

2015

Becoming Transdisciplinary: Exploring Process in a Research Initiative on Climate Change

Emil Tsao
University of Vermont

Follow this and additional works at: <https://scholarworks.uvm.edu/graddis>



Part of the [Place and Environment Commons](#)

Recommended Citation

Tsao, Emil, "Becoming Transdisciplinary: Exploring Process in a Research Initiative on Climate Change" (2015). *Graduate College Dissertations and Theses*. 488.

<https://scholarworks.uvm.edu/graddis/488>

This Thesis is brought to you for free and open access by the Dissertations and Theses at ScholarWorks @ UVM. It has been accepted for inclusion in Graduate College Dissertations and Theses by an authorized administrator of ScholarWorks @ UVM. For more information, please contact donna.omalley@uvm.edu.

BECOMING TRANSDISCIPLINARY:
EXPLORING PROCESS IN A RESEARCH INITIATIVE ON CLIMATE CHANGE

A Thesis Presented

by

Emil J. Tsao

to

The Faculty of the Graduate College

of

The University of Vermont

In Partial Fulfillment of the Requirements
for the Degree of Master of Science
Specializing in Natural Resources

October, 2015

Defense Date: August 19, 2015
Thesis Examination Committee:

Adrian J. Ivakhiv, Ph.D., Advisor
Kelly Clark/Keefe, Ed.D., Chairperson
V. Ernesto Mendez, Ph.D.
Cynthia J. Forehand, Ph.D., Dean of the Graduate College

ABSTRACT

The subject of this case study is the Vermont Agricultural Resilience in a Changing Climate initiative, a transdisciplinary research team at UVM that has maintained success in meeting research and outreach objectives despite collaborating in a way that does not follow any particular ideal-type transdisciplinary process. In following recent science and technology (STS) studies' accounts of cross-disciplinary collaboration, the hypothesis pursued is that the transdisciplinary study of messy or "wicked" problems like climate change brings forth an array of responses from researchers whose disciplinary backgrounds already position them to pursue their research differently, particularly when they involve outside stakeholders in a participatory action research agenda. When not addressed explicitly through the transdisciplinary research framework, these differences are likely to result in more subterranean or affective responses, such as ambivalence and equivocation, which may permeate the collaborative group process. Through a qualitative ethnographic approach, I show that transdisciplinary work is complex and situational, due to the topic itself in agricultural resilience and climate change, the affective nature of the collaborative process, the differences in disciplinary perspectives, the researchers' subjectivities, and the influence of outside actors in the initiative. I argue that transdisciplinary work must necessarily be challenging given the variety of heterogeneous forces at play, and that deeper attention to the situation elucidates underlying dynamics that are not addressed in the normal research process. This research contributes insights into the literature on transdisciplinary research on messy problems.

ACKNOWLEDGEMENTS

I depended on a tireless network in completing this work. Many thanks to the Rubenstein School of Environment & Natural Resources for their courageous decision to fund this work, which is very much outside of the norm for them. The faculty and students have been an immense inspiration, even as I have looked jealously at the mud they stomp in after a rainy field day. My seriously unbelievable committee – Adrian, Kelly, and Ernesto – thank you so much. You’ll see soon just how impactful your thinking has been on my own. Adrian, I am beyond indebted to the theoretical passageways you have opened up for me and for your willingness to humor whatever blind alleys of thought I frequently found myself in. Kelly, your warm care and utter attention to detail have inspired me to remember who I am and to never cease to become. Ernesto, I have a deep respect for the commitments you have to your worlds, and I carry that sense of responsibility with me. And of course, I thank my family, composed of Mom, Dad, and Eugene. But above all else, I extend deep gratitude to my partner in crime, Ms. Ale Peanut Rodriguez. I couldn’t have done it without you.

TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS.....	ii
CHAPTER 1: EXPLORING PROCESS.....	1
1.1. Preface.....	1
1.2. Introduction.....	2
1.2.1. Context of the Problems.....	5
1.2.2. Theoretical Underpinnings.....	8
1.2.3. Subjectivity and Values.....	11
1.2.4. Structure of Thesis.....	13
CHAPTER 2: REVIEW OF LITERATURE.....	14
2.1. Four Bodies of Literature.....	14
2.1.1. Science & Technology Studies.....	14
2.1.2. Material Feminism.....	18
2.1.3. Empirical Transdisciplinary Studies.....	20
2.1.4. Transdisciplinary Discourse.....	23
CHAPTER 3: METHODOLOGY.....	30
3.1. Research Design and Approach.....	30
3.1.1. Activities and Timeline.....	32
3.1.2. Sampling Procedure.....	33
3.1.3. Data Collection.....	35
3.1.4. Data Analysis.....	37
3.1.5. Limitations.....	40

CHAPTER 4: TRACING VERMONT AGRICULTURAL RESILIENCE.....	41
4.1. Genealogical Approach	41
4.1.1. A Changing Climate	42
4.1.2. The Transdisciplinary Research Initiative	47
4.1.3. Vermont Agricultural Resilience in a Changing Climate.....	51
4.1.4. ‘Loving Our Monsters’	53
CHAPTER 5: SUBJECTIVITY AND AFFECT.....	56
5.1. Introduction.....	56
5.1.1. Entering the Situation	56
5.2. Subjectivities	58
5.2.1. The Principal Investigators	59
5.2.2. Subjective Processes in VAR’s Transdisciplinary Work	65
5.3. Affective Processes.....	68
5.3.1. Noticing Affect, Power, and Moments of Rupture.....	68
5.3.2. ‘Speaking Frankly’	74
CHAPTER 6: INTEGRATION AND COSMOPOLITICS.....	78
6.1. Initial Integration: Strategies for Coherence.....	79
6.1.1. Strategy #1: Discursive Practices	80
6.1.2. Strategy #2: Boundary Objects.....	85
6.2. Problematizing Integration: Moving Beyond Mere Knowledge Production.....	91
6.2.1. Addressing the Ethical and Political through Participatory Action Research	91
6.2.2. Cosmopolitics	97

CHAPTER 7: LOOKING BACK AND MOVING FORWARD.....	103
7.1. Reflecting on Enactment.....	103
7.2. Becoming.....	107
CHAPTER 8: BIBLIOGRAPHY	109

CHAPTER 1: EXPLORING PROCESS

1.1. Preface

This thesis is centrally about change and process. It enacts and documents the evolution of a team that is simultaneously confronting the harsh realities of climate change while seeking to mitigate and adapt to them. I began this work nearly two years ago. At the time, I was motivated by the possibility of grounding the theoretical work I had been doing with my advisor in an empirical site, and since then, my initial motivations have been swept up by my own ‘becoming with’ (Haraway, 2008) the Vermont Agricultural Resilience in a Changing Climate initiative. The desire to produce an academic work became something much more, as professors, team members, theorists, and others began to form an evolving ‘assemblage’ that I now speak through. Through the course of my journey, I was captured by the multitude of concerns that were spoken of, both human and nonhuman.

The Vermont Agricultural Resilience initiative (VAR) is a novel conrescence of disparate entities that, for a variety of reasons, have been brought together to deal with a complex problem. In this study, I explore the movements and processes that not only led to the original composition of VAR, but also the constant process of composing and becoming that is ongoing. I problematize certain processes in VAR, not motivated by critique, but out of concern – concern for the challenges VAR faces in light of so many extenuating factors and concern for the well being of both our planet and its inhabitants. I invite you to engage with the process of becoming in this research team, both in its all-too-human, affective, and embodied ways, and through VAR’s entanglements with nonhuman actors and agents.

1.2. Introduction

The subject of this case study is the Vermont Agricultural Resilience in a Changing Climate (VAR) initiative, a research group at the University of Vermont (UVM) that is seeking to implement a transdisciplinary and participatory action research approach to improve agricultural resilience. Resilience refers to a system's ability to absorb and recover from shocks (Holling, 1973), which are expressed prominently now through climate-related events including flooding, torrential rain, drought, and storms, and most notably experienced in 2011 during Tropical Storm Irene (ANR, 2015). VAR was organized at the intersection of many events: the recently formed Transdisciplinary Spire Initiative at the University of Vermont was an endeavor designed to identify the cross-disciplinary research strengths across campus; the Food Systems Spire, which was one of the identified research strengths; and the increasing shocks and stresses farmers were experiencing with Irene as a catalyst to change. A group of research professors, their graduate students, extension staff (who work directly with farmers), facilitators, and others were recruited to join this new transdisciplinary endeavor that would seek to improve agricultural resilience for Vermont farmers. Their goals were ambitious – in three years, their research and outreach would serve farmers, policymakers, and agricultural service providers, as well as the institutional expectations of UVM and the academic expectations of various research communities.

Another key task set forth in VAR's original grant proposals was to “[research] and [apply] a transdisciplinary, Participatory Action Research (PAR) framework into practice” (Schattman et al., 2012). When I first met with the team's facilitator, this task was one of her major concerns since I was entering at the beginning of year two, which

was the phase where VAR should have been integrating the individual research that team members had conducted up to that point. While my initial motivation in reaching out was to ground theory related to the so-called ‘ontological turn’ (Woolgar & Lezaun, 2013), I decided to momentarily pursue what was presented as the imminent challenge for the team – namely, the difficulty to integrate research for agricultural resilience – and I began to participate in team meetings and interact with the team informally. From the outset of my engaging with VAR, my entrance seemed to cause a ‘ripple’ effect that elicited a varied set of responses: doubt, uncertainty, confusion, optimism, and other affective feelings. Team members seemed to harbor different understandings of VAR’s process that were never discussed in the open team setting.

Inspired by a recent publication about a transdisciplinary research group that faced a number of challenges integrating different modes of knowledge, I chose to follow the tensions and difficulties involved in VAR adopting a transdisciplinary and PAR-informed framework. My initial interactions with VAR suggested that a deep, situated inquiry was required to elucidate these feelings that only briefly bubbled to the surface. Because these ‘buried’ insights were coming from the unlikeliest of places and times, I reconsidered what ‘data’ meant in this thesis: I decided to open up the “sensorium of experience” (Merchant, 2011, p. 57) to consider data beyond the mere linguistic testimony presented in interviews, surveys, focus groups, and other traditional social science methods. I opened up the study to a wider variety of data – to my noticing of the subjective and affective, to the porosity between theory and fieldwork, and to the meta-analyses of what I was *doing* to VAR and what VAR was doing *to me*.

In this study, I principally wrestle with three problems. The first problem that I

identify is the perceived challenges in working in a transdisciplinary initiative, a sentiment that has been shared widely not just by the facilitators but also by team members. In fleshing this problem out, I seek to expand the “matters of concern” (Latour, 2008) that may problematize transdisciplinary work, but be made absent in the normal research process. The second problem, which relates to my methodological practice, asks how I can reconcile the fundamentally enacted nature of this thesis. In other words, I recognized early on that my interventions in VAR both enacted the first problem above, and spurred rippling effects among the team that persisted through the initiative’s final meetings. In addressing this predicament, I might look to action research as a methodological solution, which might say that so long as I plan my actions, my bases would be covered. But I argue that this is insufficient, because there are a myriad of actions that are enacted and continue whether I plan them or not. In my methodological chapter, I look to material feminism as a compass for navigating the mess of the second problem.

And finally, a third problem also fuels my motivation, and this engages with the “ontological turn” that sparked my interest in VAR in the first place. This problem relates to what Alfred Whitehead (1929/1978) called the ‘bifurcation of nature,’ speaking to the Western habit of dividing the world into two separate containers, placing subjects, Society, the mind, and humans into one; and objects, Nature, the body, and nonhumans into the other. While climate change is undeniably a force acting mercilessly on humans, a feeling persists that humans can still control nature – with stronger levees, increasingly dystopic geoengineering projects, so-called ‘frankenfoods’, and so on. In VAR, where human and nonhuman entanglements are vital to the success of the initiative, I argue that

the bifurcation of nature, as a habit of thought, must cease. Using Isabelle Stengers's (2010) *cosmopolitics* as a conceptual lure, I explore why we must expand our human concerns to include the nonhuman to foster greater 'symbiotic agreements' between human and nonhuman 'modes of existence' (Stengers, 2010).

At the outset of this research project, I asked, "What are the discursive, material, and affective processes involved in becoming transdisciplinary?" My hypothesis was that transdisciplinarity and participatory action research are useful frameworks for transcending the positivist paradigm that is dominant in science but that its implementation in a group is messy in practice when one considers the complex and "wicked" (Levin et al., 2012) nature of Vermont's socio-ecological problems, and the particular disciplinary underpinnings that position researchers differently. While these disciplinary differences were certainly challenging to navigate, a wider set of concerns were made present once I entered the situation that also impacted the collaborative process, which VAR had mixed success in addressing. This thesis explores this wider set of "matters of concern" (Latour, 2008), undertaking a dual research purpose of (1) Developing a situated case study of what transdisciplinary work looks like in practice to contribute and respond to recent literature on the process of cross-disciplinary research, political ecology, and qualitative research; and (2) Engaging with the matters of concerns and challenges specific to VAR that may aid their work in the future.

1.2.1. Context of the Problems

In response to the first problem, by following a research group that is actively attempting to integrate and become transdisciplinary, my study follows Fitzgerald et al. (2014), who implore scholars to conduct more empirical studies of transdisciplinary

research situations that don't function as fluidly as they are normatively characterized in the 'ideal-type' literature. Studies of cross-disciplinary research have existed in STS (science & technology studies) since the interdisciplinary field first began to emerge. While some of these studies focused on the ways in which scientific research should have *already* been interpreted as transdisciplinary insofar as they recruited a network of participants beyond the conventional sites of scientific production (Latour, 1999), many studies also realized that there were challenges faced in the relations between scientists and non-scientists. Many of these STS studies of "boundary work" deal with historical examples (see: Wynne, 1989; Star & Griesmer, 1989); however, more recently in STS there has been a push to understand the challenges of cross-disciplinary boundary work *in action*. These upstream studies of cross-disciplinary research focus less on the outputs of research than on the discordances and moments of tension within the research process itself (Rabinow & Bennett, 2012).

I address this notion of boundary work by showing how the construction of 'boundary objects', which are objects able to serve disparate social worlds, was an important strategy during the early stages of VAR's research, but proved problematic later on in the process. I also respond to Fitzgerald et al.'s (2014) call for a 'politics of experiment' that openly engages with the tensions and discordances in transdisciplinary research. I diverge from Fitzgerald et al.'s belief that healthy collaboration must follow a practice of 'equivocal speech,' arguing instead that speaking frankly can develop as a process once trust and respect are foundational to the team. Further, I address Rabinow and Bennett's (2012) suggestion that communication should always be transparent, arguing that this may not be possible in the early stages of an initiative, where

collaboration can be tenuous and require careful tending. My argument is that a middle way can be charted between Fitzgerald et al. and Rabinow & Bennett.

