doing? Is it recording? Upon answering these questions, the questions eventually subsided. Students also stopped looking into the camera lens. When students wore the camera for the first time, some were unsure and felt uneasy; others performed for the camera. For example, when students wore the camera they often took on a leadership role by directing interaction. Savat (2009) argues that “awareness of being observed, aims to make individuals adopt a specific form of behaviour” (p. 48). Indeed, students initially reacted to wearing the mobile cameras. However, during the digging of the garden and the planting of wild flowers and vegetables the novelty of wearing technology quickly wore off. Throughout the months, wearing the cameras during the entire school day and afterschool accustomed students to the cameras’ everyday presence. Use to wearing the cameras, the students stopped directing each
other during the research event. Creating a collective movement of digging and sweating, breathlessness and noise, students engaged with the garden. They communicated via nudging movements, movements of surprise (at finding tones of worms in the soil), as well as frantic movements (activated by buzzing bees relentless in their search for nectar). The mobile cameras mapped bodies in relation. The cameras moved ‘with’ bodies and mapped intimate conversations that I did not see and questions (students posed to each other) that I did not hear. They mapped residues of earthy soil in-between fingernails and on student clothing. The cameras also mapped movements of thought that grappled with how to plant kale, and if the hole they dug was deep enough for the kale plant.

At Fir Valley, gardening was approached in ways that figuratively and literally poked holes in garden-centred education. ‘Doing’ gardening creatively meant that the practice would be approached as an event and/or platform of experimentation, and thus as a process of learning. Ecologies of practice emphasize process-oriented approaches to learning. In particular, gardening was approached in ways that were attentive to bodily movement and the embodied knowledge that such movement provoked. Gardening could not be enacted in the ‘right’ way, nor was the garden engaged linearly, which is often the case with plot-style gardens.
Throughout the months and during the planting-season, students learned gardening skills as well as became familiar with a variety of plants and with the enabling constraints encountered. For instance, frost and too much or too little water were some of the issues that were discussed in relation to gardening. Sensorimotor experiences in the garden included: 1) running; 2) walking; 3) sitting; 4) digging; 5) planting; 6) exercising (i.e., community members practiced early-morning tai-chi in the garden); and 8) using technology. However, the research event was not limited to sensorimotor experiences of the garden. The research event and the ecology of practices sought to activate ‘doings,’ or bodily movements akin to the brittlestar, which differentially respond through the actual-virtual inseparability of intra-active movement. Such movement is not anthropomorphic, but rather emphasizes the non-linearity of movement. It is emergent and cannot be known beforehand. As McCormack (2015) writes, it is a way of doing research “in which the question of how one is to proceed is up for grabs every time thinking begins again” (p. 99). So much of what goes on in schools is not about thinking, but rather about knowing and being prepared for what comes next. The goal of ecologies of practice, and particularly in relation to the research event at Fir Valley, was to activate what comes next and in turn examine how seeing is more-than-sensorimotor; it is in and of durational movement.

It became evident that the design of the garden enabled non-linear movement as well as intimate proximities to vegetation. Specifically, the holes of vegetation in-between patches of grass enabled non-linear movement. The hole-y space resisted entrance and/or exits points to the garden. Students zigzagged, got up close, touched, smelled, and inhabited the garden space in ways that resisted the direction and control of
bodies. For example, the variety of mint planted in the garden caused delirium. Students and teachers were fascinated with the herb and its wild, rhizomatic growth pattern. Among the hundreds of mint variety, peppermint, spearmint, and chocolate mint were planted in the garden. The students often cut leaves of spearmint and chewed them like pieces of gum. Furthermore, a grade 2 teacher suggested that students could make mint tea with the leaves. The teacher also told the students that she used chocolate mint in her baking. She engaged with the garden along with her class of grade twos. They snipped tendrils of mint for her baking throughout the weeks.

The use of handheld technologies was also significant during the event of gardening. Students used tablets to explore the garden – the space was wirelessly connected to the Internet. The school librarian and media studies teacher worked with the students and myself to make the garden wirelessly accessible. At the beginning of the school year tablets were purchased for the school and Mr. D was eager to use them with the students. Setting up Wi-Fi (wireless internet access) and student passwords for the tablets, as well as reconfiguring wireless routers to prepare the garden for access took a considerable amount of effort. Using technology outside of the school was a new way of learning for Mr. D and the teachers at Fir Valley. Prior to the use of the tablets, they had been sitting in storage for the first half of the school year. I asked why the tablets had been sitting there for so long. Teachers responded by explaining that they were not sure how to use the tablets in relation to the curriculum and other teachers felt that it was too complicated and time consuming to access technology and the outdoors (also see Tan & Pedretti, 2010). It became evident that the use of tablets during the digital diagramming event as well as in the garden provoked other teachers to use them by the end of the
school year. The grade 7/8 teacher used the tablets outside with his students for the first time, as did the librarian and media studies teacher. One of the ways that Mr. D’s class used the tablets in the garden was through the creation of quick response codes (QR Codes).

QR codes are found on posters, products, and/or commercial packaging. The codes enable tablet and/or smartphone users to scan the QR code and connect to online content about the product. Creating QR codes for the garden, students selected a vegetable or herb that was planted in the garden. Students conducted online research about the vegetable or herb. They also downloaded an online recipe that required the use of their herb or vegetable. Students then pasted the link from the website into an online QR code maker. Students printed the codes and attached the QR codes to stir sticks that the local paint store donated to the school. Students placed a QR code beside each vegetable
or herb in the garden. Once the codes were in place, students uploaded a QR code application and/or ‘app’ onto the tablets. Using the tablets, students and community members (who also had smartphones) scanned the codes and read about the different vegetables and herbs in the garden. Community members and particularly mothers from the parenting centre enjoyed reading-up on recipes. They were also interested in the many different ways that herbs could be used for cooking. The mothers, students, and the students’ parents were instrumental in selecting the vegetables and herbs in the garden. Cultural meals were prepared with the vegetables and herbs, such as tomatoes, eggplant, coriander and dill. Pole beans entangling the schoolyard’s chain link fence were also harvested. In particular, mothers shared their coriander-based recipes with me and amongst themselves. Students, teachers, parents and community members engaged with the garden in many different ways. Some of the garden-related content learned during the event of gardening as well as throughout the various research events included information about:

1. Plant structures
2. Plant growth and measurement
3. Seed structure and germination
4. Soil properties
5. Worm biology and breeding cycles
6. Vermi-bin composting
7. Cross pollination
8. Bee pollination and biodiversity
The content was learned through embodied practice and thus in a processual manner, meaning that topics of research were entangled in ways that often led to other topics and questions of inquiry. For example, intra-acting with bees in the garden led students to question what exactly bees do and where they might ‘live.’ Through bee conservation efforts, such as planting flowers and asking the school grounds staff not to mow the grass around the garden and flowers, students learned about the importance of bee pollination and the biodiversity of urban environments. In North America, pollinators and specifically bee populations have been dwindling due to the lack of biodiversity among many other reasons that also include the use of agricultural pesticides. In particular, the students at Fir Valley learned about ground nesting bees that are active during the spring season. Bees are often thought of as living in hives, which can be seen on popular television shows and children’s movies. However, ground-nesting bees require cool and moist places, usually building their nests underground. Students learned to spot the bee nests (i.e., colletes inaequalis) by identifying large holes in the soil that were surrounded by tiny molds of dirt.
I will also note that the mothers in the parenting centre intra-acted with the garden in other ways and in the phases leading up to garden engagement. For example, mothers were intimately involved in the event ‘Seed Swap.’ Vegetable and flower seeds were donated to the school through a community event in which local residents gather and exchange non-invasive seeds that they have harvested from their gardens or purchased for themselves. A majority of the seeds were gathered from community centres in the area and in turn used to build a school library of seeds. The intent of the library was not to store the seeds, but to rather swap them with parents and community members, thus returning the seeds to local residents and urban spaces.

The students built a mini library out of wood in which peat moss pots (filled with soil) were housed. Coffee ground filters were used to keep the soil moist. Seeds were then sorted, labeled, and placed in vintage library card-pockets that students still use to borrow books with. The library cards were alphabetized and a letter went home to parents listing the seeds in the library. Parents were asked to select (on the form) which seeds they wanted to borrow. Holding the (returned) form in hand, students selected seeds and pots from the library to take home. The pots catered to parents and community members that were novice gardeners and container gardening. Also, some parents did not have gardens, nor the space to build one. The seed swap in turn required parents and community members to swap the seeds from their harvest. Seeds were to be swapped in the month of September the following school year. Unfortunately, seeds were not returned the following September. However, students, parents, and community members rather swapped stories with me, explaining that the plant had died or they ate their harvest. One mother told me that she grew basil and used it throughout the summer. The herb sat on
the window sill in her kitchen. She apologized for forgetting to swap seeds and offered to go buy some instead. I appreciated her gesture and kindly told her that it was not necessary.