In response to the second problem, I draw on material feminists and other poststructuralist thinkers who turn our attention to the embodied and enacted (Mol, 2002) nature of research. By looking at material-discursive practices, Karen Barad (2003) shows how humans – through their discursive and bodied ways – take an active role in ‘performing’ the world, co-constructing the phenomena that emerge. In this context, language and discourse are not the only ways of knowing or accessing the world, as a multitude of affective and embodied ways of being exist (Blackman, 2012). Annemarie Mol (2002) and John Law (2004) also draw our attention to the ways that researchers enact the realities that they eventually represent. Because these realities are ontological, that is, they exist in the world, rather than as mere discursive representations of the world, researchers are required to make ethical and political decisions about their enactments. Moreover, in responding to Lather’s (1993) understanding of validity in poststructural research, I suggest that two main questions are raised in my inquiry with VAR: “How do I participate in the ways VAR is enacted?” and “How does my participation produce representations of VAR and how could it be otherwise?” In responding to these, I argue that this thesis is not merely a product of my own subjectivity, but has been co-constructed by a number of parties, including the facilitators of VAR. They have advised the directions of the research, and helped to create meaningful methodological enactments. As Childers (2013) realized, the situation calls for certain practices, and reflexivity helps understand the complex, and entangled ways through which I worked with VAR to co-construct this thesis. As for representation: I seek to spark a ‘difference

that matters,' looking not only at how VAR *is*, but also at how VAR *could* be and can become.

In response to the third problem, my study is aligned with a growing academic movement colloquially referred to as the “ontological turn” (Woolgar & Lezaun, 2013). This is in reference to the “radically constructed” (Stengers, 2008) ways that the world is composed of humans and nonhumans. Whitehead (1929/1978) argued that the separation of humans and nonhumans (and other subject/object binaries) was a “fallacy of misplaced concreteness” (Stengers, 2008b), indicating that our tendency to set humans apart from the rest of the world is an artificial belief. A wide range of fields – like geography (Escobar, 2007), anthropology (Blaser, 2013), and science & technology studies (Woolgar & Lezaun, 2013) – have looked at the porous categorical boundaries between human and nonhuman, attending to the hybridity of the world (Latour, 1993), and the possibility for multiple worlds (Law & Lien, 2013). Moreover, Nigel Clark (2011) has recently problematized the relationship between the human and the nonhuman, demonstrating some of the radical asymmetries in the world, exhibited when natural disaster events fundamentally rupture and disrupt human activity. I argue that an understanding of *cosmopolitics* (Stengers, 2010) in VAR, a term that draws attention to the disparate cosmoses of the world, can begin to grapple with ethics of increasing entanglements between humans and nonhumans, as well as the radical asymmetries that exist, witnessed in Vermont during Tropical Storm Irene.

1.2.2. Theoretical Underpinnings

Underlying this thesis is an understanding of ontology and epistemology that is counter to the Cartesian-Newtonian ontological view that sees the world as a free-floating

arena composed of independent, pre-existing objects that can be objectively known in isolation of each other (Law, 2004; Coole & Frost, 2011). Rather, what I presuppose in my research approach and theoretical framework is a process-relational ontology that sees the world in a constant state of becoming rather than being (Halewood & Michael, 2008). In this understanding, there are no such things as ‘essences’ or ‘stable objects’, instead, all that exists are processes in relation to one another – what Whitehead (1929/1978) calls “actual occasions” – that have varying levels of coherence: some actual occasions have strong bonds, becoming what Whitehead calls “societies” or “nexuses,” while others become other actual occasions. While the essentialist ontology is made up of “objects, substances, structures, or representations,” a process-relational ontology is composed of “relational processes, encounters, or events” (Ivakhiv, 2013, p. 12).

The effect that this theoretical framework has on my thesis is in seeing that process, change, and becoming are a *natural* part of the research process. Rather than assuming that the transdisciplinary research process *should* be a certain way, I seek to explore a dynamic engaging within the group, across humans and nonhumans, as they seek greater integration and coherence. Tension and discordance are not interpreted as occurring because the team did not follow what they were supposed to, but instead as a necessary process of becoming in the Vermont Agricultural Resilience initiative. The move I make towards a stance that sees the world as dynamic and in a process of becoming alters what is normally meant by ‘epistemology’ and ‘ontology’ – the latter, what the world is, and the former, what we know of the world, are reflections of the ‘bifurcation of nature’ (Stengers, 2008b). In the process-relational view, ‘knowing the world’ is a process of ‘enacting the world’ (Mol, 2002; Law, 2004), as the apparatuses

that we use to see, probe, describe, understand, and access the world have the effect of constructing the phenomena that was previously thought just to be passive knowledge of things (out there). Instead, our scientific apparatuses have brought into existence hybridities – quasi-subjects and quasi-objects – that are now participants in our realities (Latour, 1993). Karen Barad (2007) argues that we need to see research as a process of ‘onto-epistemology’, since as Lisa Mazzei (2014) writes, “practices of knowing *and* being cannot be isolated from one another but rather are mutually implicated and constitutive” (p. 745).

Additionally, representation in research becomes problematic – because the researcher actively shapes the data that emerges, the research material or subject cannot be said to exist independently of the researcher, leading to a crisis of representation, or what can be considered truthful. The ‘things’ represented in the body of my thesis are not ‘things’ that I accessed objectively, at ‘arms-length’, but emerge as a result of my interventions and enactments in VAR. Patti Lather (1993) writes, “the crisis of representation is not the end of representation, but the end of pure presence” (p.674). These theoretical underpinnings have three generative effects on my research:

1. An ‘antipositivist’ stance that the validity of the meanings and knowledge I generate should not be subject to conditions of pure correspondence to truth or predictability, but rather by its ability to “foster differences and heterogeneity” or to “unsettle from within” (Lather, 1993, p.686). The conceptual result of this is using Bruno Latour’s (2008) “matters of concern” as a lure for broadening and diffractively interpreting the Vermont Agricultural Resilience’s transdisciplinary challenges.

2. An ‘antifoundationalist’ stance that runs counter to the view that there are “absolute frames of reference” (Lather, 2001, p. 221) from where we can objectively do research. Instead, I acknowledge my situatedness and embodiment, my subjectivity, my own “matters of concern,” and the particularities that can only exist as I’ve enacted them in this thesis.
3. A ‘posthumanist’ stance (Barad, 2003) that recognizes a profound porosity between the categorical boundaries of human and nonhuman. As “earthlings” (Latour, 2007), we (humans and nonhumans alike) are bound to a single planet, inextricably connected ecologically, victims to a variety of asymmetrical agencies, and increasingly entangled. This thesis charts some of those interdependencies.

These three stances, along with a process-relational view of the world, form the theoretical underpinnings that enable the meanings, connections, and conclusions drawn throughout this thesis.

1.2.3. Subjectivity and Values

John Dewey (1916) remarked, “Reflection appears as the dominant trait of a situation when there is something seriously the matter, some trouble, due to active discordance, dissentience, conflict among factors of a prior non-intellectual experience” (p. 11). And more recently, Nigel Clark (2011) writes, “Instead of beginning with what we believe to be our powers and capabilities, I set out from the position of our susceptibility to the earth’s eventfulness, from our all-too-human exposure to forces that exceed our capacity to control or even make full sense of them” (p. xiv). Subjectivity, values, and biases are integral to our ‘all-too-human’ nature. In this thesis, reflexivity

becomes a generative practice for sensing affective moments and matters of concern. I will argue that the subjectivities of VAR's team members have been integral to the collaborative experience. This also follows my aim to be upfront about my subjectivity, to 'auto-ethnographically' notice my own feelings and biases rise to the surface, and to follow the effects of my engagement in the team. Reflecting on Dewey and Clark, I believe that our value judgments are required to grapple with the 'active discordances' that arise from these "forces that exceed our capacity to control or even make full sense of them." Later, when we look at participatory action research in VAR, we will see how we *must* make ethical and political decisions based on our value judgments, requiring us to openly listen to what others need.

To be upfront, however, of my own noticing of the possible biases that shape this research, I did not grow up in Vermont, I am a male, I don't have a background in science, and much of VAR's work remains mysterious and technical to me. At the same time, as a minority, especially in Vermont, I'm also aware of the totalizing power of labels, essences, and micro-aggressions. Self-critique, however, may not be enough to adequately address the representational nature of our work (Lather, 1993), as I may analyze the team in ways that may differ from their own impressions. As I mentioned before, this thesis is indebted to a cast of individuals who have also engaged this work, influencing me to be more rigorous, reflexive, and intentional. Their value judgments, expertise, and subjectivities have enabled another level of critique to respond to Lather's notion that self-critique is an insufficient insurer of reflexivity.

Finally, this research has spilled over in so many ways: the themes that I address seem related to so many other things in my life, I consider many in VAR to be friends,

and my own becoming will forever be linked to VAR. Because of this, I choose to include my feelings of gratitude, nerves, excitement, and doubt.

1.2.4. Structure of Thesis

In the next chapter, I will outline and explore the literature that I most prominently draw on, looking at science & technology studies (STS), material feminism, and transdisciplinarity. After this literature review, the following chapter addresses my methodology and describes how it relates to my research tasks. Then, in chapter four, I genealogically trace VAR's conditions of possibility, showing how the concrescence of VAR occurred as a result of a constellation of events including tropical storm Irene, the push for transdisciplinary research, and the lead PI's commitment to doing research differently. In chapter five, I bring us to the collaborative space of VAR, looking at how subjectivity and affect inform transdisciplinary work, and how 'frank speech' can arise over time once trust, respect, and humility has developed. In chapter six, I tackle VAR's challenge of integration, looking at the provisional strategies for sustaining coherence, and the problems that arose out of these. I argue that 'cosmopolitics' can augment a transdisciplinary and participatory action research approach by broadening the modes of existence considered in the approach. And finally, in chapter seven, I conclude the thesis by reflecting on the positive repercussions of my methodological enactments in VAR, looking at the co-construction of my methods and the ways process has unfolded in VAR.

CHAPTER 2: REVIEW OF LITERATURE

The aim of this chapter is to ground my research with VAR in the fields of literature that inform this thesis's content and research design. Annemarie Mol (2002) writes,

So what I have to tell in the present book does not just relate to the events that figure in my stories, it also relates to other texts...Systems and events, controversies, similarities and differences, co-existence, methods, politics. If I am to make explicit how *this* text departs from the others around it, if I want to show how it both differs from them *and* is made possible by them, I will have to *relate to the literature*. But how to do this? How to relate to the literature?

While Mol chooses a style of two parallel texts, one of her story, and one of the literatures that she is in dialogue with, in this thesis, I choose to present four standalone bodies of literature in this chapter, before 'plugging in' my research by "reading insights through one another" (Barad, 2007, p. 25) in chapters four, five, and six. The fields of literature that I engage with form a tentative 'assemblage' (Deleuze & Guattari, 1980/2004) for my research, beginning with four thematic areas that I present in this chapter, before drawing on other theorists, ideas, and literature as they relate to VAR's situation in the later chapters. These four areas, which have shaped the development of this thesis, are science & technology studies (STS), material feminist theory, transdisciplinary discourse, and studies of transdisciplinary practice.

2.1. Four Bodies of Literature

2.1.1. Science & Technology Studies

The first body of literature I engage with is from the interdisciplinary field of Science & Technology Studies (STS), which marks intent to understand the "origin, dynamics, and consequences of science and technology" (Hackett et al., 2008). STS aims

to understand science and technology, and their intersections with the world. A key insight in STS has shown that science relies on a complex political, cultural, and material network to enable its experiments (Latour, 1999). Moreover, the field of STS is unified by a concern for a more equitable planet in which science is not seen as representing “transcendent” truth but that operates based on situated logics that deal with social values, ethics, and norms (Hackett et al., 2008).

Thomas Kuhn (1962/2012) initially drew awareness to the consensus-based and constructed nature of scientific facts and knowledge, leading to a ‘constructivist’ school of STS. There were two initial schools of thought that are described as the ‘sociology of science (SS)’ and the ‘sociology of scientific knowledge (SSK)’. In SS, the sociologist Robert Merton (1973) followed the goals and interests of scientists, looking at how social norms shaped scientific behavior, such as how reward and incentive structures shaped the nature of scientific inquiry. This school of thought, however, came under scrutiny as critics argued that it assumed that the science itself was robust and objective (Sismondo, 2008). Scholars operating in the field called the ‘sociology of knowledge’ (SSK) were particularly critical, and became known as the ‘strong program’ in STS, as they posited the idea that scientific researchers were strongly biased towards scientific explanations that were neat, predictable, and comprehensible. Unlike Merton’s sociology of science, which assumed scientific practices would result in scientific truth, the sociologists of knowledge had a keen interest in critiquing rationality and undertaking a “sociology of error” (Barnes 1974/2013; Bloor 1976/1991). For the “Strong program,” science was often times mediated and decided by interests, positionality, and heated debate. This viewpoint has been developed in even greater detail by feminist STS scholarship that

looks at the “sexist origins of particular scientific claims” (Sismondo, 2008). This has been further developed into a field called feminist science studies (Haraway, 2008), a key movement linking feminist and STS traditions.

In the late 1970s, early STS practitioners moved into various sites of scientific production to observe these practices, experiments, and apparatuses first hand. By employing the anthropological notion of ‘fieldwork’ and its associated ethnographic toolkit, STS researchers were able to generate empirical insights by following “science in action” (Latour, 1987). Bruno Latour found that everyday interactions between scientists and the ordinary routines in the laboratory setting were instrumental in the foundation of scientific facts, as he examined the discursive and inscription practices that provided the factual evidence for laboratory scientists he was following. These everyday practices, he found, were a strategic method to help organize, codify, and give order to results, despite the messiness present in their making. Latour (1987) also posited the ‘Janus face’ as a figuration for the two-faced nature of science where scientists publicize their research to the outside world as neatly coherent while amongst their immediate colleagues, they engage in messy, day-to-day debates over what is certain.

Partly in response to Latour’s work, a group of scholars developed a framework for studying science and technology called actor-network theory or ANT (Law, 2009). As STS practitioners began to move into the empirical field site using ethnographic methods to study their subjects, what emerged was a startling display of nonhuman actors and agents that were vital to the functioning of human networks. While early STS studies looked at the social norms and biases that affixed scientists, ANT grounded scientific practice in materiality, looking at how the social is also necessarily material. Early

examples of these human-nonhuman relationships include the significance of the microbe for Louis Pasteur (1993), the scallops' roles in a complex socio-political network of fishermen (1986), and the significance of navigation devices and texts in the Portuguese route to India (1986). ANT is today a popular methodology that has grown out of STS to other fields in geography (Willems-Braun, 1997) and medicine (Mol, 2002), and is characterized by its "material-semiotic" approach (Law, 2009): It is 'material,' insofar as technoscientific networks must enroll an array of nonhuman entities to function, and it is "semiotic," since its function and meaning emerge as a result of the relations between the network's actors.

As a result of this material shift ANT spurred, an outgrowth of theory and empirical research broadly referred to as the 'ontological turn' in STS has been ongoing, signifying a broader desire to attend to the nonhuman entities present in various networks, systems, and worlds. Ontology therefore has broader implications than just being an investigational tool in ANT, and entails critical questions about the materiality of things, moving beyond the social constructivism that characterizes social science (Law and Singleton, 2005; van Heur et al., 2013; Woolgar & Lezaun, 2013). Research associated with this ontological turn has explored performativity, and the debate between whether the world precedes enactment and representation, or whether the world is actually performed and enacted (a process of 'worlding'); the latter presents the possibilities for multiple worlds (Pickering, 1995). Annemarie Mol (2002) explores the notion of *enactment* as a key process for how objects exist as a result of the ways they are performed or enacted, and not existent as independently stable entities.

In this thesis, STS provides a fertile backdrop for understanding the issues that

permeate VAR's scientific processes. STS has demonstrated that scientific results are not universal but are situated in particular assemblages, which in VAR means a specific set of farms in Vermont. Materiality is also integral to human networks, such as the microbes and ecosystems that sustain research and farm livelihoods. Science and technology reflect larger cultural values in society, like the increased attention to environmental disasters. STS has also showed that the scientific process is messy and full of discontinuities, and that positionality (such as power and gender) influences the scientific process, which will also factor into VAR's transdisciplinary and collaborative challenges.

2.1.2. Material Feminism

While STS fuel critical questions about science and technology, a related but distinct school of thought called material feminism has engaged with similar questions by also asking inquiring into the influences of subjectivity, knowledge, affect, power, and embodiment. In 'new materialist' thought (Coole & Frost, 2010), it is essential to see beyond a Cartesian-Newtonian understanding of matter: Descartes saw the cogito as having ontological primacy in the world, rendering matter to be ontologically secondary, while transforming humans into rational and reasoning subjects. Newton elaborated on this understanding of matter as passive, theorizing that material objects are "identifiably discrete; they move only upon an encounter with an external force or agent, and they do so according to a linear logic of cause and effect" (Coole & Frost, 2010, p. 7). In contrast to this understanding of matter (which constitutes the 'material') as passive, mute, and waiting for us to imprint our discursive constructions onto, 'new materialists' take into account contemporary scientific understandings of matter in which particles are

fundamentally vibrant in nature.

Karen Barad (2003) follows Foucault's understanding of discursive practices by adding that this new vibrant matter doesn't precede human contact, waiting for our observation, but is rather 'vibrant' *because* we observe them through our cultural and discursive 'apparatus':

Apparatuses are particular physical arrangements that give meaning to certain concepts to the exclusion of others; they are the local physical conditions that enable and constrain knowledge practices such as conceptualizing and measuring; they are productive of (and part of) the phenomena produced (p. 819)

The insight that apparatuses are physical arrangements is crucial for moving beyond the passive understanding of matter that the 'new materialists' eschew: whereas observation in the essentialist ontology would see the phenomena as preceding and existing independently of the researcher, in the material feminist theoretical view, the phenomena is observed as a result of the physical, embodied nature of the 'apparatus' and does not precede the observation, but emerges out of it. Coole and Frost (2010) write, "corporeality further dislocates agency as the property of a discrete, self-knowing subject inasmuch as the corpus is now recognized as exhibiting capacities that have significant effects on social and political situations" (p. 20).

STS also draws attention to modes of enactment and performance, but material feminism elaborates by elucidating those other "registers of experience not contained by bounded singularly human subjects" (Blackman, 2012, p. xiv) such as embodied knowing (e.g. touching, feeling) and affective knowing (e.g. sensing, subconscious thinking), and the relationships these have with more rational ways of knowing. Scholars working in the interdisciplinary field of 'body studies' look at how the "body is not therefore a

‘thing’ to retreat to, [but] a material basis to explain how social processes take hold” (Blackman, 2012, p. x), and seek ways of researching this broader register of experience. Stephanie Merchant (2011), for example, who sees the “sensorium” as “the sum of a person’s perceptions” (p. 57), captures the embodied experience of divers as they recount their stories of seeing themselves dive in deep water on screen, triggering “reactions in registers beyond the visual and aural” (p. 68).

The emphasis on subjectivity and its bodied nature also demarcates material feminism. Sara Childers (2013) looks at how she had to actively critique certain discourses that would have tried to funnel her into narrowly looking at gender, when in fact her situation called on her to investigate questions of race, poverty, and materiality. Thus, her subjectivity became a vital tool for noticing what mattered in the situation, and actively avoiding a narrow feminist discourse to allow for these other concerns to be addressed. As we will see, affect and subjectivity figure in the Vermont Agricultural Resilience team. Material feminist theory expands on the work in STS by articulating why noticing these other registers of experience should not be avoided, since there is a socio-political dimension to the work in VAR that *must* attend to matters beyond mere rational knowledge.

2.1.3. Empirical Transdisciplinary Studies

A third body of literature that informs this thesis is the study of transdisciplinary work in action, which is an outgrowth of STS that focuses more intentionally on scientific collaboration across disciplines. Three categories of studying this work have been fruitful places to begin my study: the study of boundary organizations that manage divergent interests (Parker & Crona, 2012), the power dynamics between academic

disciplines in transdisciplinary groups (Rabinow & Bennett, 2012), and the actual experience of collaborating in transdisciplinary groups (Fitzgerald et al., 2014).

Parker and Crona (2012) look at a transdisciplinary initiative on water resources at Arizona State University that faced an “active, dynamic process requiring continuous negotiation between conflicting demands” (p. 263), drawing our attention to the process-relational nature of transdisciplinary work. Because there were a variety of different stakeholders— university administrators, researchers, local service providers – each with their own “fundamentally incommensurable” (p. 262) demands, meeting these required careful ‘boundary management’ by the initiative for stakeholder groups to be satisfied. These divergent interests required the organization to prioritize some demands over others at different times – and while all demands were eventually met, these did not happen simultaneously. The ‘boundary’ concept has figured prominently in STS, beginning with Thomas Gieryn’s (1983) notion of ‘boundary work’, indicating the ways by which researchers met multiple stakeholder demands at once. Star and Griesemer (1989) elaborated on Gieryn with the idea that objects can also be the proxy for these intersections, looking at how collected natural specimens (a boundary object) were able to become the mediating agent for the divergent social worlds of university administrators, curators, scientists, and public enthusiasts at a natural history museum in Berkeley.

A second endeavor looked at another set of challenges, this time in the power difference between disciplines. Rabinow and Bennett (2012) attempted to work with molecular scientists to implement better governance of synthetic nano-biology creations that posed challenging ethical dilemmas. In the process, however, they describe facing from their scientific colleagues a “wide-ranging lack of curiosity outside of their

specialties” (p. 4), where their own perspectives were “rarely addressed seriously and...easily neglected, when it came to the inclusions of the human sciences in bioscientific enterprises” (p. 7). Facing “perplexity, indifference, and/or hostility,” “active resistance,” and a “hierarchy of power and privilege” (pp. 8, 20), Rabinow and Bennett observe that their transdisciplinary projects catered more to the physical scientists, with the social science included as an afterthought to meet a particular grant’s demand to be transdisciplinary. They recommend engaging in a mode of ‘frank speech’ to resolve these power dynamics.

Fitzgerald et al. (2014) notes that,

There are still relatively few accounts of what it is actually like, in the most basic sense, to participate in such [transdisciplinary] collaborations, and even fewer analyses of the broader logics of collaboration that root themselves in such experiences, or in the feelings engendered through them. (p. 3)

Fitzgerald et al. describe the collaborative process of their transdisciplinary group working in neuroscience at the intersections of STS, literary studies, sociology, anthropology, and clinical and cognitive psychology. The authors describe having entered the collaboration armed with an in-depth understanding of cross-disciplinary concepts in STS such as boundary-work, notions of trade (Galison, 1997), interaction (Collins & Evans, 2002), and integration (Huutoniemi et al., 2010). And although these authors were familiar with how expertise, interaction, and exchange occurred across other case studies, these ideal-type concepts “did not serve the group at all well when they encountered the more mundane realities of actually producing knowledge within a collaborative and transdisciplinary research space” (Fitzgerald et al., 2014, p. 3).

They found that feelings of ambivalence and equivocation factored prominently

into the team collaborative space. Some members were even unaware of tensions in the group, while others were acutely aware of them but chose not to say anything. And despite these tensions and not following any ideal-type prescription for how cross-disciplinary work was portrayed in the literature, the team successfully generated a novel result and published their work.

Our proposal is that this success might have come precisely because we did not speak frankly; we did not seek the truth; we totally failed to acknowledge – let alone discuss – the consequences of our experimental situation. What we did, instead, was to try to work and live within a zone that was just about ambiguous enough to keep everything together – that was sufficiently averse to frank-speaking to keep the worst of the resentments at bay. We suggest that collaborators attend instead to an ethic of ‘equivocal speech’ – a mode that is attentive to the things that are better left unsaid, to the feelings that are as well off not articulated and to the senses of awkwardness and ignorance that probably will not help anything if openly acknowledged (Fitzgerald et al., 2014, p. 16).

This thesis engages with Fitzgerald et al. and Rabinow and Bennett’s accounts. While the latter encourage frank speech, the former warn that equivocation may create a healthier inter-personal dynamic. I suggest later, in chapter six, that there may be a middle way.

2.1.4. Transdisciplinary Discourse

But what is this original transdisciplinary discourse that these projects reference, and is there a singular understanding of what ‘transdisciplinary’ means? Over the course of my engagement with VAR, it became quite clear that the term ‘transdisciplinary’ was often viewed with confusion or misunderstanding. This led to my own exploration of the term, leaning on many scholars that have studied the term in far greater detail than I have. While there were clear commonalities around the term – most notably, as a research approach to solving complex problems by transcending or transgressing disciplinary

boundaries – there were also fundamental disagreements about the extent to which problems can be solved, how disciplinary assumptions should be put aside, how to assess the success of a transdisciplinary team, and so on. In this section, I present some of those debates as well as a brief historical overview of the term.

Hirsch Hadorn et al. (2008) see transdisciplinarity as addressing an original separation of scientific knowledge from various aspects of practical knowledge. According to Aristotle, scientific knowledge (episteme) contrasts with the everyday skills in society humans need to act (praxis), to produce (poiesis), and to have prudence for the future (phronesis). Science was initially detached from practical life so that scientific knowledge could be “universal, explanatory, [and] demonstrated to be true by a standard method” (p. 20). Science and technology did not readily produce practical innovations for society until the 17th century, when they began to play a major role in the rise of the liberal market economy (Hirsch Hadorn et al., 2008). A division emerged between the humanities and natural sciences based on their different epistemological assumptions: while the latter investigated “general aspects of empirical events by universal laws,” the former attended to the “individuality of empirical phenomena, giving them values to aid the understanding of their meaning and importance” (p. 22). This tension was also visible in the social sciences. While some, like Max Weber, aimed to construct a sociology that could address both universality and particularity, others, like Jurgen Habermas, critiqued sociology’s positivism, arguing that this approach was misleading in its thinking that human behavior could be readily known. And as the rifts grew larger between the sciences, social sciences, and humanities, so too did the degree of specialization within these broader fields of knowledge (Hirsch Hadorn et al., 2008).

This disciplinary splintering sets the backdrop for the rise of inter- and transdisciplinarity. Scholars who sensed that academic research did not adequately address societal problems began to conceive of alternative theories, frameworks, and methods that did not separate scientific knowledge from social action (Hirsch Hadorn et al., 2008). They write, “Societal knowledge demands for a better understanding of, and solutions to, concrete issues in the [real world]” (p. 28). Transgressing disciplinary boundaries and integrating different disciplinary perspectives was seen as necessary to counteract the narrowness of specialized research (which had depth but not breadth).

While both inter- and transdisciplinarity presuppose this transgression and integration, their difference is most visibly related to their different applications. Julie Frodeman et al. (2012) argue that transdisciplinarity entails working jointly with practitioners to solve a real-world problem. In a transdisciplinary approach, the subject matter is driven by real-world problems, and focused on generating solutions. It is therefore ‘problem oriented’ research. Interdisciplinarity, on the other hand, involves the transgression and integration that is characteristic of transdisciplinarity, but is focused primarily on generating new knowledge that was previously unattainable with prior disciplinary perspectives. Interdisciplinarity is a powerful framework for generating new understandings of the world and working through disciplinary limitations, but it is fundamentally knowledge-oriented research. For Scholz (2011), interdisciplinarity refers to the “fusion of concepts and methods from different disciplines” (p. 374) while transdisciplinarity involves “processes of mutual learning among science and society, [integration of] knowledge and values from society into research...and an appropriate research paradigm that better reflects the complexity and multidimensionality of

sustainable development” (p. 376).

Inter- and transdisciplinarity present different types of solutions for dealing with a hyper-specialized university. Interdisciplinarity is a mode of moving beyond the splintering of disciplines that occur between the natural sciences, social sciences, humanities, and arts. Here, I would characterize interdisciplinarity as broadening what might be considered true knowledge, without necessarily calling into question the divide between knowledge and the world. Transdisciplinarity, on the other hand, deliberately transgresses this divide through its orientation around problem solving in the life-world. In this understanding, transdisciplinarity goes beyond challenging the episteme, which in Foucault’s (1970) conceptualization is understood as the conditions that lead to knowledge being deemed scientific or not. Instead of presupposing a divide between scientific knowledge and the ‘real world’, transdisciplinarity draws attention to the situated and embodied knowledges that abound in the world, where science is one among many ways of knowing. Transdisciplinarity challenges the current episteme, which values science over other ways of understanding. Transdisciplinarity offers a radical ‘opening up’ to the myriad ways of knowing, understanding, and interpreting that exist, such as indigenous knowledges and lay expertise.

Yet at the same time, despite the openness to different forms of knowledge that scholars attribute to transdisciplinary approaches, the original foundation of transdisciplinarity rests squarely in natural scientific frameworks. Thus, some scholars have criticized the term for only serving to re-enforce pre-existing epistemological assumptions. For example, although the ‘post-normal’ transdisciplinary approach sees that “science becomes just one vote in an agora of arguments solving real-world

problems” (Scholz, 2011, p. 377), Carolan (2006) notes that in this view, “science remains untouched by uncertainty, as does the undisputed preserve of scientists in terms of how the accompanying questions are answered and who is involved in the evaluation of those answers” (p. 663). The degree to which transdisciplinarity allows for a wider integration of modes of knowledge is dependent on a myriad of factors, and interdisciplinarity and transdisciplinarity both reflect a general interest in critiquing the discursive practices that perpetuate university silos and the characterization of public knowledge as ‘lay’ knowledge. Both, however, can still reflect entrenched scientific values.

If we characterize transdisciplinarity as being fundamentally real world driven, that is, the problems of focus emanate from actual social-ecological conditions, then the transgression of pre-existing disciplines may not provide the necessary toolset given the complexity and novelty of issues like climate change. While transdisciplinarity emphasizes the democratization and incorporation of various knowledges, academic and non-academic, pre-existing epistemological approaches that construct knowledge in particular ways may not be suited for the unpredictable and non-linear systems in which they are applied. As Robert Frodeman (2012) writes in the *Oxford Handbook of Interdisciplinarity*, “Our assumptions concerning the viability of expertise have been guided by the metaphors of the laboratory, where the separation of a bench experiment from the world at large has been thought to be relatively epistemologically unproblematic” (p. xxxiv). This has led some to articulate a ‘weak’ vs. ‘strong’ transdisciplinarity, where the first denotes a more organizational and collaborative mode, while the second seeks to create radically new ‘transdisciplines’ that deeply question

these pre-existing epistemological approaches (Max-Neef, 2005).