Although parents and community members did not swap seeds in return, I understood the event as a successful process not invested in the end goal of receiving seeds back. I conceived of the event as a transversal process that made qualitative difference in the very intra-active processes of growing vegetables and harvesting one’s own food. Furthermore, it is a hopeful space in the nature-cultural place of one mother’s kitchen – where seeds travelled and grew – that one seed might provoke a movement of thought (on a micro-political scale) that “incorporates the environment” (Deleuze, 1989, p. 88), thus changing how one thinks sustainability is performed.

I would like to shift the focus from the content that was learned toward the learning process itself. I pay attention to the actualization of embodied knowledge that is not reducible to content, nor to educational models of application. When attention is paid to intra-active processes of learning what begins to emerge is an affective dimension of thought. What begins to emerge, as McCormack (2015) says, “is a way of moving with the qualities and properties of the thing as it affects and is affected by other things and you” (p. 102). Using technology in the garden, for instance, was a creative way of approaching that space. The garden-design was also a creative and emergent way of engaging the garden from a sensorimotor as well as spatial perspective not foreclosed to a predetermined plan. However, Massumi and Manning (2014) note this as well, that the design of the garden and the use of technology does not necessarily make the garden creative in terms of political and ethical movement. A minor and/or affective politics, for
example, is not about objects and the way things appear to be or look. The garden at Fir Valley was not created as an object of sustainability and thus an object of knowledge. The garden became creative in its intra-activity; it became creative in its enactment of events that performed beyond the garden. Massumi (2011) similarly echoes the latter point. He states:

It’s not the gadgetry or setup that’s creative, even if nothing like it has ever been seen before. The setup is creative to the extent that an emergent experience takes off from it that has its own distinctive lived quality, and because of that its own self-differing momentum. (Massumi, 2011, p. 54)

In the following pages and through theories of affect and movement (Manning, 2013a, 2009; Manning & Massumi, 2014), I examine the ruderal ecologies on school grounds as an event that emerged during gardening that challenged ideologies of sustainability and human-centred frameworks of agency. Furthermore, I examine how wearable technologies enable more-than-human inquiry that is embodied and aesthetic and, therefore, attentive to processes of materialization that shape school ecologies. In so doing, I dismantle positivist research practices in relation to technologies and grapple with the impossibilities of ‘capturing’ movement (of thought) in educational research. What might be learned from an attention to embodied processes of materialization are not solutions to social and environmental injustice, but rather entangled ways of living nature-cultural realities that rework injustice in more-than-human times of qualitative movement.
The Mechanics of Positivism and Tending Toward

Machinic Relations

In the more-than-human world of 3-D printers, mobile payment systems, bio-engineering/bio-hacking, and the use of a drone (i.e., an unpiloted aerial vehicle) by the ‘average’ user, technology is happening in contradictory ways. New technologies have become ‘ambient’ (Braidotti, 2013) apparatuses of innovation that measure bodies, push them to extremes, as well as cyberhack, bully, and assassinate them with techno-weaponry. The human body in relation to technology has become more-than prosthetic. In academic institutions, Grusin (2015) argues that digital media technology is a part of perceptual reality that has intensified time and embodied academic interactions. He makes note of viral videos and the online stream of content that populates Twitter and Facebook as ways of doing academia in the twenty-first century. He writes: “The machinic temporality of contemporary scholarship, and the intensity created by all forms of socially networked media, exemplify how the nonhuman has altered the modes and rhythms and style of academic discourse” (Grusin, 2015, p. xiii). From this perspective, even online blogs seem passé in post qualitative times of the digital where the pace of change has become more-than-human. The technological and/or digital has become more-than-human in the sense that Internet content has the capacity to change with and without the human (Grusin, 2015). The QR codes that were created for the garden exemplify Grusin’s (2015) point. For instance, the information captured by the QR code is not closed, nor stored in the exact same way it was initially retrieved. Pages of online content and metadata reconfigure at iterative speeds of repetition and difference. Chun
(2015) argues that the “repetition of stored information reveals that the value of information no longer coincides with its initial “discovery”” (p. 147). Chun (2015) is suggesting that content and the value of content cannot survive its moment of invention. Yet there is still an intense desire in educational research and in everyday practices to capture, code, and repeat.

Body monitoring with the use of wearable technologies, for example, is happening in many different ways, including an interest in capturing and measuring moments of body-performance. In the world of fitness and health, wristwatches – among many other gadgets – are passé technologies that have been re-vamped with extraordinary capacities and exorbitant pricing. Watches are branded as all-in-one gadgets that monitor and measure heart rate, steps taken, floors climbed, kilometres ran, pace, calories burned, and hours slept. They have GPS (Global Positioning System) capabilities and keep the body virally connected via text and call notifications. The watch even pokes the body when it is not performing at a preset capacity desired by the wearer. The new Apple watch, for instance, transmits a ‘digital tap’ to other users. The watch even sends the wearer’s heartbeat to friends. Detailed summaries of body-performance and/or body-data are synced to smartphones and computers for online viewing. Wearables are indeed a positivist body-project that measure data ‘on’ movement (Manning, 2009).

Positivist experimenter, Etienne-Jules Marey (1830-1904) spent his life making machines to measure movement (Manning, 2009). He toiled with perception, his main concern being that of measuring the body’s inner movements (Manning, 2009). Similar to the fitness-watch-machine described above, he monitored and recorded the human pulse. He desired to make visible what one could not see – the rhythm of the pulse in its pulsing
movement. Marey’s interest in invisibility, Manning (2009) explains, led him toward ‘machinic’ experiences of experimentation and/or an interest in ‘body-vision’ that entangles the apparatus with environments in and of which a movement of thought emerges (i.e., a transversal movement). Relentless in his practice for understanding the rhythms of the pulse and other modes of movement, Marey remained unsatisfied throughout the years. He could not find an adequate source of measure for movement and so his practice began to shift toward the processuality of movement ‘in’ movement (Manning, 2009). This new approach resisted representations of movement and instead focused on ‘movement-passing’ (Manning, 2009). He created new techniques for measurement and some were of course ethically questionable. For example, Marey was interested in birds and how they fly. Using a thin cable, he attached a movement-machine to each wing (Manning, 2009). What he did learn from this experiment, however, was that movement was not entirely in the control of the bird’s body, but rather that the air and wind served as resistance toward its wings (Manning, 2009). The latter point may seem obvious at this present time in aviation history. However, throughout the years Marey came to see many of his experiments as ‘generative failures’ and moved toward the invention of a chronophotographic apparatus that absorbed bird-movements ‘in’ flight (Manning, 2009). It is Marey’s chronophotographic invention that enabled him to attend to the tension between the actual and virtual movements of the body (i.e., movement-passing) (Manning, 2009). Manning (2009) states:

The processes for vision he creates are platforms for relation for the perception of perception. Perception becomes machinic in the sense that it is no longer a stable given in the process of exploring movement, but itself becomes a milieu through which experimentation takes place. In the exploration of margins of
indetermination for the mechanism of perception, what Marey continuously foregrounds is the imperative to make the machine sensitive to change. From experiments of movement to experiments with movement, Marey’s work begins to foreground how perception fields the relation between incipiency and displacement [i.e., between the virtual and the actual]. (p. 105)

Marey was interested in how apparatuses live movement, rather than represent it (Manning, 2009). In that regard, his chronophotographic apparatus is similar to the diffractive apparatus articulated through Barad (and the example of the brittlestar). Marey, like Barad, became concerned with the embodied practices of the apparatus. Quoting Simondon, Manning (2009) explains that such thought “opens up a margin of indetermination within the machine itself” (p. 105). What Manning (2009) suggests and what I am arguing is that the chronophotographic, diffractive, technological, and wearable apparatuses – as perceiving machines – operate through the embodied “emergence they provoke” (Manning, 2009, p. 105). In other words, and what I examine through student engagement with the ruderal ecologies on school grounds, is that wearable technologies are not apparatuses of capture, but rather work ‘with’ bodies to map proximate and indeterminate boundaries that show that perception is not stable, not given, nor merely human in processes of learning.
The Mobile Eye in Matter: Ruderal Ecologies and Re-Valuing