The theory of transdisciplinarity is diverse and evolving, but so is the literature related to the actual implementation, practice, and assessment of transdisciplinary research. Funding agencies like the NSF and USDA are increasingly pushing transdisciplinary research to foster more public good out of research institutions (NSF, 2003). Transdisciplinary research is occurring in a wide variety of areas, like public health (Haire-Joshu & McBride, 2013), synthetic biology (Calvert and Martin, 2009), conservation and resource management (Reyers et al., 2010), and sustainability (Hirsch Hadorn et al., 2006). The evaluation and assessment of transdisciplinary research is also a hot topic, with no singular method for evaluating the success or impacts of a transdisciplinary initiative, but rather theories on how to assess transdisciplinarity and possible methodologies for doing so (Klein, 2008). From top to bottom, or theory to practice, multiple interpretations of transdisciplinarity have been offered about what the term means, how it should be implemented, how it should be evaluated, and what the term can actually do or what values it only serves to perpetuate.

These four areas reflect the major undercurrents of literature that inform the design and content of this thesis. In the first section, scholars in science and technology studies look at the socially constructed nature of science, critically analyzing the intersections of science and society. In the second section, scholars in material feminism broadened those concerns by also looking at subjectivity, embodiment, and affect, and how the ‘facts’ of science do not exist value free but are mitigated by power relations beliefs about what counts as data or evidence. In the third section, studies of

transdisciplinary work foreshadow the challenges that I encountered and faced in the Vermont Agricultural Resilience initiative, as elements of boundary work, frank, and equivocal speech emerged in my inquiry. The fourth section considers the topology of transdisciplinary discourse, understanding the landscape to be deeply diverse from theory to practice, foreshadowing the transdisciplinary confusions that exist in VAR.

CHAPTER 3: METHODOLOGY

3.1. Research Design and Approach

Following my theoretical framework, my research approach assumes that the world is full of diverse enactments and that there is not a fundamental separation between humans and the rest of the world. Rather, humans take part in co-constituting the world in a process that Karen Barad (2003) calls ‘intra-action’. My research design is based on the assumption that through my entanglement with the group, new phenomena emerge as soon as I enter the team dynamic. Simultaneously, VAR is engaged in a process of entangling with a wide range of entities that merit being attended to in the situation. Giving attention to processes, flows and forces producing (and produced by) VAR’s entanglements means attuning to what the various entities do to me and to the full transdisciplinary scene as it is unfolding. The central aim in my methodology then seeks to implement a practice of ‘attunement’. Clark/Keefe (2014) describes the everyday enactment of attunement as the corporeal and inter-corporeal conditions of deeply connecting with others and/or to the material world (i.e., a mother to her infant; an artist to his materials, etc.) (p. 791).” She suggests that a similar stance can be adapted by researchers interested in tracing the socio-material circumstances of complex assemblages such as VAR. Under such inquiry circumstances, “Attuning involves becoming acutely awake to and influenced by the co-implicative nature and nurture of *affiliating*—of deeply noticing and noting the material-discursive intra- and interactions of being in the world (Clark/Keefe, 2014, p. 791)”

To say that I’m attuning to the Vermont Agricultural Resilience initiative is too broad, however. I need to outline what it is I intend to ‘notice and note down’ – a stable

outline of what constitutes data. Maxwell (2013) argues that a conceptual framework is designed to help map out what a researcher might expect in doing his or her fieldwork, and what expressions these might take. In the introduction, I laid out a theoretical framework that had three commitments: to create meanings and knowledge that spark a difference, to acknowledge situatedness and embodiment, and to recognize the presence of human-nonhuman entanglements. These three commitments, I argue, can be cultivated through a conceptual framework that is attuned to the discursive, material, and affective processes in VAR. Discursive because VAR is engaged in a variety of speech, text and language practices while also being impacted by discursive constructs, like transdisciplinarity and participatory action research. Material because VAR is engaging with the materiality of the world – floods, soils, computers, microbes, and so on. And affective, because subjectivity, embodiment, and different ways of experiencing are vital ways of understanding tension, mess, and difference. Thus, my own ‘attunement’ relates to my ability to deeply notice and capture these processes in VAR.

Methodologically, I principally follow Clarke’s (2011) re-working of grounded theory in qualitative research. Traditional grounded theory is a popular qualitative research methodology that “begins with inductive data, invokes iterative strategies of going back and forth between data and analysis, uses comparative methods, and keeps you interacting and involved with your data and emerging analysis” (Charmaz, 2014, p. 1). Although grounded theory has been critiqued for its positivist tendencies, Clarke (2005) argues that grounded theory can be suited for the ‘postmodern turn’. Since grounded theory is traditionally coupled with the symbolic interactionist understanding of life as being produced through negotiated meanings, symbols, and processes, Clarke

argues that grounded theory can account for poststructuralist developments by also incorporating reflexivity, heterogeneity, and the nonhuman. Since some of these developments are central to my theoretical underpinnings, I follow Clarke in seeking to capture a wider variety of processes than are normally given voice in grounded theory. I argue that these processes occur and are enacted by an apparatus composed of many aspects, including my subjectivity, VAR's facilitators, and the theories that I plug into. This complicates what might be normally considered data, and I follow other qualitative researchers who believe that we need to approach data collection more openly (Brinkmann, 2014).

Clarke aims to account for the broader situation by including macro organizations (like social institutions), discursive elements (like transdisciplinarity), nonhuman actants (like microbes), and other heterogeneous entities. In embracing the notion that our perspective of what the situation is has an effect on what the situation does, Clarke asks, "What new thoughts does this nexus of productively experienced relations make it possible to think?" (p. 23). Clarke's situational analysis is therefore pragmatic, aligned with what Stengers (2008a) writes is "the need to actively and explicitly relate any knowledge-production to the question it tries to answer" (p. 92). Thus, the question this thesis asks is, "What are the discursive, material, and affective processes of becoming in the Vermont Agricultural Resilience initiative and how can I help them?" Below, I explain the means by which this 'attunement' has occurred.

3.1.1. Activities and Timeline

Research activities and data collection occurred from early 2014 to mid 2015 over the second and third years of the three-year VAR initiative. During this time frame,

I have had monthly meetings with the facilitators, attended bi-monthly team meetings, VAR outreach events, and sub-committee meetings. The lead principal investigator of VAR sits on my graduate committee, and has engaged in the proposal and comprehensive exam process. His research group in agroecology has also provided feedback on the focus group I implemented. My advisor, a professor in environmental thought and culture, has given me numerous rounds of pivotal feedback and editing; and my third committee member, a professor working in material feminism, has also offered crucial feedback and methodological mentorship. Additionally, I have presented versions of the material in this thesis at the IARSLCE conference (International Association for Research on Service Learning and Community Engagement), the annual graduate research symposium in my department, a food systems sponsored panel on transdisciplinary research, and a course taught by VAR's facilitator. IRB exempt status was received in October 2014 and February 2015; the first exemption was for survey and focus group methods, and the second exemption was for the overall use of field notes, analytic memos, and interview transcriptions. I intend to present this research to the VAR team through two opportunities: my Master's defense presentation, which is open to the public and has been shared with VAR, and a separate presentation directly to the team.

3.1.2. Sampling Procedure

Traditional grounded theory argues for theoretical or purposive sampling, which is designed to iteratively evaluate data, open-ended codes, and theoretical categories until saturation is reached (Charmaz, 2014). However, in acknowledging the ways in which we are already operating (consciously and unconsciously) with theories, analytical

categories, and assumptions, Clarke (2005) argues that, “we also need to *design* our research from the outset in order to explicitly gather data about theoretically and substantively underdeveloped areas that may lie in our situations of inquiry” (p. 76). By being transparent about the theoretical categories identified at the outset, Clarke argues that greater reflexivity may be brought into the sampling process.

The VAR initiative, as we will see, is a broad situation that includes administrative stakeholders, agricultural stakeholders, policy makers, and staff, in addition to the principal investigators (PIs) who form the research team. While sampling the entire range of individuals involved – such as farmers and other stakeholders – would be beneficial for gaining a systemic picture of the initiative, my initial task as voiced by the team’s facilitators is primarily oriented around the challenges and difficulties in integrating disparate research approaches, particularly among the research PIs. I’ve therefore chosen to document team members that are involved in the VAR research process. Based on this theoretical interest, the individuals in VAR that I sampled and are present in this thesis include three graduate students (studying under the PIs), three Extension staff members, the lead facilitator, the lead PI, and five other PIs. These individuals are all regularly engaged in team meetings and/or participate regularly in transdisciplinary integration activities and VAR decision-making. A survey to the team in October 2014 yielded positive results from the team that they would be willing to participate in my greater research study. Moreover, this initial method allowed me to notice certain collaborative dimensions, such as particular disagreements around the implementation of participatory action research. This furthered my intentions to capture the interesting dynamics that seemed to be taking place in VAR, and these early results

indicated that there were certain subterranean feelings – or feelings that were not normally voiced in the team setting – that could be elucidated.

3.1.3. Data Collection

Material feminist literature suggests that researchers do not stand nicely at “arms length” away from their study (Maclure, 2003), but rather are engaged in the enactment, emergence, and re-telling of the participant’s testimony (Jackson & Mazzei, 2012). Jackson and Mazzei (2012) write that in traditional qualitative research, the privileging of the participant’s voice “assumes that [their] voice makes present the truth and *reflects* the meaning of an experience that has already happened” (p.4). In following Karen Barad’s (2003) intra-action, I argue that data does not emerge passively, as the ‘passive’ investigator listens to the participants ‘actively’ convey their truth. Rather, this data emerges from the interaction itself, as a result of the myriad of complex implicit and explicit affective, material, and discursive intra- or interactions between, for example, an interviewer and a participant. John Law (2004) argues that in traditional qualitative research where voice is privileged, the audience of the research receives “a set of fairly specific, determinate, and more or less identifiable processes” (p. 6), when in reality, the site where these were enacted was messy, indeterminate, and deeply complex. Law continues,

Instead I argue that (social) science should also be trying to make and know realities that are vague and indefinite because much of the world is enacted in that way. In which case it is in need of a broader understanding of its methods. These, I suggest, may be understood as methods assemblages, that is as enactments of relations that make some things (representations, objects, apprehensions) present ‘in-here’, whilst making others absent ‘out-there’. The ‘out-there’ comes in two forms: as manifest absence (for instance as what is represented); or, and more problematically, as a hinterland of indefinite, necessary, but hidden Otherness. (p. 14)

Crucially, by representing or enacting phenomena, or making it ‘present’, it is being produced *out of* other possibilities, which Law calls the “absent ‘out-there’”. Thus, traditional methods that privilege voice and lack the reflexivity to understand the enactment of the data misleads and brackets off the messiness and affect that may have actually occurred at the field site, as well as the other realities that can simultaneously exist. Finally, in looking to affect as an attuning lure, I draw awareness to embodiment, and the dynamic range of inexpressible feelings that may typically be bracketed off from the traditional qualitative process (Blackman, 2012). Qualitative researchers have recently experimented with ways of detecting and capturing these affective moments, such as Ringrose and Renold (2014), who seek to notice the “affective intensities” that emerge when the discursive category ‘slut’ is uttered among teenage women. Ringrose and Renold (2014) call these “hot spots,” or “those affective relations to data that both “disconcert” and create a sense of “wonder”—where data “glows” for the researcher in various moments of fieldwork, analysis, and beyond” (p. 773).

So what is, or what are my data? Law argues that it is situational, and that data is immanent and emergent in the field site, and not presupposed or universal. In my case, data came from unsuspected places: it took confirmation from a stranger in New Orleans to tell me that I was onto important insights in VAR for me to feel motivated, inspired, and excited to continue pursuing certain threads. These moments, or “hot spots” (Ringrose & Renold, 2014) often came in the most unexpected of interactions, and are as important to the formation of this thesis as the actual utterances from team members. Data, then, “transgresses” (Clarke/Keefe, 2014) its traditional boundaries in this thesis, showing up as sensory data, emotional data, response data, and so on. As Jackson and

Mazzei (2012) also suggest, our theoretical knowledge can't help but shape the form our methodological enactments take, as our data collection apparatuses are shaped by our theoretical conceptions of the world.

My 'data', then, emerges from a wide variety of places. 'Officially,' these have been through monthly meetings where I observe and document the team, survey data, focus group and interview transcriptions, field notes, and analytic memos. These have followed the normal grounded theory process, as survey data informed initial semi-structured interview design, which was altered based on new theoretical categories and reflected on through period analytic memo writing as I continued to interview VAR team members. In the broader understanding of data that I argue is necessary, my field of data multiplies to include the noticing of affective hot spots, questions that don't shy away from shaping or enacting the scene, and theorists that have shaped the underpinnings of this thesis.

3.1.4. Data Analysis

My approach to data analysis has followed a traditional grounded theory approach, but in taking into account the heterogeneity and complexity in VAR, I have also drawn on Clarke's (2005) *situational analysis* and Jackson and Mazzei's (2012) notion of 'thinking with theory.' Since data analysis and interpretation forms the crux of grounded theory (Charmaz, 2014), I began by transcribing interviews and engaging with open-ended coding in the software program HyperRESEARCH. While some of the same authors who I draw on in my methodology are critical of coding in qualitative research, I have used it as a technique to re-vitalize the data, allowing me to do some initial mapping for situational analysis. The critique of coding among poststructuralist

qualitative research stems from concern about “analysis that treats words (e.g., participants’ words in interview transcripts) as brute data waiting to be coded, labeled with other brute words (and even counted), perhaps entered into statistical programs to be manipulated by computers, and so on. In some cases, words are reduced to numbers” (St. Pierre & Jackson, 2014, p. 715). And although it is true that HyperRESEARCH offers features to statistically correlate various codes with one another, my use of coding has been purely as an analytical exercise to lure my thinking in different ways. Instead of seeking to represent VAR in a correspondent matter, I follow Kelly Clark/Keefe (2014) in asking, “What does the data do?” looking at what new diffractive understandings are produced when I engage with the data through coding and other analytical approaches.

Adele Clarke (2005) developed an analytical approach called ‘*situational analysis*’ to map the heterogeneous entities in a situation, including the researcher’s own subjectivity. She writes that situational analysis “allows researchers to draw together studies of discourse and agency, action and structure, image, text and context, history and the present moment – to analyze complex situations of inquiry broadly conceived” (p. xxii). It entails a cartographic approach that takes initial data, codes, and themes, and lays them out in maps to illuminate possible connections, relations, and meanings among both human and nonhuman elements. Clarke’s maps are exciting exercises that provoke numerous ‘diffractions’, and do so in a visual way that can disrupt the usual linearity in thought that writing can produce. The heterogeneity in VAR can be made more intelligible through these maps, as they not only provide new analytical approaches but also rich visual figures for analysis.

Analytic memo writing has been a useful tool to reflect on what new themes,

categories, and codes emerged throughout interviewing and the initial open coding phase. The pragmatist philosopher Dewey (1918) writes, “All knowledge, as issuing from reflection, is experimental” (p. 13), which indicates the contingency of knowing, that is, that knowledge is not universal, but situated. One of my key analytical influences stems from Barad’s (2007) notion of a “diffractive methodological approach.” Lisa Mazzei (2014) writes, “whereas the metaphor of reflection reflects the themes of mirroring and sameness [e.g., coding], diffraction is marked by patterns of difference [e.g. analysis after coding” (p. 743). Coding is an initial catalyst that sparks new ideas; while the data is continuously plugged in and analyzed through different texts and producing differentiated insights. In my case, my research occurs through the lenses of post-structuralist theory, science and technology studies, material feminist theory, and environmental studies. Thus, whereas traditional grounded theory seeks out “commonalities and strains towards coherence” (Clarke, 2005, p. 11), I try to use grounded theory and situational analysis to attend to differences, contingencies, and multiplicity in VAR.

Finally, this thesis would not exist in the same way without theory constantly influencing my judgment of what the data is ‘doing.’ Mazzei (2014) writes, “In a diffractive process of data analysis, a reading of data with theoretical concepts (and/or multiple theoretical concepts) produces an emergent and unpredictable series of readings as data and theory make themselves intelligible to one another” (p. 743). Mazzei and Jackson (2012) show what data analysis in a diffractive mode can look like, as they plug into poststructuralist thinkers that prompt new thought patterns. In chapters four, five, and six, I do the same, recruiting a variety of theorists to prompt new diffractive interpretations of the Vermont Agricultural Resilience initiative.

3.1.5. Limitations

Because I have decided to sample the core group of VAR that has attended team meetings regularly, complications have inevitably arisen. It was difficult to access some team members who for personal (e.g. maternity) or professional (e.g. sabbatical) reasons were intermittently absent. One of my interviews occurred over the phone, and one occurred over Skype. Two PIs were unable to schedule a time to interview, and many of the interviews had to be pushed until the semester was finished because of busy schedules. The advantage of my conceptual focus has been to understand the processes of this core group more intimately, however, because it is a transdisciplinary research project, VAR is a widespread initiative that reports to university administrators, has an advisory committee composed of non-university stakeholders, and is working with a myriad of farmers, agricultural service-providers, and other local stakeholders. A research study of this wider group would prompt new research questions and insights in understanding the ramifications or impacts of their work on the people who this endeavor is designed to serve.

Other studies (Parker & Crona, 2012) have looked at how a transdisciplinary university-located research hub must act as a boundary organization to many stakeholders, and shown at an organizational level what is required to maneuver the research hub around divergent interests. An undertaking at this scale may be useful for VAR, however my main conceptual interest lies centrally in the processes of the core group. Finally, because the collaborative processes in VAR relate to personal values, identities, and relationships, I use fake names for all team members, as well as using the placeholder 'team member' when addressing the more sensitive aspects of collaboration.

CHAPTER 4: TRACING VERMONT AGRICULTURAL RESILIENCE

4.1. Genealogical Approach

The Vermont Agricultural Resilience in a Changing Climate initiative represents a concrescence of processes, to use Whitehead's (1929/1978) language. Conceptualizing VAR as a successful concrescence of disparate events nonetheless sets the stage for this chapter, as it allows us to broaden what we are aware of impacting the current-day group and to trace where specific problems may have been initially formed that remained when I entered. To use Foucault's (2003) words, VAR emerged out of a "constitution of knowledges, discourses, domains of objects, and so on" (p. 306). In this chapter, I draw on Foucault's genealogical method to trace the major processes, events, and conditions that led to VAR's formation. I do not, however, go into as great depth as may be required to do a full genealogical analysis of VAR. Rather, I seek to do a *minor* genealogy as a method to contextualize the initiative that existed when I entered. Colin Koopman (2013) sees Foucault's genealogy as 'an immanent and reflexive engagement with the full complexity and contingency of the conditions of possibility for doing, being, and thinking in our cultural present' (p. 23). The key objective in this section is to contextualize VAR, but to do so not as a historical method of tracing the events leading to VAR's organization, but to critically analyze the vectors and undercurrents of knowledge, power, and circumstance that constellated to enable VAR's existence. I employ Foucault's notion of 'problematization' as a way of looking at the contingency and complexity that preceded VAR. As both an "act of critical inquiry" and the "nominal object of inquiry" (p. 98), Koopman (2013) argues that problematizing the contemporary through a genealogical mode requires actively tracing the conditions that led to the

current situation.

In this chapter, I set up the major challenges of the present, the “matters of concern” at hand, which Latour (2008) writes “is what happens to a matter of fact when you add to it its whole scenography, much like you would do by shifting your attention from the stage to the whole machinery of a theatre” (p. 39). In contextualizing my participation in VAR, I believe a brief genealogical analysis of the events leading to its formation help foreshadow the later challenges that emerged when I began to observe team meetings. Thus, I seek to build the ‘scenography’ of the Vermont Agricultural Resilience initiative, beginning with a major natural disaster event that ruptured the normal routine of Vermonters and spurred a shift in thought. I draw on historical texts at the university where VAR was founded, insights from team members, and team texts that were constructed at the outset of the initiative. I also engage in the practice of ‘plugging into texts’, drawing on the theorist Nigel Clark, transdisciplinary discourse, and Latour’s notion that we need to ‘love our monsters.’ I choose this genealogical practice not as a method to deconstruct VAR’s existence, merely pointing to the systems of power and knowledge that are perpetuated by the initiative, but rather in moving towards a Latourian (2004) constructivism where critique is about “generating more ideas than we have received” (p. 248) and never letting the lessons of the past die away. By engaging in this practice, a new type of data is produced that sheds new light on the problems VAR face today. Finally, because team members begin to figure into the story in this chapter, their names have been changed to respect their confidentiality.

4.1.1. A Changing Climate

Nigel Clark (2011) explores an idea in his book *Inhuman Nature* that is counter

to the anthropocentric understanding of the world that sees humans as an exceptional species, superior to other things that we place in the categories of nature, animal, and nonhuman. The philosopher Immanuel Kant operated under this worldview, but as Clark notes, Kant's move to privilege humans was one of practical importance, and not, as is more commonly interpreted of him, because he necessarily believed it to be universally true. Clark writes,

Kant recognized that the temporal and spatial dominion of our species was disturbingly inconsequential when viewed in the context of the earth's eventful history or the vastness of interplanetary space. 'A being belonging to the world of sense', a creature with the capacity to absorb and process the phenomenal productions of physical reality, was at the same time one which was at risk of being overwhelmed by the exertions of the earth and cosmos. Humankind, the only known efflorescence of thought, or proper freedom, was thus vulnerable to being swept away – which would leave the universe utterly devoid of any way of making sense of itself. (p. xii)

In Clark's view, Kant necessarily had to construct a metaphysical outlook that privileged human rationality, since he believed reason and ingenuity were the tools required to deal with such mortal vulnerability. An earth that could so capriciously open up – for Kant it was the 1755 Lisbon earthquake – needed to be seen as a planet that could, with the collaborative abilities of humans, be tamed, known, and controlled. Clark therefore puts Kant into a radical framework that sees anthropocentrism as a survival response to the radical asymmetry between humans and the planet as represented by huge natural disaster events.

Clark's (2011) own approach attempts to re-frame Kant's understanding, to draw our attention back to this 'inhuman nature' on which Western human thought has attempted to build a metaphysical fortress to guard against. Clark's critique goes beyond Kant, however, to target another approach in actor-network theory. He argues that this

famous STS methodology, which is designed to recognize how crucial nonhumans and material actants are for human life, does not adequately frame the radical imbalances between humans and Earth. Clark reads ANT as a mode for understanding how humans and nonhumans are increasingly entangled, but it falls short in addressing the larger human-planetary dynamic. While ANT has been used to look at the discursive practices of climate change (Blok, 2010), looking at the ways that we socially construct climate change, Clark argues that ANT does not adequately deal with the totalizing power of climate change and the inconstancy of the earth.

He writes, “A major upheaval of the earth, survivors tell us, not only takes the ground out from beneath your feet, but unravels the very fabric that holds things together and allows us to make sense of the world” (p.17). Clark’s ‘inhuman nature’ is non-rational, asymmetrical, and violently forces us into situations that stress, unnerve, and confound our worldviews. It’s no wonder, indeed, that Kant attempted to build stronger psychological technologies – or metaphysical architecture that could guard the supremacy of humans over all else. And with the advent of climate change, this inhuman nature is becoming experienced with greater frequency, with natural disasters occurring at an increasing rate globally (Schiermeier, 2005).

In Vermont, this ‘inhuman nature’ was experienced in 2011 when tropical storm Irene struck the Northeast, flooding and wreaking havoc to Vermont’s river ways, landscapes and communities. Irene devastated multiple sectors, disrupting the local infrastructure, and forcing more than 7,200 Vermonters to register for Federal Emergency Management Agency aid to cope with the damage (FEMA, 2011). Public health and water supplies were in jeopardy, as hazardous waste and fuel spills threatened to taint

Vermont's natural resources (Pealer, 2012). The whole experience marked a "profound rupture" (Clark, 2011, p. 73) to Vermonters, and was immediately framed in relation to the increasing incidences of climate change-related events (Betts, 2011). Much has been written in the social sciences and humanities about climate change as a discursive construct (Blok, 2010), but in communities across Vermont, Irene became a living embodiment of what it means to live on a planet that is unconcerned with its human inhabitants, and could, at a moment's notice, wash away centuries-old New England towns. In 2011, Irene exceeded the purely techno-scientific discourse of climate change, as its force was experienced viscerally as a destructive, physical force. While locally spun campaigns like 350.org had warned of climate change's harsh realities, Irene cemented these as material agents.

Irene's destruction prompted, in a Kantian sort of way, an immediate human response. Vermonters thought more about how to adapt to and mitigate future climate events. While the state economy, including its key industries, was severely impacted from Irene, there was increased reflection on the role that some of these industries played in the rise of climate change as well as the steps needed to mitigate these risks. In the case of agriculture in Vermont, an estimated \$10 million were lost through crop losses and cropland damage (Pealer, 2012). And while climate change seriously threatens agricultural viability through seasonal shift, changes in temperature, and precipitation patterns (Dunnington, 2010), agriculture itself is a significant contributor to greenhouse gas emissions (GHGs), emitting approximately 31% of all GHGs globally (Scherr & Sthapit, 2009). Vermont's Agency of Natural Resources was aware of this tricky bind, seeing the best option as a middle way that could both protect our food production and

prevent further emissions. Vermont's agricultural industry was encouraged to pursue "research and policy initiatives to improve the state's adaptability to changing conditions" (Dunnington, 2010). Almost immediately after Irene, as Clark might expect, Vermont went into 'disaster relief mode', not just assessing and repairing the immediate damages, but planning for its future to hopefully insure the longevity of the state's well being.

Up to this point, 'inhuman nature' like Irene has been perceived as an asymmetrical force – a force that does not care for us, is indifferent to our existence, and wholly more powerful than humans. Clark, however, would have us interpret these events as 'gifts', since natural disasters can interrupt the normal patterns of life and spark a greater reflection on the "radical asymmetry of an opening into the unknown and the unknowable" (p. 74). And not only do they spark greater reflection, but they can spark action. We are passive victims of untold natural power, but, as Kant argued, we are also able to bounce back. And we can either recover in the same way as before, perpetuating the same material realities that led to the current problems, or we can band together as a "community" to learn from each other and our missteps, becoming *resilient* and improving the odds of withstanding shocks in the future. Clark's 'gift' marks the opportunity to take collective action and re-assess our previous entanglements with the planet.

I argue that Irene, along with the advent of climate change, represents a profound rupture in how we conceptualize our relationship to the planet. Irene problematized the normal ways of living for many communities, and forced greater reflection on the future direction of the state. The term 'sustainable' agriculture takes on

a different connotation in this light, with meanings of finitude and death coming to the fore. The bind that the Vermont Agricultural Resilience initiative inherits is that a future with humans is one that must be less anthropocentric, since these tendencies contributed to a planet that can rupture at a moment's notice.

4.1.2. The Transdisciplinary Research Initiative

The University of Vermont (UVM), the largest higher education institution in Vermont, is located in a picturesque liberal, college town that is nestled between the scenic Lake Champlain and the Green Mountains. Both of these formations feature a unique socio-ecological history. Forests in Vermont and the Green Mountains, which form the upper section of the Appalachian Mountain range, were heavily logged due to a bustling timber industry in the 19th and 20th centuries, and at its heyday, Burlington was the third largest lumber port in North America (CEDO, 2015). This history of extraction was curbed in 1970 with the historic legislative signing of Act 250 – an act designed to mitigate the harm caused by development and extraction projects to human and ecosystem communities. Lying on the Western border of Vermont, Lake Champlain currently faces a toxic algae issue caused by excess phosphorus runoff from agriculture and stormwater pollution. UVM is currently undertaking a variety of applied research projects to address these issues, and in my department as well as numerous others, interdisciplinary and transdisciplinary projects are mobilizing a variety of stakeholders including NGOs, academics, agricultural stakeholders, policymakers, and the Vermont public to tackle watershed issues.

UVM is located in a unique geographic and historical context, with environmental issues both in the rearview mirror and the passenger seat. As Vermont's

land-grant university, UVM's original mission was to teach practical skills to as wide a public as possible, a model designed to counter the liberal arts curriculum that focused on more abstract thinking (WSU Extension, 2009). The author of the State Land Grant Act, also known as the Morrill Act, was Justin Smith Morrill, the U.S. Representative of Vermont in 1862, and a prominent figure in Vermont's history and whose name is feature on a UVM building. Today, UVM is known for its efforts in the environmental field, featuring an Extension school that "integrates higher education, research and outreach to help individuals and communities put knowledge to work in their families and homes, farms, businesses, towns and the natural environment" (UVM, 2015c), and an Environmental Program that is home to the second most popular undergraduate major on campus (UVM, 2015b).

In 2009, two years before Tropical Storm Irene, in an effort to advance their "role as a premier small research university", UVM formed a cross-campus endeavor called the Transdisciplinary Research Initiative (UVM, 2015a). Led by senior administrators at UVM – the provost and vice-president – the initiative was,

Designed to help map the University's existing and emerging capabilities; to identify those research, teaching, and public service areas that hold the strongest potential for distinction; and to use the findings to guide us in pursuit of our goal of becoming a recognized center for learning and discovery in selected fields (UVM, 2014).

As part of the mapping process, the initiative accepted proposals from existing graduate programs at UVM to advocate for a "transdisciplinary spire of excellence," which was a broadly defined category that referred to cross-disciplinary strengths on campus. The creation of the Transdisciplinary Research Initiative arrived during a period of deep economic recession. In a 2009 university-wide memo, the provost and vice-president

write (my italics below),

"[T]here is no doubt that this undertaking would be eased by an infusion of new resources to support its implementation. The *economic realities of the foreseeable future* preclude this, yet we are not excused from our responsibility to pursue a strategic vision that best utilizes our extant resources. In fact, the challenges we face are further calls for clear programmatic focus and the thoughtful and disciplined allocation of resources. We will all benefit from the greater competitiveness and stability our institution will achieve as a result." (UVM, 2009)

It is unclear whether “the challenges we face” are intended to denote transdisciplinary research challenges or the economic challenges presented by the recession, however the endeavor marked a strategic move to identify university strengths and push those as leverage points for greater recognition around the country. Other higher education institutions were meanwhile doing the same thing, as the University of Minnesota, UC San Diego, University of Pennsylvania, Washington University in St. Louis, Texas Tech, and Harvard University also pursued transdisciplinary research initiatives to leverage greater research opportunities.