Urban Space

What makes a wearable camera different from a traditional video camera is its capacity to foreground the process of perception as it is forming (Manning, 2009). In particular, what makes the use of wearable cameras (during the research process) different from traditional point-and-shoot visual methodological approaches is the capacity of the camera to sense what is seen ‘with’ the body-in-relation, thus creating body-vision in the very act of gardening. Keeping the cameras powered on at all times and in the middle of intra-activity, wearable technologies sense speed, slowness, and touch through a wide angled lens. I argue that the lens is affected by and affecting the subtleties of durational rhythm that bodies in movement iteratively co-produce. The mobile cameras are sensitive to change akin to Marey’s movement machine. My research intent was, however, not to measure movement, nor to capture its passing. My intent in using the cameras as a relational technique was to challenge human-centred understandings of perception in order to provoke new directions in qualitative research that are generative and affirming of urban schools and environments. The research event was also concerned with a re-valuation (of perceptions) of sustainability in urban environments. Shifting from a focus on what sustainability is and how it is discursively constructed through human-centred approaches, the research event focused on the materiality, discursivity, spatiality, and agency of the gardening process that was in turn not static, nor confined to the space of the garden. The research event was not invested in the garden as an object of knowledge ‘about’ sustainability. The use of wearables, their lack of a viewfinder and viewscreen
(often used to view and edit video while it is recording) was significant to emphasizing the micro-movements of perception and the relational becomings that sustain urban environments. Traditional visual methodologies often use the camera as a reactive tool of observation. From a reactive angle, the shot is composed through the optics of the human eye. On the other hand, I argue that the wearable camera becomes a generative apparatus, a performative and thus embodied eye in relation ‘with’ and ‘of’ matter.

Drawing on Deleuze (1986, 1989), the embodied eye in matter is a machinic perception. The embodied eye is not transcendent, but rather potentializes transversal movements not rooted in the human condition. Foregrounding movement, I conceive of the embodied eye as a body-in-movement that is in relation with the more-than-human world. The embodied eye similarly to the iterative speed of online content is not solely reliant on human ways of seeing or action-oriented ways of learning. In fact, the brittlestar is not reliant on human optics at all. However, to refrain from anthropomorphizing the brittlestar, I note the human condition of binocular disparity as a way to think about the process of conditioning as an intra-active event of sight not rooted in the human.

Binocular disparity is how humans come to see. The condition suggests that each human eye creates a different image. The difference in imaging is the disparity. The human visual system fuses the image made with the left and right eye into an image, converting the disparity into a perception of depth. The human is then able to judge how close and how far an object is from the body. Massumi (2014) suggests that the moment of fusing is a virtual force that makes objects ‘pop out.’ The condition of binocular disparity also points out that objects of perception are virtual appearances that are
proximately conditioned by the co-functioning of two separate eyes, senses, as well as habit (Massumi, 2014). This brief note on human optics leads to an understanding that virtual forces of sight, sensation, and bodily movements of habit cannot be separated from perception, nor replicated in a future time. Qualities of expression and thus of experience cannot be ruled out either, which further makes the point that qualities of living and perceiving cannot be built into methodologies of practice. Qualities of experience cannot be built into research models because, as Manning (2009) notes, they operate “at the level of the barely there” (p. 74). What wearable technologies do is not create extensive images of some reality the human cannot or did not see, but rather compose with animate and inanimate matter in actual-virtual movements that differentially constitute environments. The embodied eye in matter, therefore, does not restore narrative optics of thought, but merges with the differing modes of thinking and feeling to create movements of thought (Massumi, 2011). From a new materialist perspective and through the lens of the embodied eye, this new thought and/or image that comes to pass simultaneously becomes a living out of experience that does not represent an object or subject in the world, but a process of perceiving in and of the world.

When technological innovation – such as the wearable camera – creates new ways of seeing, what the camera is doing is simultaneously shaping the body’s “natural” capacities and its “acquired artifice” (Massumi, 2014, p. 18). This simultaneous movement engenders an understanding of the ‘artifice’ or the wearable camera as more than a prosthetic tool. Movement (actual-virtual) engenders an understanding of the body as always already ‘self-prosthetic’ (Massumi, 2014). It is important to state that the students’ bodies mattered in their experience and their physical capacity to garden. Sara
Ahmed (2010) describes ‘doing’ something as that which simultaneously expands and restricts human capacities. She writes: “[W]hat we “do do” opens up and expands some capacities, although an “expansion” in certain directions might in turn restrict what we can do in others. The more we work certain parts of the body, the more work they can do” (Ahmed, 2010, p. 252). Ahmed (2010), however, explains that “it is not always decided which bodies inhabit which spaces, even when spaces extend the form of some bodies and not others” (p. 252). She, for instance, argues that “women “do things” by claiming spaces that have not historically belonged to them” (Ahmed, 2010, p. 252).

Ahmed (2010) mentions Virginia Woolf, and describes her as a woman who claimed space by picking up a pen and proceeded to write as a political act. Ahmed (2010) asks the very question: “So what happens when the woman writer takes up her pen?” (p. 252). In other words, what happens in the ‘doing’ of writing? This is a methodological question that enables a thinking of ‘doing’ as a future-oriented performance or that of intra-action. What happens when the writing or, for purposes, here, the ‘doing’ of curriculum and pedagogy break from habitual practices by attending to ‘collective enunciations’ (Guattari, 1995)? What happens when researchers and teachers think ‘with’ students in the more-than-human world? Ahmed (2010) problematizes the above question by explaining that perhaps the pen and the writing table “might even appear differently if we follow such moments of deviation and the lines they create” (p. 253). Perhaps even chairs and the ones that students sit on in schools appear differently (Springgay & Rotas, 2014; Manning & Massumi, 2014; Massumi, 2011). Perhaps the spaces inside of classrooms and outside on the schoolyard and city can be perceived in ways that do not call for a
particular mode of sustainable action, but rather attend toward a self-prosthetic futurity of sustainability.

A diffractive methodology and the apparatus are attentive to modes of self-prosthesis that operate immanently and collectively. Collective performances, or borrowing from Guattari (1995), ‘collective enunciations’ can never be the result of project implementation, nor the action of one. Collectivities are immanent to the events and/or platforms of experimentation that diffractive methodologies enable. Collectivities transversally move toward the limit of borders and bodies. Collectivities swarm toward edges and outsides that are simultaneously the embodied self, yet mark difference from itself through the body’s thinking and feeling apparatus. Although the brittlestar does not travel in group-formation, it is an example of a species that marks difference from itself through bodily space-time reconfigurings (i.e., matterings) (Barad, 2014). The brittlestar is an agentive force that does not foresee its relations yet responds with its self-prosthetic apparatus to work with the constraints and conditions of the oceanic environment, and without human intervention. Simply put, the brittlestar unfolds future possibilities of being via its being and becoming in relation. Moreover, ruderal ecologies are an example of an inanimate space that operates self-prosthetically, and without human intervention. Akin to the brittlestar, ruderals regenerate without human intervention. Ruderals thrive as complex ecological networks that self-prosthetically generate matter and sustain biodiversity by, for example, providing shade for species to thrive. Species form micro-ecologies ‘with’ and in the ruderal ecologies of urban environments. Ruderals are also complex social and cultural spaces that are generative of histories of industrialization and land appropriation. They are tied to discourses of urban poverty, waste, and dereliction.
As previously noted, and to this present day in history, ruderal ecologies are tied to racist and class-based discourses that induce vagrancy and fear. The massive ruderal ecology in the back corner of Fir Valley’s schoolyard was perceived as such a space.

The ruderal ecology at Fir Valley was the size of a soccer field. Micro-ecologies thrive as do tall and weedy plant-species that were shoulder length and towered over students most of the time. Exploring the ruderal ecology was initially prohibited at the school. Over the years, justifications that students could not explore the ecology included the risk of broken beer bottles and the accumulation of trash. Used needles and condoms on the school grounds were also of issue at the school in the past. Exploration of the ruderal ecology was directly prohibited through the school’s discourse of “don’t…don’t do that, don’t go there!” The ruderal ecology posed a ‘problem’ particularly at recess time. A teacher was placed on duty near the space in order to ensure that students did not go near it. Aside from the fear of dirty or hazardous materials in the ruderal ecology, fear manifested in the following ways: 1) students could not be ‘properly’ monitored; 2) students could potentially engage in fighting; and 3) the potential of strangers hiding and/or observing children. I conceived of these justifications as entrenched in marginalizing discourses that froze the movement of bodies through the fear of these perceived ‘things.’