If selected as a transdisciplinary “spire of excellence,” this area would stand to gain a variety of institutional and economic resources. Each spire would eventually hire program administrators, and fourteen tenure-track hires would be freed up across the selected areas alongside new grant funding for faculty. After a year of proposals and committees advocating in a wide variety of areas, three spires were finally chosen in 2010. The fields of Complex Systems, Neuroscience and Public Health, and Food Systems were selected, and in 2011, the same year as Tropical Storm Irene, UVM expanded these spires into fully-fledged programs by hiring administrators and establishing communication networks between faculty members in the three applied

areas. In the 2011-2012 academic year, these spires ramped up activity through outreach events, hosting scholars from around the world, implementing new undergraduate and graduate curricula, and developing grant proposals for the newly available funding (UVM, 2014).

In researching UVM's transdisciplinary spire initiative website, which includes extensive documentation through the entire process, I was unable to find any qualifiers of the use of the term 'transdisciplinary'. In announcements and memos to the UVM community, and in calls for proposals led by the TRI steering committee, there was no definition of transdisciplinarity, and the word's only discursive context is in sentences like "developing transdisciplinary excellence at UVM" (UVM, 2014, p. 2). Moreover, while a multitude of resources were provided to committees who were applying to be a transdisciplinary spire, none of these included literature related to defining the scope of 'transdisciplinarity' or 'transdisciplinary research', which as seen before, is a complex discursive entity. The resources that were provided included funding plans from national agencies like the National Science Foundation (NSF) and the Environmental Protection Agency (EPA), and although these plans acknowledged the increasing need to shift knowledge away from disciplinary and isolated siloes, any qualifying definition for transdisciplinarity was missing (NSF, 2006). Was UVM attempting to foster "a zone that was just about ambiguous enough to keep everything together" (Fitzgerald et al., 2014)? Or were calls for proposals left ambiguous to allow for as many proposals as possible? Whatever the case was, this ambiguity problematized the Vermont Agricultural Resilience initiative, as the meaning of transdisciplinary had remained a mystery for the team when I first entered. However, because we can trace this definitional vagueness to

before VAR's conception, we see that other issues, such as institutional maneuvering and funding strategies, also produce transdisciplinary ambiguity.

4.1.3. Vermont Agricultural Resilience in a Changing Climate

One member of the Food Systems Spire steering committee, however, recognized an opportunity to conduct a transdisciplinary research project with a novel approach. Diego (whose name I have changed), a widely regarded faculty member, built his career working on participatory action research projects, a research approach that, like transdisciplinarity, was controversial for its collaboration with non-scientific modes of knowledge. Diego told me that, while UVM was vague about what constituted transdisciplinary research, he was able to take advantage of the opportunity as a scholar that had extensive experience with transdisciplinary research, which was more prevalent in his field of agroecology. The initial call for proposals from the Food Systems Spire, in fact, presented an opportunity to do a project where he did not feel like he had to compromise any of his values as an agroecologist. Diego told me,

VAR is one of the first times that I've actually written a proposal and gotten funding to do exactly what I wanted to do. So, for me, including the participatory action research piece in there openly, [then] including the transdisciplinary piece to do this work has been amazing... Because a lot of the times in the past I've felt that [in order] to get the funding I had to follow more, you know, the rationale of, "What does the funder want to hear," and almost subversively incorporate the PAR pieces and transdisciplinary pieces...VAR gave me the strength and the hope to pursue this research for what it is rather than this attitude of, you know, I'll do what NSF wants so I can get the funding to do my research and I'll add on these other parts [later].

Diego's own research group had already surveyed farmers' attitudes towards climate change, and he recognized the need for a project to help food systems mitigate

and adapt to climate change. With the support of his research group, he conceived of a transdisciplinary project that could engage farmers and agricultural service providers through a participatory action research approach while orienting the research strengths of various faculty members towards a real issue. Diego invited faculty from a variety of departments to join his proposal to receive a grant from the newly created, transdisciplinary Food Systems Spire. This new group of principal investigators at UVM included new faculty hires, tenure-track UVM faculty, established UVM faculty with tenure, and UVM research faculty operating primarily in the field.

Diego and these new principal investigators (PIs) settled on a proposal focused on fostering agricultural resilience in Vermont. Dubbed the “Vermont Agricultural Resilience in a Changing Climate Initiative,” they proposed an ambitious three-year timeline with multiple objectives. From the outset, with VAR’s activities requiring the facilitation and coordination of multiple social groups, the intention was to use a transdisciplinary and participatory action research approach. The project sought to “better understand the interactions among farmer management (i.e. climate change best management practices – CCBMPs) and decision making with current and alternative policy regimes addressing climate change.” Additionally, it addressed the devastation of Irene through the “need to develop strategies that respond to extreme climate events,” as well as the impacts these have on food production capacity.

Their original grant proposal states,

Our transdisciplinary approach integrates methodologies from the social sciences, agroecological analysis, agent-based modeling (ABM) and scenario visualization. We will disseminate our findings through farmer-to-farmer workshops that focus on sharing knowledge on and implementation of CCBMPs. Results will also be shared with policy makers and other stakeholders through facilitated workshops. Expected outcomes include: 1) Developing a transdisciplinary research

methodology to address climate change in agricultural landscapes; 2) Identifying and evaluating promising CCBMPs; 3) Developing a farmer to farmer outreach model for CCBMPs; 4) Supporting the adoption of a regional climate change agricultural policy and outreach strategy; and 5) Integrating ABM and scenario visualization to assess social and policy drivers of farming practices amidst alternative climate change scenarios.

While this ambitious proposal later proved to be problematic for VAR's limited timeline, the team successfully received the three-year grant, firming up funding to hire a part-time facilitator, free up time for PIs, partially fund graduate students, purchase research equipment, and set aside funding to compensate farmers for their involvement. Thus, out of a confluence of processes, including Irene, the push for academic excellence at UVM, and the capacities built into agroecology for transdisciplinary work, the Vermont Agricultural Resilience initiative was formulated, setting the stage for three rich yet challenging years of transdisciplinary collaboration.

4.1.4. 'Loving Our Monsters'

Bruno Latour recently proposed that we must begin to accept and “love our monsters” (2012), which he defined as any “technological crime against nature.” Monsters, he argues, are what have emerged as a result of the human drive to channel, dominate, control, and tame nature. Latour sees Dr. Frankenstein's greatest mistake as forsaking his creation when it only needed his love and care. He proposes that instead of the ‘modernist notion of modernity,’ or increasing attempt to master nature, we should seek a “compositionist [notion] that sees the process of human development as neither liberation from Nature nor as a fall from it, but rather as a process of becoming ever-more attached to, and intimate with, a panoply of nonhuman natures” (para. 7). If we frame agriculture as one such monster, we see that our relationship to the world becomes more

complicated: agriculture, as a way of dominating the soil, is what sustains our human bodies and livelihoods, but it has also become a “technological crime against nature” that further alienates us as an ecological invasive species, contributing to this new monster we call climate change.

We began this section by looking at Clark’s critique of Kant’s modern, liberal subject as the locus of control. Clark sees Kant’s move as a tactical one in response to the heartbreaking Lisbon Earthquake that leveled Western Europe. Ultimately, though, the move to prioritize human rationality was futile, as the ground that humans tread on continues to open up and swallow them. Nevertheless, humans continue trying to build stronger levees, unable to truly come to grips with the “monsters” they’ve created. As part of Latour’s project, who argues that our attempts to purify ‘Nature’ from ‘Culture’ have only resulted in increased hybridities, the main goal of political ecology becomes how we can account for the “process of becoming ever-more attached to, and intimate with, a panoply of nonhuman natures.” Latour doesn’t speak of ‘care’ or ‘improvement’, which evokes a metaphor of maintenance, but rather of love and entanglement: engaging with the ecological, immanent, and unknowable ways that we are *of* this earth rather than *on* it. Yet it may not be as simple as ‘continually caring for our technologies as we do our children’ (Latour, 2012), for our agency is many times, like during Irene, out of our hands. Thus, VAR’s instructions entail the simultaneous recognition that we are both planetary movers and passive recipients to the planet’s inhuman activities.

Returning to our original genealogical prompt – reflecting on the “full complexity and contingency of the conditions of possibility for doing, being, and thinking in our cultural present” (Coopman, 2013, p. 23) – we can begin to see that VAR is a

conrescence of other ongoing processes: higher education is adapting to compete for research grants; transdisciplinary discourse is operationalized for different uses; Vermonters understand what it is to live in a changing climate; scientists are being called on to inform ethical and political problems; and disparate social groups are being draw into novel collaborations. With the Vermont Agricultural Resilience initiative finally organized, the task ahead becomes to grapple with their challenges, to admire their successes, and to look beyond, at what may be possible in the future. In the next three chapters, I look at key aspects in VAR's successes and challenges, always analyzing in a 'diffractive' mode to offer new interpretations and possibilities.

CHAPTER 5: SUBJECTIVITY AND AFFECT

5.1. Introduction

The following three chapters form the analysis and discussion components of the thesis. I have chosen to follow and enact three major themes following my research tasks and concerns. In this chapter, I explore how processes of subjectivity and affect permeate the team collaborative space and the overall values represented in VAR. I look at the team's process of 'speaking frankly', addressing Rabinow and Bennett (2012) and Fitzgerald et al.'s (2014) differing stances on equivocal speech. In chapter six, I tackle integration, looking at VAR's early strategies for maintaining coherence throughout a challenging period of organization and coordination. I problematize these early strategies, arguing that the ethics and politics tacitly assumed in transdisciplinary work must be explicitly addressed. While participatory action research may be a mechanism for integration of humans and their disciplinary commitments, I also look at the involvement of nonhuman actors. Using Stengers's (2010) 'cosmopolitics', I venture into VAR's human and nonhuman entanglements, articulating a mode of transdisciplinarity and PAR that can reach beyond the human. Finally, in chapter seven, I conclude by offering a meta-reflection on my enactments in VAR, looking at the impacts of these, and reflecting on the co-constructed nature of these enactments.

5.1.1. Entering the Situation

The Vermont Agricultural Resilience in a Changing Climate initiative (VAR) was in the middle of its second year when I first reached out to them. My first contact was with the lead PI's (Diego's) graduate student, Madeline, who was imminently getting married, and referred me to the team's facilitator, Elizabeth. Diego was at the time taking

a yearlong sabbatical to do agroecological research in Central America, and Elizabeth had the responsibility of facilitating VAR's activities while he was away. My first meeting with Elizabeth was very promising. I had brought with me a handful of ideas to the table ranging from following the researchers on-farm, to building an actor-network model of the entire VAR initiative. Elizabeth also brought up an idea relating to VAR's original mission. In VAR's original research proposal to the UVM Food Systems Spire, they state five intended outcomes for the project, the first being to, "Develop a transdisciplinary research methodology to address climate change in agricultural landscapes" (p. 3). She told me that VAR's activities up to that point had been largely individual, and had yet to focus on the task of transdisciplinary integration. Moving forward, this was one of her biggest concerns, and I decided to pursue the idea a bit further.

After attending a few team meetings, it was evident that I entered during a crucial period of collaboration in the three-year timespan: some PIs were winding down their research while others were just beginning to ramp up; equipment difficulties and delays were complicating some research activities; and team integration meetings were leading to conversations about how to integrate the disparate research of all the PIs. Because of this feeling of evolution, that things were in a constant state of change, I began to use Deleuze and Guattari (1980/2004) to conceptualize VAR as in a process of becoming: "There are lines of articulation or segmentarity, strata and territories; but also lines of flight; movements of deterritorialization and destratification. Comparative rates of flow on these lines produce phenomena of relative slowness and viscosity, or, on the contrary, of acceleration and rupture" (pgs. 3-4). I asked to myself, "What if integration,

in a transdisciplinary sense, was never static or stagnant, but always processual – muddied at times, rhizomatic and springing forth at others?” Deleuze and Guattari describe ‘rhizomatic’ as denoting a sense of “ceaselessly establishing connections between semiotic chains, organizations of power, and circumstances relative to the arts, sciences, and social struggles” (p. 7). Thinking with rhizomes and processes of becoming here produces a different narrative to VAR: the challenges inherent in collaborating, especially in the face of the processes analyzed in the last chapter, are a natural process of transdisciplinary work. Perhaps, I thought, the challenges were necessary moments in the team’s development, and not an indication of the impossibility of integrating.

5.2. Subjectivities

In this chapter, I explore three main ideas, that 1) The subjectivities and values of each researcher both converge and diverge in important ways; 2) The researchers’ levels of participation had a direct impact on the collaborative and leadership processes; and that 3) An affective realm operated in this collaborative process that was palpable and therefore generative of new modes of thought and sensory insights. In this chapter, I begin to populate VAR with the subjectivities of the researchers, looking at the impacts of their varied modes of participation, and attempting to notice the “hot spots” or “affective glows” (Ringrose & Renold, 2014) where more subterranean processes were taking place. Throughout the chapter I weave in interview data, observed vignettes produced from field notes and observations, and theory. An assemblage unfolds, where subjective, affective, and inter and intra-personal actants connect and diverge, producing what I came to experience as crucial entanglements to VAR’s becoming transdisciplinary. Reading these entanglements diffractively, I argue that VAR was able

to ‘speak frankly’ only after a process of trust, respect, and humility was developed, and when the possibility of not integrating was not seen as a failure.

5.2.1. The Principal Investigators

I open with brief vignettes of each team member’s unique subjectivity as they reveal more than their mere disciplinary positioning. From the outset, a diverse group of researchers were recruited by Diego to compose VAR’s group of principal investigators. The intention was created from the beginning to not only incorporate the identified research areas that were deemed necessary, but also to bring in a group of researchers that would work well together and enjoy each other’s company. As I continued to observe and sit in on VAR’s team meetings, I began to learn more about each of the PIs own backgrounds – noteworthy things that were never expressed explicitly in the team setting. Because the team meetings were difficult to schedule and often packed to the brim with agenda items, many of these underlying aspects of the team’s subjectivities were never expressed, even if they related closely to the process of transdisciplinary work. In interviewing the team, I sought to understand each researcher’s subjectivity – as they would express it – and learn about the path that brought them to VAR, not only in the invitation to become a principal investigator, but also the values, passions, and skills that led them to doing applied research. I begin by describing each researcher individually.

Jake is the most senior faculty member, after Diego. A longtime UVM member, he has worked in a variety of offices, from community engagement to service learning. Having received an interdisciplinary Ph.D. in public policy, and directing the M.P.P. (Master’s in Public Policy), he had a variety of interests, ranging from complex systems, network governance, and institutional decision-making as applied to real world problems,

particularly his work co-leading one of the most established transdisciplinary projects at UVM, which studies issues plaguing Lake Champlain. In our conversation, he expressed the need for VAR to have a real “metalanguage” when doing transdisciplinary work, as he himself indicated a “pretty advanced sense of the relationship between epistemic communities, knowledge communities, [and] how they relate with one another.” Despite this deep knowledge, he is also committed to a variety of other projects, which impacted the time he had for VAR.

A colleague in the same department as Jake, Robert was trained as an applied economist looking specifically at agricultural systems. Robert had a career of running against the traditional model of an economist. Stating to me that he wasn’t even sure he would fit in at another economics department, he mused that all of his jobs – even non-academic – had been food-related somehow. Although he is not as informed on transdisciplinary discourse as his colleague Jake, Robert works in another Food Systems Spire-funded transdisciplinary project, which he felt was more hands-off than VAR. Seeing VAR through this other point of reference, he strongly admired Elizabeth, the project facilitator, for her skills in facilitating an overall positive collaborative experience. Reflecting on his previous experience working with farmers, he said it was sometimes like “riding a bull by the horns... It’s like this huge monster vehicle that you have poor steering control.” I asked him whether he thought others in VAR had a similar experience, and he responded that he didn’t know, but had just assumed that others were going through similar challenges. It was also obvious to me that he cared a great deal about his graduate students ability to do top-notch research in VAR. In team meetings, Robert would credit his graduate students for their results, and in talking with him, I

could tell he was proud that one of his students was publishing in an upcoming journal. Graduate students and research assistants would play a significant role in VAR, as they became, in some cases, the primary connections between the research PIs and the farms. Faculty members were constantly seeking more funding and publications not only for themselves, but also in the interest of developing their graduate students' own careers.

Janet, both a food systems faculty member and the director of the Extension-based center for sustainable agriculture, is a brilliant systems thinker with an interdisciplinary Ph.D. in food systems and health. Like Jake, she also has extensive knowledge about transdisciplinarity, and when I asked her about how she got interested in food systems, and what shaped her values as a transdisciplinary researcher, she took me back to her childhood:

Yeah, I mean when I think about it and I hate to be ridiculous about it, but the truth of the matter is I was 12, and I grew up in the city of Chicago and in the summers we spent time on the family farm. And I went to bring the hogs and the cows to the slaughterhouse when I was 12. And I was like “*whoa*”; I was not really comfortable with that. And when I got home I said I would like to be a vegetarian. And it was the time when Frances Moore Lappé’s books had just come out...and they are very focused on food choice, in the context of world hunger... And so, that was pretty compelling to me. I had started in a very moralistic sense, but it transformed a little more, into the food choices that I make have an impact in the world.

Janet was well regarded on the team, having mentored Diego’s graduate student through her Master’s, and working closely on other projects with the other PIs. Her own experience with transdisciplinary research was shaped by her work with another transdisciplinary project looking at food access, as well as seeing how graduate students become points of integration among their committee members’ different ways of knowing. When I spoke on a panel with her, she articulated the challenges of being

pigeonholed into disciplines as an interdisciplinary researcher herself.

In the school of natural resources, Susan was a new assistant professor and had not completed her move to campus before Diego approached her to join the team. After securing the position, she received a call from him explaining the project and his desire to have a climate change scientist come on as a PI. Susan brought a large scale perspective to VAR, telling me that her interests were “in the impacts of different changes, [like] global changes largely driven by people or how carbon is stored or how much is lost from a system and how nitrogen either stays in a system or doesn’t.” Initially, Susan faced a variety of dilemmas in VAR: Vermont presented a very different environment than what she was used to, which complicated her methods; she had recruited a graduate student to move to Vermont to do research, but the research sites were not finalized yet; and she herself was adapting to a new environment:

My thought process was largely confused, as I was just new to the university and even to the whole group of people. So I think I was learning who people were and what their ambitions were and what their goals were. And I did not fully understand agroecology and what that means.

Socio-ecologically, the farms in Vermont were managed in very different ways than in Colorado, where larger tracts of land led to more homogeneity, while in Vermont, the heterogeneous formations of smaller size farms next to swaths of conserved land complicated her research decisions, like how to get consistent measurements across farms, what greenhouse gasses to measure (I learned from her that there are a variety of them, each with differing impacts), and what equipment would best serve her research. Susan’s own passion was in understanding the way the world works, and she spoke of microbes and soils as these ‘amazing’ entities that were able to breath in carbon dioxide,

thereby mitigating their release into the atmosphere.

A close collaborator of Susan and also a PI in VAR, Anne was trained as a landscape designer and received a D.Des. (doctor of design degree). When she moved to UVM, she immediately saw Diego as a “kindred spirit,” who shared her belief in the value of a holistic, socio-ecological approach to research. Her research looked at the ways in which ecology, design, and aesthetics could be coupled to help produce “cascading effects for the ecosystem to self-maintain in a sustainability and resilience path.” Prior to UVM, she had found a calling in doing applied work at the intersections of ecology, design, and aesthetics, with a unique ability to move between different social worlds:

I'm an artist for some groups and I'm a scientist in others. I'm kind of constantly riding the line between the two and I'm okay with that, but it's really fun to be with people who would describe themselves as more pure social scientists versus natural scientists versus economists. I do feel like in this project, I'm more on the creative and visual side, and definitely for the goal of social thinking and understanding the farming community to ideally improve the ecosystem health. It's like blending the social and ecological and the artistic.

Anne’s own piece in VAR was to look at the aesthetics of agricultural resilience. Using visual manipulation software like Photoshop, she altered base photographs of farm landscapes to show what they would look like with different management practices. She readily acknowledged that in the beginning of VAR, these were difficult to understand for the rest of the team, and even hard for her to envision how they could be researched. She relayed to me her feeling that landscape architecture and design could be hard to comprehend, and felt that it took the other team members some time to gain an understanding of her work.

Diego is the lead principal investigator of VAR and distinct not only for charting

an interdisciplinary path in academia, but also notable for his extensive experience doing work with rural livelihoods, working with farmers and NGOs outside of the United States. Born and raised in Central America, Diego conveyed to me that a career in academia has always been a complex choice for him, that while he loves doing research, he is also passionate about working on the ground with local farmers. He began to do mixed methods research early on, drawing on both the social sciences and sciences in a participatory action research approach (PAR), which became a way to merge the passion that he had for research with the commitment he had to improve agroecological systems. PAR and transdisciplinarity became a key part of his agroecological practice, as he pushed his own field to draw on both to do more rigorous and applied research. Transdisciplinarity, he felt, could be an accessible framework for researchers who still wished to maintain a research presence while working to help solve local socio-ecological problems. At UVM, Diego became a prominent figure for his research and teachings on agroecology, and his leadership in the food systems and environmental studies programs.

Additionally, Diego recruited a project facilitator who had a background in community engagement, service learning, and social science research. Elizabeth would become the main process organizer and gatherer over the course of the three years, becoming what she described to me as the “generalist” of the group, holding everyone’s research in mind while constructing a team process. If Elizabeth seems to figure prominently in this thesis, it’s because she has: during my first year, we met monthly, and she read many of my proposals, offering me many valuable suggestions. In the second year of VAR, she helped me construct a survey to see what the team thought of the

progress of VAR and the transdisciplinary process, and we later presented this work together at an international conference on service learning and community engagement. Elizabeth's own path began in conservation biology, but in seeking a more integrated approach to environmental problem solving, she gravitated towards experiential education, recognizing the need to introduce young people to environmental issues by giving them the means to act.

5.2.2. Subjective Processes in VAR's Transdisciplinary Work

I earlier hypothesized that the disciplinary positioning would prove difficult to navigate in the transdisciplinary context, and while I maintain that this may be true, I believe it is also influenced by the diversity of subjectivities represented in VAR. All of VAR's PIs had a wealth of research experience, and all, in their own ways, indicated moral commitments to improving the planet, especially at the intersection of social and ecological systems. This shared goal seemed to be deeply rooted: many shared stories of learning about these issues in college, or going on volunteer trips abroad, or witnessing environmental destruction firsthand. For some, these deep seeded motivations continue, while for others, they evolved and morphed into a desire to contribute to the world in a technical capacity. Notably, these shared goals were never present in team meetings, as the logistical realities of doing transdisciplinary work – funding, scheduling, presenting – seemed to occupy much of the space, which for some team members became tiresome over time.

In addition to their personal commitments and values, each team member sees different leverage points for change. As one team member remarked, “Well, when I started I thought PAR was photo-synthetically active radiation.” Some team members

see positive change occurring through empowering locals, some see aesthetics and design as a powerful linchpin, some see farming as a community enabler, while some see farming as a potential climate mitigation tool. Others look at the institutional scale, while others look in the soil, at the microscopic level, at what changes can be brought about at a scale imperceptible to the naked eye. In recalling the path that brought them to VAR, Diego reflected on his career going between NGOs and academia, while Anne spoke of her journey among social scientists and landscape designers. For Madeline, Diego's graduate student, VAR's work was also personal: as both a farmer and a researcher, she was looking to make sure the relationship between farmers and researchers did not become too contractive – researchers just paying farmers to use their farms for research. She described feeling like she had a commitment to provide healthy food to her family and community.

So, do the subjectivities of team members matter in VAR, and should they be addressed explicitly in the team space? As an expression of the deep-seeded commitments that drew team members in, VAR is shaped by and representative of the shared values of its researchers. And this follows the conceptualization of transdisciplinarity as a normative practice – that scientific research cannot anymore be decoupled from the world that it is part of. If we are to construct projects that are aimed at solving problems, should we be upfront about the values, commitments, and subjectivities that orient the normative definitions of these problems? What if the team process was structured so that these deeper subjectivities – the complex identities and moral commitments that drive the team – were allowed to come through? How would this affect a transdisciplinary agenda, and the normative nature of defining and solving

real-world problems?

I argue that the subjectivities of VAR's PIs represent a variety of 'matters of concern' that if addressed openly, could contribute to a different transdisciplinary dynamic – one that readily acknowledges the divergent values, interests, and needs of those involved. Here, I look to Bruno Latour's (2008) first specification of a matter of concern:

Matters of concern have to *matter*. Matters of fact were distorted by the totally implausible necessity of being pure stuff of no interest whatsoever – just sitting there like a mummified limb – while at the same time being able to “make a point”, humiliate human subjectivity, speak directly without speech apparatus and quietly dissenting voices. ...Can we do better and distinguish those various and confused layers to make sure that our scenography registers that they matter for some people who have to be specified, and for whom they are the source of an intense interest and a redirected attention? (p. 32)

In VAR, those layers are multi-faceted and include a deep passion for learning more about the world, a commitment to fostering healthier communities, responsibility for other research projects, among a multitude of other matters of concern. Could a transdisciplinary framework, in spite of all the emergent challenges – logistical, structural, or personal even – be called on to openly address these “various and confused layers” around matters of concern? Perhaps *in theory*, but what about in practice? I've so far only intermittently alluded to the space that the team occupied collectively – the team meeting – which is the primary collaborative process structured into VAR. The lively subjectivities I just presented may, if Fitzgerald et al. (2014) are correct, breed resentment if they are openly addressed or communicated. In the next section, I explore how affect plays a role in VAR's collaborative space, particularly as a result of the intra-action (Barad, 2003) between team members and between team members and their

research. I also attend to power dynamics, hypothesizing, if Rabinow and Bennett (2012) are right, that “frank speech” may also be necessary, albeit approached diplomatically, respectfully, and drawing attention to habits that may be unhealthy for the team dynamic.

5.3. Affective Processes

5.3.1. Noticing Affect, Power, and Moments of Rupture

While the ratio of male to female principal investigators was equal, there were others who were regularly involved in the team process, including Elizabeth, members of Diego’s research group, and Extension staff. Diego’s research group was typically represented by his graduate student Madeline, a farmer herself who was undertaking mixed methods research to develop a typology for understanding farmer’s behaviors and attitudes to climate change, and another female research associate who worked extensively on Diego’s other projects in Vermont and Latin America. The Extension staff, which was always present at team meetings, was composed of two males and two females, all with graduate degrees. A team meeting might theoretically have as many as sixteen people, give or take some when graduate students were present, while a typical meeting would actually have ten individuals present, a combination of PIs, research assistants, graduate students, and staff.

The gender ratio was always in flux, but I noticed a tendency for meetings to have a higher number of men than women. I asked Elizabeth what her sense of the power dynamic was among the PIs, and how this affected the collaborative process. She replied, “It’s certainly something that I felt a responsibility to have an awareness of. I remember earlier on the project, noticing and talking as a group about how the male voices, particularly from [one school], tended to be much louder.” I was interested in how

Elizabeth saw some of these early tensions, particularly because she seemed to have such a strong understanding of power and gender imbalance, as well as being conscious and reflexive of the issue in VAR. As she voiced to me,

I think about my female New England identity and how my predisposition is to prioritize harmony and smoothness and comfort. I still put myself in all those tensions all the time because I see that's where the richness lies. I feel it's an almost internal paradox between my identity and my location. I sometimes have to have discipline to hold myself and hold a group in a tense space because I'm torn between knowing that there is richness in tension, but also I don't want people to be uncomfortable and I don't want them to disengage and abandon the process.

While Elizabeth openly acknowledged the 'richness possible in tension', I gained a sense that these power imbalances weren't readily addressed in the facilitation process. Team members had a wide range of interpretations about facilitation in VAR. All of the PIs felt strongly that Elizabeth was a great facilitator, laying down the process in a way that encouraged dialogue. While there were minor gripes about certain team meetings that featured more logistical decision making, even the team member who was the strongest internal critic of VAR felt that she did an admirable job, saying, "Elizabeth is a strong process person, she has a lot of integrity, I've got a lot of respect for Elizabeth." This comment rings true across the board, and my own experience of her was as a calming force – I recall nervously preparing the night before my first conference presentation, and Elizabeth checking in on me the next morning and making sure I was doing okay.

In VAR, facilitation takes on an important role in the transdisciplinary process. Nowhere is this more visible than in the dynamic between Elizabeth and Diego. Diego is seen as the team's leader with Elizabeth acting as the team's facilitator, but those roles can become blurred when the team is actively interacting in a meeting. In one example

of this, Elizabeth had worked to prepare an integration activity to determine how to get each PI's data to connect to each other. In the team meeting, when Elizabeth was introducing the activity, the plan quickly changed when Diego explained in front of the team that the "holistic problem assessment" she was introducing was not what he had in mind, and that the focus should be on farms, not on the climate change best management practices. The moment – noticed by me as a 'vibrating intensity' (Ringrose & Renold, 2014) – caught her off guard, and she quickly took a backseat as Diego continued to facilitate and lead the discussion around integration. When I asked Elizabeth about it afterwards, she explained,

I had proposed something [before the meeting] and Diego had said I should work something differently. I brought you into this, so that we could come up with something different and he was like, "I still want something different." Finally, he proposed something and he used the term, 'holistic problem assessment', but lower case. I created something with [another team member] around Holistic Assessment and Diego stopped by before the meeting, and looked at what I had created and said, "We're on the same page." I thought we were on the same page. We got in there [to the team meeting] and people started questioning [it] and I realized we were not all on the same page. That's what I felt. It was in that moment that I was [like], "Oh, what I am facilitating here is not what Diego wanted." I probably should have had him facilitate it, but he didn't have time to put it all together.