Upon the creation and student engagement with the school garden, which was located adjacent to the ruderal ecology, notions of sustainability began to reconfigure through student and teacher curiosities of what else might be possible in the untamed space of the ruderal ecology. It was particularly the act of gardening that activated such curiosities. Specifically, the excitement of intra-acting with worms and the delirium over
the rhizomatic spread of mint leaves set them along transversal paths towards the ruderal ecology. Not asking to go into the space, researcher, teacher, and students found themselves running in the midst of the ruderal ecology with one student enthusiastically exclaiming: “We’re in the woods! We’re in the woods!” Throughout the weeks and toward the end of the school year, research events were enacted specifically in and ‘with’ the ruderal ecology and the thousands of species that inhabited it. The students engaged in plant species identification and butterfly and bird watching. However, the ruderal ecology became a space of free play, excitement, and expression. Wearable technologies were not used to capture student delight, nor were they ‘powered on’ to record an instance of a social movement rebelling against the authoritarian discourses that control student bodies in urban schools. Often, agency in schools is performed as a macro-political, liberating project grounded in conceptualizations of agency as empowerment. For instance, activist projects often mobilize their efforts by foregrounding student voice through documentary film-making. Chiu (2009), for example, argues that migrant and minority ethnic groups can reaffirm identity by representing their experience of difference through participation in participatory video projects. The research event at Fir Valley and particularly student engagement with the ruderal ecology became a collective expression of a new limit that could never be built into the plan of a research event, nor methodology.

Throughout the weeks student engagement with the ruderal ecology was not questioned. In fact, other classrooms including students who have been ‘formally identified’ with behavioural issues and deemed ‘at risk’ for violent behaviour were engaging with the space. Furthermore, school administration has developed a recent
partnership with a non-profit conservation group that will be planting trees and non-invasive species in the ruderal space. The group of environmental scientists also greatly emphasizes education and will be treating the ruderal ecology as an ecological lab in which students will continue to explore and experiment with ruderal species.

What can be learned from student engagement with the garden and the ruderal ecology, as well as the use of wearable technologies in embodied practices of teaching and learning is that research is less a matter of ‘collecting data’ from people and places than a matter of “making variations in the world” (McCormack, 2015, p. 94). Micro-movements, such as student engagement with the ruderal ecology make a difference in qualitative terms that resist containment into narratives that foreground signification and thus exhaust meaning.

Engagement with the garden led to engagement with the ruderal ecology. The ruderal ecology was also potentialized (through more formal channels) as a future place of learning at the school. However, student engagement or ‘doing’ also caused something to change in the non-linear, co-causal, co-constituting way that Barad (2007) explains. The indeterminacies of the non-linear, co-causal, co-constituting process is
where more-than-human inquiry attends to an ethics of sustainable becomings that
gestures toward living differently in the world. More-than-human inquiry is rooted in the
very ruderal becomings of urban spaces that ‘do’ justice to the social, cultural, ecological,
and spatial complexities in and of time. I, therefore, resist engaging with the narrative
structure of what student engagement with the ruderal ecology meant to each student. The
very engagement with the ruderal space, in its various moments of intra-activity signals
toward a self-organizing ethics of sustainable becomings that provoke re-valuations of
space, place, self, human and nonhuman, as well as inanimate other. Moments of intra-
activity are where collectivities of embodied thought emerge. Therefore, I argue that the
event of gardening remained on the outsides and edges of a representational practice of
gardening that cultivates objects of knowledge. In many ways the students outdid the
initial proposition to ‘think outside the box.’ Gardening at Fir Valley generated its own
rhythm that indeed flowed through variations of human-centredness toward ruderal
ecologies of curiosity and future thought (Manning, 2015b).

Two things can be learned from the use of
wearable technologies and student engagement
with the ruderal ecology. Firstly, using wearable
technologies enables a different way of seeing
with the body that does not mobilize efforts to
overturn school authority, but rather works from
within and toward the ‘outsides’ of experience
that cannot be captured and collected. To see
‘with’ the body and thus to see the ruderal space
as a space of potential, as the students at Fir Valley did, is to compose with the nonhuman and confront the nonhuman and inhuman (in the self) through the challenge of the unthought. Deleuze and Guattari (1994) contend that to confront the nonhuman is to turn toward more-than-human movement, toward the unthought. I argue that composing ‘with’ and in ecologies gestures toward an ethics of sustainable becomings that does not look for a solution to social and environmental justice, but rather creates ‘mutant values’ (Braidotti, 2013) that the event of relation and thus the ecology of practices calls forth. Such movement is of the human as it merges with the human; however, it is simultaneously more-than the human in the very resonant practices of ecologies of relation that cannot be determinately mapped (Manning, 2015b). Mutant values are potentially immanent to practices that encourage: 1) self-organizing subjectivities; 2) a minor and/or affective politics; and 3) an immanent ethics (Braidotti, 2013).

Secondly, what can be learned from student engagement with the ruderal ecology is the potential for a space to reveal itself (Manning, 2015b). From this perspective, which is not based on what is seen, what is at stake is the immediate environment itself (Manning, 2015b). What if, for example, instead of wanting to change an environment, social and environmental justice attends to the complexities and resiliencies of the space itself (Manning, 2015b)? What if social and environmental justice were not thought of in technical and/or instrumental terms, but instead through dimensions of the ecology – social and cultural practices and ‘natural’ and built environments (Manning, 2015b)? If the complexities of ecologies were at stake, perhaps engagement might come to mean something more than just a routine practice that students do with other students and in relation to curriculum. Attending to the complexity of ecologies suggests paying attention
to the practices or more-than-human modes of composition that are already underway, and in turn responding to such movement in affirmative ways rather than imposing what the researcher might think is missing.

I have discussed the need for a minor politics, noting the impossibilities of excluding as well as capturing immanent thought with the use of wearable technologies. In this particular Ecology (III), I discussed self-organizing and/or self-prosthetic potential in reference to the brittlestar, ruderal ecologies, and student collectivities of engagement. In the ‘Final Ecology,’ I discuss how an immanent ethics is required for a new articulation of sustainability that ‘reveals itself’ in schools. In so doing, I rethink notions of sustainability (grounded in conservation efforts) as a becoming process and in relation with images of bodily thought. I specifically refer to the photographic images and video ‘data’ generated during the research process in ways that encounter data with movements of thought. Furthermore, in encounters ‘with’ ‘data,’ I examine what data does and how it is part of the earth’s (ethics of sustainable) becoming. I conclude the Ecology with propositions for more-than-human inquiry in educational research.
Final Propositions

Ecologies of More-than-Human Inquiry
According to Braidotti (2012), sustainable becomings are rooted in the everyday micro-practices of practices. In the context of the research event at Fir Valley, I understand and interpret the above statement as attending to what emerges from embodied practices of learning. Braidotti (2012) explains that a helpful strategy in accounting for practices and sustaining becomings is to map out or diagram the entanglements of the research event. The process of mapping, Braidotti (2012) argues, helps in constructing a ‘liveable present.’ Materialist practices are also committed to living “more sustainably with less violence toward a variety of bodies” (Bennett, 2015, p. 235). Not rooted in scientism, a new materialist understanding of sustainable becomings is rooted in embodied practices that do not separate matter from perception.

Conservation and/or sustainability efforts rooted in traditional approaches to garden-based learning (noted in the review of garden literature) serve important purposes, such as informing ecological literacy and stewardship in schools. However, a new materialist research event approaches sustainability through relational and affective frameworks. For example, at Fir Valley the event of gardening was approached as an aesthetic-affective platform of experimentation that activated creativity and imagination. Imagination and embodied creativity provoke future-oriented thought through collective performances that undo and outdo initial propositions. Sustainable becomings are self-organizing thinking and feeling movements that zigzag and disrupt the repetitive patterns of curriculum, pedagogy, research practices, and social, cultural, and environmental discourses. Sustainable becomings think, feel, and move toward perceptions that are at
the limits or thresholds of bodies. Echoing Braidotti (2013), I conceive of sustainable becomings as an ethical act. Embodied creativity and the imaginative dimensions of ethical becomings are central to the epistemologies of feminism (Braidotti, 2013).

Particularly noting Haraway, Braidotti (2013) writes that

…the creative powers of the imagination is an integral part of feminists’ appraisal of lived embodied experience and the bodily roots of subjectivity, which would express the complex singularities that feminist embodied females have become. Conceptual creativity is simply unimaginable without some visionary fuel. (p. 191-192)

New materialist frameworks such as Braidotti’s emphasize matter, vitality, and difference as practices of sustainability. Current practices of sustainability in schools continue to invest in technical approaches that are not engaging. For example, recycling is a technical approach that has become a chore in schools. Sustainable becomings require new materialist techniques (such as propositions) that optimize learning environments, not condition them. Focusing on optimizing bodily capacities through platforms of experimentation, a new materialist research event activates the performance of sustainability. Sustainability is performed through the minor political practice of becoming, which is self-organizing and thus an ethical instance of change. Ethical relations are not found in processes of experimentation, but rather activated through intensities of learning that are collective performances that do not exclude the nonhuman and inanimate other. An immanent ethics is also that of agentive force, which I discuss (below) through the use of two concepts: 1) geological force; and 2) partial objects. I use these concepts to expand notions of ‘data’ and to flesh out a transversal ‘analysis’ of the
photographic images and video images generated during the research event. A transversal analysis, I argue, opens up ‘data’ to sustainable becomings in post qualitative times of more-than-human inquiry. Engaging in more-than-human inquiry – specifically in relation to the visual image – suggests that images are not static objects of knowledge, but rather becomings that co-produce a ‘partial glimpse’ (Hansen, 2015) into present times of climate change. Furthermore, in the following pages, I discuss how students engaged in more-than-human inquiry in relation to the image. I conclude with a series of propositions that suggest how research practices and teaching practices in urban schools might be rethought in more-than-human ways.

Images of a doomed futurity resonate with environmental sustainability issues and how they are framed in popular culture and in film. The cinematic imagery of disaster tends to follow a predictable apocalyptic scenario of death and monstrosity. These popular images generate vulnerability between humans, technology, and the environment. Braidotti (2013) makes note of the top-grossing Hollywood film, Avatar (2009), as an example of a contemporary machine of techno-cultural power. In the film’s attempt to apparently destabilize difference, the film induces difference negatively through necropolitics and techno-transcendence (Braidotti, 2013). Within the last ten years there have been actual ecological disasters of massive scale including earthquakes, tsunamis, and nuclear disasters that have been covered by the international media and experienced by communities world-wide – communities that continue to experience the history of all three events. My neighbours, upon their recent return from Japan, reminded me that it has

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been four years since an earthquake and tsunami hit the Japanese northeastern coast, causing radioactive poisons to spill into oceans and destroy habitats and communities. The Fukushima Dalichi Nuclear Power Plant suffered a massive meltdown as a result, and its radioactive materials seeped into bodies of water and soil. The history of this event will not only be relived differently through travel, technologically-mediated memory, written text, and visual images, but its history is very much present in ecologies that have been destroyed. This devastation is also part of the earth’s futurity, as radioactive materials continue to poison, displace, and decompose bodies.

Recently, tsunami debris has reached the Vancouver, Canada coastline in the form of wood, plastics, Styrofoam, and fishing material (Fisheries and Oceans Canada, 2012). Following the 2014 winter season, lumber fragments and larger objects such as motorcycles and small fishing boats have surfaced (Fisheries and Oceans Canada, 2012). The Japanese government estimates that 1.5 million tones of debris have dispersed across the Pacific Ocean (Fisheries and Oceans Canada, 2012). The mobile debris has become a symbol of a ‘viscous geography’ that cannot be ‘signified away’ (Saldanha, 2006). The disaster is still of urgent concern as is the many other ecological disasters that have come after it, such as the 2015 oil spill in Santa Barbara and the Colorado mine spill that spewed gallons of toxic metals into waterways. However, I must note that the sight of tsunami debris on the west coast and the sight of neon yellow waterways in Colorado do not mean that sustainability concerns will become urgent or ‘obvious.’ In many ways, the debris is still ‘not-so-obvious.’ Sustainability issues are not obvious for many reasons that include how sustainability is approached in schools (i.e., through technical means). Another reason includes the power of the media and political platforms to spin what is
‘real.’ For instance, ‘climate resisters’ gather, analyze, and deploy ‘data’ in ways that soothe environmental concerns and/or leave citizens confused about climate change (also see Russell & Dillon, 2010). Furthermore, sustainability is still not-so-obvious in the taken-for-granted ways that cigarette butts are tossed out of car windows and chewing gum spat onto sidewalks. I always wonder who that cigarette-tossing, gum-chewing person thinks is going to clean that up! A sustainable ethics of becoming is, however, not one of wondering who will clean up. Sustainable ethical relations are about creating new valuations of living that resist the taken-for-grantedness of the human and the more-than-human relations that sustain the intensities of environments and practices of learning. What becomes perceived in the ‘obvious-not-so-obvious’ time of ecological disaster and more broadly, climate change, will only become urgent if urgency does not “require us to learn to modes of reading, comprehension and narrative communication but should awake us from our human-all-too-human narrative slumber” (Colebrook, 2014, p. 25).

More-than-human times of inquiry suggest a reconfiguration of damaged narratives of urban poverty and Greek tragedy. The formation of new subjectivities is thus significant to a social and environmental ethics of becoming that re-values the very entanglements of geographies, cities, spaces, and the more-than-human earth. An obvious question one might pose is: How might this more-than-human inquiry proceed?

Postcolonial historian, Dipesh Chakrabarty (2009) acknowledges the complexities of more-than-human times and he struggles with the reorganization of spatial and temporal realities. He explains that the difference that new technologies and climate are posing in this present time in history is a methodological challenge in the analytic strategies of postcolonial historians. In fact, Chakrabarty (2009) argues that the scientific
debate about climate change – in relation to the impact of the biological human – is changing what the human thinks about the capacity of the human. He points out that “philosophers of freedom were mainly, and understandably, concerned with how humans would escape the injustice, oppression, inequality or even uniformity foisted on them by other humans or man-made systems” (Chakrabarty, 2009, p. 208). It is, however, as Chakrabarty (2009) suggests, no longer merely a question of a self/other positioning in the geo-historically viral period of climate change, which is supposed to be known as the Holocene. The Anthropocene is debatably coined the current epoch of geological time. Kohn (2014) describes the Anthropocene as an epoch “in which futures, of human and nonhuman kinds, are increasingly entangled, and interdependent in their mutual uncertainty” (p. 460). I am suggesting, as does Braidotti, Chakrabarty, and Colebrook, that learning and living is no longer a simple interaction between self and other and between man and ‘nature.’

Through three methodologies of research, I have argued that learning is intra-active and thus more-than-human inquiry requires a dismantling of binary thought. Therefore, an interactional model to learning and research is no longer enough. An interactive relation, Chakrabarty (2009) explains, is a relation

…humans have always had, or at least that is how man has been imagined in a large part of what is generally called the Western tradition. Now it is being claimed that humans are a force of nature in the geological sense. A fundamental assumption of Western (and now universal) political thought has come undone. (p. 207)
Far from inducing crisis scenarios about climate change, Chakrabarty (2009) (through a historical lens) and Braidotti (2013) (through a post anthropocentric lens), propose that the formation of new subjectivities is required in order to grapple with times of unsustainability and climate change. Chakrabarty (2009) and Braidotti (2013) describe the more-than-human subject as a geological agent and/or force. Attending to relational forces of agency and a geological sense of time, subject formation is understood as an enactment ‘with’ environments that must not ignore the actions in them. This understanding of the human emphasizes the entanglements of human and nonhuman species. Historically, Chakrabarty (2009) explains that humans have been biological agents (as individuals and collectivities). He insists that human agency has, however, enlarged since the Industrial Revolution and picked up speed in the second half of the twentieth century with the onset of new technologies. Chakrabarty (2009) definitely pushes human bodies to the limits by saying the following. I quote him at length, here. It is necessary in order to flesh out a reading that foregrounds relational movement in more-than-human times.

The wall between human and natural history has been breached. We may not experience ourselves as a geological agent, but we appear to have become one at the level of the species. And without that knowledge that defies historical understanding there is no making sense of the current crisis that affects us all. Climate change, refracted through global capital, will no doubt accentuate the logic of inequality that runs through the rule of capital; some people will no doubt gain temporarily at the expense of others. But the whole crisis cannot be reduced to a story of capitalism. Unlike in the crises of capitalism, there are no lifeboats for the rich and the privileged (witness the drought in Australia or recent fires in the wealthy neighborhoods of California). The anxiety global warming gives rise to is reminiscent of the days when many feared a global nuclear war. But there is a
very important difference. A nuclear war would have been a conscious decision on the part of the powers that be. Climate change is an unintended consequence of human actions and shows, only through scientific analysis, the effect of our actions as species. Species may indeed be the name of a placeholder for an emergent, new universal history of humans that flashed up in the moment of the danger that is climate change. But we can never understand this universal. (Chakrabarty, 2009, pp. 221-222)

What I would like to highlight from Chakrabarty’s (2009) argument above is his emphasis on the effects of humans as ‘species.’ His argument reminds me of Haraway’s book, *When Species Meet* (2008), in which she grappled with understandings of the relational human and its more-than-humanness. Haraway (2008) particularly attends to the ‘lively knottings’ of the human and nonhuman on the level of the species where value can be ethically encountered. An immanent ethics on the level of the species does not create a model of perception, but rather puts into question the human-centred optical models of representation that image binary thoughts of man versus nature; woman versus man; human versus nonhuman etc. An ethics that is immanent to encounters of value seriously takes into consideration the entanglements of the human, nonhuman, and inanimate objects and spaces. With Deleuze and Guattari’s concept of the ‘partial object’ and Bennett’s (2010) vibrant reading of metal objects, I extend Haraway’s thinking by emphasizing the entanglements of the human ‘with’ inanimate objects and thus the entanglements of the researcher ‘with’ images of ‘data.’ This discussion leads to how researchers might rethink still and video images as a partial glimpse of thought that requires surrounding ecologies to break from human-centred optics of sense and perception.
Partial Objects: ‘Data’ Demand Ge(c)ologies

We have always thought the world was made of discrete objects, and interactions happened between individuals that existed prior to the exchanges. But what would we think if our frames of reference were disrupted by a new, convincing theory that asserts the exact opposite, namely that individuals exist because of the existence of given interactions: and, furthermore, that even matter exists as a phenomenon, i.e. as the materialization of relationships? (Kleinman, 2013)

Cellphones, tablets, tires, and visual images are partial objects. The metal found in technological hardware and rubber tires is a partial object. Metal is worth money and used in war. It is a resource and form of transmission (Parikka, 2015). Metal is associated with mining and water pollution. It colonizes land, conducts heat, and fuels technologies. A partial object is not merely an object or a thing of representation. Partial objects are more than their parts. They bear traces of histories, and according to Deleuze and Guattari (1977), partial objects activate future thought. Deleuze and Guattari (1977) describe partial objects as “dispersed working parts of a machine that is itself dispersed” (p. 324). The concept suggests that objects are partial understandings of processes that are ongoing. Akin to Deleuze and Guattari’s (1987) concept of the partial object, Bennett (2010) discusses the object of metal in dynamic ways. Her theorizing is helpful in extending Deleuze and Guattari’s concept toward understandings of the inanimate as vibrant and alive in indeterminate encounters of value.

Bennett (2010) refers to the power of metal and/or ‘metallic vitality’ (Bennett, 2010) and its capacity to transform itself in many different ways. Through Manuel De
Landa’s (1995) work on the dynamics of ‘spreading cracks,’ she suggests that cracks found in ruins or the brittle flesh of old buildings are operative of defects. Bennett (2010) argues that “the line of travel of these cracks is not deterministic but expressive of an emergent causality, whereby grains respond on the spot and in real time to the idiosyncratic movements of their neighbors” (p. 59). Bennett (2010) suggests that even cracks in old buildings mark an immanent ethics of boundary making that happen in unpredictable ways. Seismologists, for example, study earthquakes and seismic waves. They monitor tectonic plates and are attentive to the zigzagging cracks (i.e., fault jogs) of the earth’s crust. The earth’s zigzags carry pressurized fluid and rupture as a result of earthquakes. Seismologists can study these cracks – among many other horizontal earth-movements – in order to predict future earthquakes. Seismologists gather the earth’s data and work to forecast unpredictable futurities that the human, nonhuman, technological and inanimate generate. The role of the seismologist is to predict what might happen. It is through mapping of what seismologists refer to as ‘surface rupture data’ that they create ‘rupture maps’ in order to study past earthquakes and predict futurities of seismic activity (Klinger, 2010). The more detail the maps include, the more complex ruptures appear to be. Often, rupture patterns are thrown off track by the movement of water or glaciers (Klinger, 2010). Consequently, Klinger (2010) explains, “precise data for these ruptures does not exist” (p. 2). Furthermore, changes in movement or what seismologists refer to as ‘bends’ or ‘azimuth’ are difficult to define if the rupture is sinuous or discontinuous (i.e., depending on the ruptures curvature). Curvature, as previously noted through Riemann’s differential geometry, is a qualitative movement not reducible to form. Metals also curve and not merely in the sense that if one were to apply heat to metal that it would
bend. Metals consist of tiny crystal grains that fill space (Bennett, 2010). Crystals negotiate space by interfering with the growth of other crystals ‘in’ space – this is why the curving happens (Bennett, 2010). The relation of the crystals determines the shape of the metal more than its internal structure (Bennett, 2010). Metal fabricators and/or metallurgists exploit the crystals and grains when they, for instance, turn iron into steel (Bennett, 2010). Aside from the point that metals can be used as a tool of capitalist power and exchange, Bennett (2010) directs her attention to the ‘elusive materiality’ of metals – an ontology of metal. She explains that metal is a heterogeneous material with and without the intervention of the metallurgist. Metal is “itself a differential of intensities, itself a life” (Bennett, 2010, p. 57). The elusive materiality of metal is similar to the photosynthetic intensities of plant life. Plants occupy intensive space (Marks, 2010). Marks (2010) insists that “plants do move” (p. 3). In garden-centred education, plants are often approached as objects that grow. As a partial object of growth, a new materialist research event encounters the plant as becoming ‘with’ the intensive movements that convert molecules into glucose and oxygen. In other words, the photosynthetic process does not connect the object to parts, but rather the plant iteratively materializes in and of space-time. The intra-action of space and time (i.e., spacetimematterings) produce knowledge, which Barad (2007) refers to as phenomena. The materialization of relationships become phenomena. Knowledge is thus not an object, but rather a matter of process in and of matter. When knowledge becomes an ongoing process of reconfiguration, then, rupture maps and any kind of mapping in educational research that attempts to predict future patterns will always remain representational. In the context of
the thesis in which I emphasize ontological dimensions of knowing, an act of prediction even seems pointless.

In her forthcoming publication, St. Pierre writes that “method always comes to late…method not only can’t keep up with events, more seriously, it prevents them from coming into existence” (p. 5). Conventional methods of data collection and analysis, she says, cannot be done in ‘new empirical inquiry.’ Thinking with Deleuze and Guattari, as St. Pierre has done over the years, she knows that new empirical work is almost impossible to do when thinking with elusive ontologies of movement. Massumi (2014) makes a similar point about the elusive materiality of knowing and makes one suggestion. He says that one of many ways to account for the intensities of movement is by “catching the virtual in the act, then looking closely at how it works, and working from there to press its paradox into conceptual service in order to see what difference might be made in how we think about perception” (p. 4). The impossibility of such work, and Massumi knows this, too, is that in the moments that perception is forming, it is always too early and/or to late to ‘catch’ the virtual dimensions of reality. However, this does not mean that researchers do not account for the materialization of knowledge through mapping methodologies of movement, as I have done through the ‘three ecologies.’ The map takes into account how a practice worked in order to provoke new thought, not to repeat what has been thought. A new materialist practice is committed to “thinking about how the properties of how things move might inflect the qualities of the accounts you produce” (McCormack, 2015, p. 104). However, such an approach easily falls back into human optics and for that matter, attending to qualities of experience does not require data. St. Pierre (forthcoming), indeed, makes an excellent point. A student, for example, does not
need data to tell her what she experienced, or to prove that something actually happened. Experience is always already in and of matter. That being said, then why do researchers need data after all? I will say that the ways in which data is disseminated is problematic because data is often dumped into generalizable categories that make sense too easily. Often, conference presentations have to be so clear that everyone in the room nods. It is of course not a great feeling when no one gets it either. But what is there to get when data is dumped into codable categories? You ultimately get what the presenter gives you to get. A question I have been experimenting with in relation to the research event at Fir Valley is: How might ‘data’ be rethought in more-than-human ways?

Curriculum scholars, philosophers, and materialist methodologists are not quite sure what do with data. Scholars have been experimenting in many different ways. For example, they are: 1) performing a diffractive analysis of data (van der Tuin, 2014); 2) treating data as a machine-assemblage (Jackson, 2013); 3) engaging in a schizoanalysis of data (Ringrose, 2015); 4) engaging in a collaborative Deleuze-Guattarian diffractive analysis (Lenz Taguchi, 2013); 5) performing a slow intensity of coding data (MacLure, 2013); 6) undergoing a nomadic analysis (Cole, 2013); 7) engaging in a more-than-human visual analysis of data (Lorimer, 2013); 8) questioning data and analysis (St. Pierre, 2013); and 9) resisting data (Manning, 2015a; 2013b). The collection of data and what to do with it is ‘big business’ within and outside of the academic field. For example, technological innovation and Internet Technology (IT) companies are at the fore of ‘Big Data’ and analytics, data architectures, data processing, cloud computing, data management, data warehousing, data protection, data mining, and so forth. According to
IBM – a world-wide IT and consulting service company – ‘Big Data’ is everywhere. The IT firm explains that

…every day, we create 2.5 quintillion bytes of data – so much that 90% of the data in the world today has been created in the last two years alone. This data come from everywhere: sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records, and cellphone GPS signals to name a few. This data is big data. (Clough, Gregory, Haber, & Scannell, 2015, p. 152)

Data warehousing, for example, is a service that IBM provides. Data and analytic insights are stored in a virtual warehouse and/or repository. The warehouse is populated with information at a rapid rate, promising access to volumes of ‘data-in-motion.’ The IT organization argues that they will “empower all employees to make data-based decisions, instead of relying on instinct and past experience”. This is what I hope data will not become in educational research.

I have been grappling with 10 months of ‘data’ by viewing it, mapping it, and even considering if I should ‘include’ still and video images in the thesis. During the research event, I never felt that the ‘data’ (i.e., visual images and journal entries) were mine to collect and interpret. The raw data became entangled ‘with’ students and teachers. One of the ways data became entangled was by putting the raw video images (generated with the use of wearable technologies) on the television screen in the school lobby. A feed of research events ran throughout the months, constantly updating the staff

and students. Another way ‘data’ became entangled was through Mr. D’s website. He generated images as well as had access to the images the students and I generated throughout the research event. ‘Data’ was also grappled with during the research process and with students. For example, the photographic images generated during the diagramming event were reworked and re-diagrammed. Diagramming resisted static representations of what had happened through the repetition of difference. The data, if we are still to call it that, was not something collected during the school visits only to be poured over in the isolation of a research office months later. Instead as vital matter the images, texts, plants, bodies, and school site became living fields of data that were propositionally worked through techniques, diagrammed, and diffracted on a daily basis. Repetitions are grounded in immanent ecologies of relation. They are not extensions of reality, but rather iteratively reconfigure through ethical relations and/or sustainable becomings of space and time. Barad states:

…what is at issue is differential material embodiment (and not merely of humans), not in the sense of the conscious subjective experience of the individual human subject but in terms of different material configurations of ontological bodies and boundaries, where the actual matter of bodies is what is at issue and at stake. (2007, p. 155)

Therefore, the ecologies of practice focused on ‘feeding forward’ (Whitehead, 1978) data into intensive compositions, which I argue displaces extensive interpretations of technological machines and the images they co-produce (Hansen, 2015). The ecological approach of ‘feeding forward’ understands images as ‘alive,’ which is an onto-epistemological understanding of the image as producing future thought, beyond its
constituted form (Mazzei, 2010). Conventional humanist qualitative methodologies that are reliant on individualism were disrupted through a transversal mode of working ‘with’ ‘data,’ which involved: 1) working with data alongside students and teachers; and 2) conceiving of data as ecologically informing every occasion of experience (Hansen, 2015). Working with data transversally, I was interested in how technologies and images moved and merged with experience, not as a result of experience. I grappled with a Deleuzian ontology that would dislodge the image from human consciousness, or awareness about the ‘environment.’ I was concerned with how ‘data’ might become an exteriority, or an ‘outside’ within the living out of (more-than-human) material experience (Hansen, 2015). A concern with an ‘outside’ suggests a movement that attends to phenomena and tends toward the limits of ecologies of practice. Deleuze (1986) contends that the limit is at which perception becomes machinic. Machinic perceptions operate with matter and movement; machinic perceptions are of molecular movement. Focusing on the moving images generated with the use of wearable technologies, I was particularly curious how a re-imaging of the image might be rethought ecologically. An ecological approach to the image suggests that: 1) a ‘discursive viewing’ (Mazzei, 2010) is in and of matter and movement and thus related to phenomena; 2) the constituted form of the image is alive and meaning is renewed through discursive and material performativity; and 3) the image requires its ecology.

Experimenting with a Baradian and Deleuzian line of onto-epistemological thought, the technique of ‘mashing’ was created. The practice of ‘mash-ups’ was popular among the students at the school. Mash-ups involve editing two or more songs together to create a new song. The practice became popular as a result of a prime-time television
show called *Glee* in which high school students would mash-up songs during music class. Instead, the students at Fir Valley mashed-up the video images that were generated with the use of the wearable cameras. They used editing software that Mr. D taught the students how to use. Students created digital short videos that enabled them to map their own experiences on a computer screen. Throughout the weeks, students re-worked their digital maps by mashing-up different images.

Upon viewing the images, it became evident that the wearable cameras captured motion. For example, students witnessed phenomena that escaped talk and text methods (Lorimer, 2010). Students did not realize that they did something, did not recall saying something in particular, and noted that they and their friends sounded and looked differently. Other students felt queasy viewing the images, noting the rapid movement of bodies and unfocused shots. When the moving images were re-projected on the computer screen in ways that had not appeared before, I argue that a
materiality was felt in and of which the subject did not come to know herself; rather, the images worked to de-familiarize the self and in turn opened up the ecology of viewing to a durational force of movement, not human-centred motion.

Deleuze (1986) contends that movement must be put back into the image. He suggests that, for example, instead of seeing students and images of students moving, movement can be put back into the image by re-projecting the images on a surface, such as a computer screen (i.e., re-constituting the image). Movement cannot be added. Movement is generated relationally in and of ecologies of matter and movement that are always already underway and shaping future practices and phenomena. Wearable cameras are unique in that they generate a moving image that is affective. There is a materiality to the viewing of the image as it expresses its own unique durational force (Lorimer, 2010). I have also extended this latter argument to still images and the diagrammatic process. However, I would like to particularly focus on the relationship of viewing in the act of viewing images (i.e., the immediacy of viewing). Such a performative understanding moves away from human-centred notions of the subject as an individual agent that alters the image. This is difficult to do, as educational researchers have not yet engaged with affective and provocative moving image technologies (Lorimer, 2010). A more-than-human inquiry of the image works toward performative techniques (such as mashing) that do not see the object (and/or image) as a stable form, but rather as an ‘objectile’ (Manning & Massumi, 2014; Manning, 2013a; Springgay & Rotas, 2014) that expresses durational force. Force and/or movement in turn becomes co-constitutive of new phenomena in ecologies of practice.
The concept of the ‘objectile’ is similar to Deleuze and Guattari’s (1987) concept of the ‘partial object’ and Bennett’s (2010) notion of ‘elusive materiality’ in that these concepts understand the object as constituent of partial knowledge and capable of future thought. A plant, for instance, can be conceived as an ‘objectile.’ The photosynthetic durational force of the plant highlights the relational capacity of the plant to qualitatively transform itself. This understanding of force is quite different from a human-centred understanding of the subject as an agent of change and the plant as an object of knowledge to learn from. Manning and Massumi (2014) explain that immediate experience and/or intra-action is not composed of objects. Experience is co-composed of a relational quality that cannot exclude the temporal and molecular processes of matter like light and energy conversion. The plant as an objectile requires its ecology; it is entangled with past, present, and future phenomena in the making. In other words, the plant is iteratively reconfiguring phenomena. The moving image can similarly be conceived as that which iteratively reconfigures (or becomes differentiated in and of durational movement). The moving (GoPro) image indeed shows experience as fleeting and in constant motion. However, the technique of mashing attends to the temporal and spatial materialization of experience that activates new affections and shapes new perceptions and possibilities. These perceptions are not merely evocative of the human; they are composed of a multiplicity of human, nonhuman, and inanimate durations (Colebrook, 2002). As Colebrook (2002) writes:

We perceive other persons as bodies, like ours, and within our world; we don’t perceive the different ‘world’ of the other, their own duration. There is, Deleuze insists, a multiplicity of human durations and inhuman durations. Only if we think
beyond our spatializing and ordering viewpoint can we think these other durations. (p. 47-48)

Taking more-than-human durational movement seriously in post qualitative educational research suggests that the moving image is “inseparable from the series which makes it vibrate in relation to the movement which derives from it” (Deleuze, 1986, p. 83). Via Deleuze, what I am suggesting is that the image, and more broadly ‘data,’ requires its ecology. What data as ecology suggests is that knowledge and/or phenomena cannot be severed from its ecology, nor added to ecologies in instrumental ways. What such an understanding further suggests is that a shift is required away from understandings of data as ‘packets of information,’ toward an understanding of ‘data’ as a ‘partial glimpse’ of past events that can be taken up in different ecologies and of course in new ways. Therefore, I argue that data must account for practices and be grappled with in ways that emphasize the capacity of data to produce knowledge immanent to the ecology, rather than reproduce and represent it (Manning, 2015). In that case, if data needs ecologies to work in this generative and ethical manner, do ecologies need data? For instance, do school-ecologies need data, or is data merely packets of information that researchers and bureaucracies grapple with?

I am unsure about ‘data’ and I have been using ‘scare’ quotations throughout the text to emphasize my indeterminacy. I think that it is okay to be indeterminate about ‘data’ and to risk saying so in a document that will be examined. My indeterminacy suggests that I am thinking long and hard about ‘data’ and its significance in educational research and practices in schools. I also argue that new materialist research and events of
relation are indeterminate encounters with theories, methodologies, people, places, spaces, objects, and animals. Moreover, I am unsure about ‘data’ because it is entrenched in histories of conventional humanist methodologies that use data to prove what happened and determine what is right for people and communities. I am also unsure if schools at the everyday, grassroots level need data. What I can only gesture toward is what I have performed throughout the text, which is how ‘data’ was enacted (as a generative technique) in the school-ecology that was Fir Valley.

In the closing words of the dissertation, what I will say is that when ‘data’ is worked ‘with’ in ways that enact a transversal movement, a conventional analysis is not performed. An actual movement (not separable from ontological thought) is enacted by the ecologies of bodies that live and breathe the space of the school on a daily basis. An emphasis on movement in relation to ‘data’ suggests that a becoming process is potentialized that is not institutional, nor pathologized. I contend that becoming ‘with’ ‘data’ is ethically just due to the immanent mode of techniques and positionings that refute the stability of pre-existing knowledge; this, however, simultaneously requires knowing that a permanent escape from marginalizing discourses is an impossibility. An ethics of sustainable becomings generates and works ‘with’ ‘data’ in ways that work ‘with’ the constraints and conditions of environments. Working ‘with’ ‘data’ in these ways re-projects (in and of time) continuities and discontinuities of thought that affirm the complexities of urban schools and environments. Particularly, I note the potential of wearable technologies and moving images. These techniques attend to the materialization of processes. Tending to processes of materialization in educational research provokes an understanding that suggests that not all knowledge is actualized yet experienced and thus,
‘real.’ Techniques and positionings, akin to feminist epistemologies, are key to ecological modes of knowing, unknowing, and becoming undone.

What the research-creation event at Fir Valley contributes to the field of post qualitative research methodology is an attention to: 1) how data can be produced from the middle of more-than-human intra-action; and 2) how data can be transversally worked ‘with’ to challenge instrumentalist methods of research. I am also hopeful that renewed emphasis on sustainability issues, not grounded in humanist orientations of conservationism but rather in becomings, seriously considers alternative practices to sustainability that do not foreground the object-oriented goals of school gardens. The dissertation is also concerned with what might be made possible. Therefore, I will not close the text with a list of what can be learned, or a map of what was learned. I will close the text with new materialist propositions for future research and intra-action in schools.

40 Propositions

The following propositions serve as platforms of experimentation that will affect school-ecologies in many different ways. Propositions emphasize interdisciplinary and collective projects enacted across schools and communities. They foster socially and culturally responsive research practices that are affirming and resist goal-oriented mentalities. An attention to creativity and ecological relationships, linking schools, communities, and urban environments is also noted. Furthermore, accessing modes of imaginative thinking
and ‘untapped’ resources in schools and urban environments is required in doing new materialist work in schools (Braidotti, 2013). It is my hope that these propositions, which have been inspired by the research experience at Fir Valley, will serve as a catalyst for more-than-human inquiries in educational research and in schools.

1. Enact thinking
2. Move ‘with’ and in environments
3. Create ‘loose spaces’
4. Make tentative plans (of research)
5. Attend to the constraints and conditions of environments
6. Make variations (in the world), rather than extract knowledge
7. Engage in the ‘figuring out of things’ with teachers and students
8. Think ‘with’ animate nonhumans and inanimate objects and spaces
9. Entangle data/Share data
10. Encounter data
11. Give up control of data collection
12. Feed forward data
13. Attend, attune toward movement
14. Engage in mapping
15. Re-arrange and rework form
16. Think phenomena as knowledge producing
17. Encounter ethics/Encounter value
18. Attend to ontologies, forces, particles of matter, and practices of materialization
19. Think with the partiality of images and objects
20. Activate space-time relationships
21. Imagine intent non-linearly
22. Think material and discursive
23. Perform nature and culture
24. Imagine ecologies as always already more than their parts
25. Create new techniques
26. Resist prediction
27. Provoke affection
28. Perform responsivity and sensitivity
29. Account for techniques, activations, and materializations
30. Activate partial knowledge and perceptions
31. Open-up to detours and deviations of thought
32. Affirm capacities
33. Write collectively
34. Attend to difference
35. Embrace tension
36. Think of failure as a generative platform
37. Intersect science and aesthetics
38. Traverse disciplines
39. Conserve sustainable becomings
40. Rethink social and environmental justice
The thesis is written at a very human, all-too-human time of ailing health concerns that have encountered my family. It is ironic that I am arguing for an immanent ethics of sustainable becomings that is not human-centred, when I am in a place in my life where the health of the human fills me with thoughts and concerns ‘about’ the human lasting in time. Health is, however, a co-production and the agency of nonhumans and inanimate environments are often ignored in this regard. One of the mis-readings of new materialist theories, ecological theories, and more-than-human inquiries is the belief that the human does not exist anymore. Braidotti’s (2013) theorizing in her latest book is enough to support a more-than-human inquiry that is concerned with the human as much as it is concerned with nonhuman species, as well as the inhumanities of the world that metastasize and colonize bodies. Braidotti (2013) argues that more-than-human inquiry forces researchers to think harder. Such inquiry, she says, is “about the status of the human, the importance of recasting subjectivity accordingly, and the need to invent forms of ethical relations, norms and values worth of the complexity of our times” (Braidotti, 2013, p. 186; also see Tan & Pedretti, 2010).

At times in a life when living just seems so unfair, Deleuze (1989) contends that “we need reasons to believe in this world” (p. 172). For some, this may be an articulation of hope. For me, Deleuze’s (1989) articulation is one that requires commitment to less violent futures and resistance toward conclusions and solutions to learning and living.
This commitment is grounded in events of possibility, rather than miracles of change. As I have said, do the work of the new materialisms. Do the work of activating embodied practices that change histories of repetition that will forever get it right. Innovate, Stengers (2010) says, through the making of new knowledge that changes the human and challenges the all-too-human percept of care for the Other. I conceive of care for the Other as a human gesture of responsibility or hospitality, as Derrida (2000) says. In the dissertation, I rather write of affirmation through Braidottian and Deleuzian notions of ethics and politics, arguing that sustainable becomings are not about care for the human Other, but rather about believing in the more-than-human self that is affected by and affecting the becoming of the world – an ethical matter (Barad, 2007).

What might an ethics of sustainable becomings look like is a difficult question to answer because its potential is its capacity to reconfigure its form. The capacity for change and the belief in the more-than-human world is a different way of thinking about care on a planetary scale. Such thinking entails a re-valuative dimension that is not bound to things, but rather generated in and of enunciative events that ‘do’ and/or perform social and environmental justice in the very micro-movements of everyday practices of living. To sustain becomings is to, then, believe in future practices of learning, even when past and present times are difficult to bear.
References


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Appendix

Involvement with Urban Schools:

I have been involved with urban schools and communities for over 10 years in varying capacities including volunteerism, teaching certification (i.e., student practicum), and currently teaching in urban schools in Canada. I have also been a student of urban schooling, attending urban elementary schools and a high school in Canada.

School Demographics:

Fir Valley is part of the local School Board system in a large city in Canada. According to the Board, Fir Valley is identified as a school in the city that requires additional resources. In accordance with the School Board’s quantitative analysis of student learning – which measures external challenges facing student success – Fir Valley is ranked 51 on a list of 474 schools that face socio-economic challenges. The school with the greatest socio-economic challenges is ranked number one. Fir Valley moved 11 spots since 2011. Since 2009, the school has moved twenty-one spots. At that time Fir Valley was ranked 30 on the list. The purpose of identification and ranking, according to the Board, is to provide students, schools, and communities with resources and equitable opportunities. This ranking system, however, has labeled Fir Valley as an ‘inner-city’ school that faces many challenges, which extend but are not limited to behavioural issues (broadly defined), low student engagement levels, and low literacy and numeracy levels.
Currently, Fir Valley has 418 students enrolled, 25 teaching staff members, 4 Early Childhood Educators (ECE), 2 Special Needs Assistants (SNA), and 2 Educational Assistants (EA). The school and community members are comprised of students who are from newcomer and/or immigrant families. A majority of families in the community have emigrated from Afghanistan, Bangladesh, and Somalia. Most students are first generation Canadian citizens. English language literacy was not an issue with the students I worked with. Translation was, however, required when speaking with parents and community members. Students and/or bilingual community members would assist with translation.

School Curriculum:

The school offers programming from Kindergarten through Grade 8. Curriculum is mandated under the provincial government and is designed to implement teaching in traditional subject areas, such as Language Arts, Visual Arts, Math, and Science curriculum. Teaching goals complement each subject area and in accordance with grade level. There are also overall expectations, which pertain to ‘strands’ or themes. For example, the strand ‘Understanding Life Systems’ pertains to the Science curriculum. There are also culminating goals and specific expectations, which are geared toward assessing units of research and/or specific lessons pertaining to the theme of research.