It was a paradoxical moment because as a result of Diego stepping in to the facilitator position, a role that he had delegated directly to Elizabeth, the team began to generate positive ideas about how to move forward. In my field notes, I wrote that the "floodgates seemed to open, and the discussion livened up – once it was made clear by Diego that it may be that some of the data sets won't easily translate into knowledge that a farmer can utilize, it was clear that people felt more comfortable speaking up." In their own transdisciplinary encounter, Fitzgerald et al. (2014) argue that speaking frankly may

lead to things “that are better left unsaid, that are as well off not articulated and to the sense of awkwardness and ignorance that probably will not help anything if openly acknowledged” (p .16). Thus, a paradox was presented – by intervening, Diego opened up a space for others on the team to feel like they could be honest and truthful about the realistic possibilities for their research to integrate with others, but by doing so, he also disrupted the predetermined roles of facilitator and leader.

Diego’s own leadership style, he later told me, is one of allowing his team to flourish on its own, to help them self-organize, and to model the behavior he expects out of the team. Therefore, as a momentary rupture in the team space – when Elizabeth and Diego’s roles overlapped – what was informing this? Was it that it was the last team meeting of the semester, and the pressures of the project were mounting? To hold onto this tension a bit more, in another instance, Diego felt that one team member - the same team member who was earlier effusive in praise to Elizabeth – was unfairly vocalizing his criticisms of VAR to Elizabeth while Diego was on sabbatical.

When I spoke with the team member in question, he also explained to me that he felt it was unfair to place more responsibilities beyond facilitation on Elizabeth, when the leadership for VAR should emanate from the PIs. When I spoke with Diego about the incident, he expressed to me his own frustrations that this feedback had come while he was away on sabbatical. Elizabeth, however, indicated to me that she held a strong affinity for both Diego and this team member, having previously sought their advice on the transdisciplinary and facilitation process, while also recognizing that both were strapped for time. All three were acutely aware that VAR was occurring amidst a maelstrom of other research activities outside the team, and Elizabeth was left with the

difficult role of facilitating a group of PIs with limited time. She expressed,

Sometimes, it's hard for me in recognizing that. Everybody is really busy; when we have our meeting, when our project team is learning more from mistakes than actually getting work done. I don't want to have that happen too much because that could lead to frustration.

While an “affective intensity” (Ringrose & Renold, 2014) was certainly noticed as a result of the tension between leadership and facilitation, other affective expressions of power were also observed in the collaborative process. Two team members, both female, described feeling quieter at the outset of the project – one was just transitioning back into academia, and described feeling “overwhelmed by the complexity of the project,” and the other told me it took a while to become comfortable knowing who everyone was in VAR and being able to speak more openly and ask more critical questions. Both were integral members of the team, however, as other team members saw their research as crucial for the initiative. On these early stages, Diego acknowledged, “we definitely had some tensions because people would tend to try to dominate and there were definitely some that wouldn't speak.” In a follow-up question, I asked him whether he thought effective transdisciplinarity might require addressing some of these issues that might have been “invisiblized,” and he agreed that it might have helped.

Team rapport in VAR was more than collegial. In most cases, PIs were working with each other on a variety of other projects, and in VAR, Elizabeth facilitated an environment that led to a deep trust and sense of kinship on the team. Team members described VAR to me as feeling much more close-knit than any other research project, which led to a sense of respect and humility. In an early team meeting that I attended in

VAR's second year, team members were addressing a critique from a peer reviewer that questioned the research questions they were asking. In response, two team members humbly expressed that they felt their research component was what reviewers were critiquing the relevance of. I noticed other team meetings where this was also voiced, but I also noticed that this perspective typically did not come from any of the male team members. Overall, however, this willingness to question and critique their own research components led to an overall humility that resonated throughout the process.

At the same time that a positive, humble energy was present in the collaborative space, there were moments where confusions and disagreements bubbled up to the surface. One team member recalled an earlier moment in the project that was more frustrating,

I think it was a tension of ideas. I think tempers might have flared around that one particular thing for a very brief moment because there is other stuff going on about, like, PIs establishing themselves, and not really being sure what it is to work with people across disciplines, and maybe having a little bit more investment in one particular storyline or another.

In a transdisciplinary setting, investments can take the form of what a researcher can contribute (to a problem, to stakeholders, etc.), and what a researcher can receive out of the project (in funding for graduate students, publications, connections, etc.). Diego acknowledged that one draw for researchers doing transdisciplinary work may be the ability to gain publications out of it. Many team members felt that they would be getting publications into their respective disciplinary publications. In the instance above, however, these investments are complex, and relate to the underlying matters of concern that inform team members in different ways. These concerns, however, were not openly

voiced, and the moment was noticed as an ‘affective intensity’.

5.3.2. ‘Speaking Frankly’

In turning our attention to the debate between Rabinow and Bennett (2012), and Fitzgerald et al. (2014) on the merits or pitfalls of ‘frank speech’, it seems that both sides could argue on their behalf in VAR. In Rabinow and Bennett’s favor, I discerned a noticeable change in the team dynamic when it was made clear that there was a real possibility that the data wouldn’t be integrated – a concern that had caused some to equivocate – and that this was okay, a constructive realization in fact, since planning could then productively move forward. This change, I would argue, is more complex than Diego merely uttering, “It’s okay if we can’t integrate,” and also has to do with the processes of becoming closer interpersonally and understanding what everyone’s matters of concern are. In other words, aspects of their subjectivity played a role. When I asked a team member about the shift I noticed, she replied,

Well I feel like I’ve been a lot more transparent with Diego now about that very idea, and I think a part of that is just kind of becoming a little more solid in my position, and [knowing] what I need to do and how I need to get it done...So now I’m much more able to say to him, “Well, look, we can’t do [X] and this is what we want to do, but we can’t do these other things.” He’s also stated to me, which is useful, that he understands that I’m pre-tenure [and] I need to get certain things done.

In this instance, frank speech is a *process* of becoming, and not an absolute practice. By openly acknowledging the reality that the pre-tenure researchers had their own commitments, Diego opened a space that allowed for a more transparent and ultimately more constructive dialogue.

However, the argument could be made that frank speech might not always be healthy in pointing to the moment where “tempers flared” about what best management

practices should be researched. Fitzgerald et al. (2014) argue that a practice of ‘equivocal speech’ (p. 16) is called for to avoid expressing what might only cause resentment. In the early stages of the initiative, the team was exceeding expectations, focused more on autonomous work and less open discussions about integration. Did ‘equivocal speech’ contribute to VAR’s early success? I suggest that we need to look at what Fitzgerald et al. considered ‘success’ in their own transdisciplinary group, and compare their metric to the goals of VAR. They write,

But our experiment was also successful. We made a transdisciplinary hypothesis that drew on a literary–historical insight in order to both trouble and expand a neurobiological literature; the experiment that we designed produced a positive publishable finding, in line with our hypothesis; we wrote that finding up together and we submitted it to a journal. (p. 16)

The primary characterization of their success was a publishable result that led to a journal article. Looking further at their group, they state that transdisciplinarity is demarcated from interdisciplinarity because it does not lay out “two or more disciplines next to each other...Rather, it means to set about a question simultaneously taking into account visions and methods on the same topic from seemingly different perspectives” (Fitzgerald et al., 2014). As we saw before, the transdisciplinary discourse is a wide-open field that is in constant negotiation and debate. Critics (like Carolan (2006)) have critiqued its instrumentalization to perpetuate pro-scientific values. While Fitzgerald et al. incorporate the humanities and social sciences in their endeavor with the result that they have successfully generated a new pathway in neuroscience, they are not grappling with one of the central tenets of real-world problem that factors prominently in the transdisciplinary literature. Moreover, because this is not the transdisciplinary vision that Diego laid out in VAR, the same standards of success for Fitzgerald et al.’s team do not

apply to VAR.

Therefore, although the first half of VAR is characterized by many on the team to be lacking in deep dialogues on integration for agricultural resilience – following the mode of ambivalence and equivocation exercised by Fitzgerald et al., I argue that we need to use VAR’s own matters of concern to judge their success and determine the value of ‘frank speech’. While Fitzgerald et al. may provide guidelines for collaborating in an affective zone that achieves success using *research* and *academic* metrics, I would argue that frank speech *must* be readily practiced, not to breed resentment but to adequately address the wide range of problems and concerns that exist in *VAR*’s transdisciplinary process such as graduate student funding and timelines, pre-tenure expectations, facilitation objectives, moral/ethical values, other time commitments, and so on.

As we saw earlier in VAR, this practice of ‘frank speech’ is not without its consequences – by opening up a more transparent dialogue, facilitation roles were momentarily jumbled up. When I spoke to Elizabeth about this moment, she indicated to me a great resilience and desire to learn from the moment instead of resenting any possible undermining that occurred. Thus, ‘frank speech’ relied on the affective abilities of Elizabeth to recognize the generativity in tension, and was thus able to occur without creating a consequential sense of resentment.

And because Diego opened up a more frank conversation, team members felt encouraged to share their doubts about their data, their ideas for integration, and their hopes that integration could still happen in the future. In response to Fitzgerald et al. (2014) and Rabinow and Bennett’s (2012) experiences, perhaps both were right, but that the affective space must be shaped processually over time. Equivocal speech may have

been a natural tendency in the early stages as the new challenges of transdisciplinary collaboration faced team members, but as the initiative unfolded over time, and team members grew to know each other more affectively through attentive facilitation; trust, respect, and humility developed to allow for a more transparent mode of communication.

CHAPTER 6: INTEGRATION AND COSMOPOLITICS

In this chapter, I look at one of the key challenges in the Vermont Agricultural Resilience initiative in its aim to integrate modes of knowledge to foster agricultural resilience. In the first half of the chapter, I explore how initial strategies to sustain coherence within the group contributed to a provisional integration that led to VAR's early success in academic outputs. I use Star and Griesmer's (1989) concept of boundary work to draw attention to two strategies in creating boundary objects and discursively constructing VAR that fostered early team collaboration. In the second half of the chapter, I problematize these strategies by looking at the ethical-political nature of transdisciplinary work, and the value decisions inherent in the process normally excluded from disciplinary work. I do this by drawing on Annemarie Mol (2002) and others who seek an ontological politics that exposes the normative nature of science. While success was achieved in producing academic outputs like journal publications, there was limited success in fostering resilience for farmers. I look at how PAR was one such mode for integrating for farmers in theory, but ultimately limited by the nature of the research process. PAR is also suited for addressing power relations in the transdisciplinary process, and I look at the complications that arose out of implementing PAR. Finally, I argue that Stengers's (2010) 'cosmopolitics' broadens the outlooks of both transdisciplinarity and PAR by allowing for multiple modes of existence, entanglements, and nonhumans to productively enter the situation. A cosmopolitical approach, I ultimately argue, allows for the recognition that VAR is itself co-constructed by a myriad of nonhuman entities, indicating the political ecological ways in which VAR is not just producing knowledge but enacting the world itself.

6.1. Initial Integration: Strategies for Coherence

The issue of integration has been present since the beginning of the Vermont Agricultural Resilience initiative. One team member told me,

I think I was overwhelmed by the complexity of it when I first started. I think I read the initial grant proposal maybe three or four times and still had a pretty limited understanding of what it meant. My understanding has definitely improved... I don't remember thinking, "How is this all going to fit together," but that's what I'm thinking now so, anyway, I think I was more in just a wait and see and I think I know what my small little piece of this is and I'm not sure how it all fits together...

This sentiment was echoed widely around the team. As we saw in the previous chapter, some team members were new to transdisciplinary work, to UVM, and to the other team members and their respective fields. One team member even readily acknowledged not fully understanding at the start of the initiative what direction her research was going to go in, given the novelty of the approach even within her own field. In addition to the mounting complexity of the endeavor for the team members, a variety of logistics had to be coordinated just to enable the VAR initiative to exist such as securing funding, managing the convoluted payment process (which I was told was a nightmare), and coordinating meetings with the team, the advisory committee, and Diego's research group.

Thus, early strategies were required to keep the team operating as coherently as possible throughout all of these early activities. I argue that two main strategies emerged as a method of achieving coherence throughout a messy process: 1) Following Latour (1979), discursive practices like writing and planning grant proposals gave a sense of order and organization to the team; and 2) Following Star & Griesemer (1989),

“boundary objects” in the form of climate change best management practices (CCBMPS) were able to provisionally meet the disparate research needs of the PIs, local stakeholders, and administrators. Additionally, while both of these strategies allowed the team to maintain unity during the initial stages of the initiative, these would also prove problematic during the later stages of the initiative when VAR needed to 1) Assess their success in relation to the objectives proposed in the original organizing texts and 2) Satisfy the normative desire to integrate the research that had been done around these CCBMPs into a useful typology for farm resilience.

6.1.1. Strategy #1: Discursive Practices

Text and writing are powerful modes to give order to the world and create a perception of organization. As poststructuralist scholars have indicated (Derrida, 1998), text is laden with power dynamics that codify certain truths while dismissing others. As Latour and Woolgar (1979) show, scientific facts depend on inscription and transcription practices to make results more concrete. Barad (2003) writes, “Discursive practices produce, rather than merely describe, the “subjects” and “objects” of knowledge practices” (p. 819). While writing is not synonymous with Barad (2003) and Foucault’s (1970) understanding of discursive practices, language and writing play a significant role in actively perpetuating the dominant norms of what should and should not be said. Discourse, much more broadly, should be seen as all of those “immanent... and actual historically situated social conditions” (Barad, 2003, p. 819).

In the context of VAR, discourse is not only the actual language practices of VAR’s researchers – what they say and write – but also the practices that inform how research is conducted, performed, and judged. These broader discursive practices have

the effect of constituting the definition of proper research, as well as instilling in researchers the proper conduct for continuing specific understandings of science. I earlier described Diego as ‘breaking free’ from convention by openly including participatory action research in VAR’s initial proposal. This convention is part of the discursive practices that actively shape (or discourage) aspects of research that are seen as ‘unscientific’, like participatory action research and indigenous/lay/embodied knowledges. We could say that NSF’s research norms “produce, rather than merely describe, the “subjects” and “objects” of knowledge practices” (Barad, 2003, p. 819), since meeting their grant conditions requires one to follow their standard of scientific or knowledge convention.

And while VAR was able to break from convention – Diego did not have to “subversively incorporate the PAR pieces and transdisciplinary pieces,” as he explained to me – the proposal writing process was still an integral part of conceptualizing VAR’s research activities. But the writing process itself was experimental and might not adequately envision the challenges that emerge. One team member told me,

Grants get written in the abstract, at least new research projects, so a lot of this was formulated in you know, bursts of sitting around a table together and constructing a proposal. I mean, what you propose and what you end up doing always get tweaked or modified...

Given the challenging nature of the work – using a transdisciplinary and participatory action research approach to inform agricultural resilience – anticipating outcomes over three years requires taking leaps that may not actually be realistic when the research process begins. Because VAR’s work entails crossing into real world systems, the potential unanticipated challenges multiply. Roy Bhaskar (2010) writes, “Almost all the

phenomena of the world occur in open systems. That is to say, unlike the closed systemic paradigm, they are generated not by one, but by a multiplicity of causal structures, mechanisms, processes or fields” (p. 4). Interdisciplinarity and transdisciplinarity, Bhaskar argues, is requisite for understanding the phenomena of the world, but planning what this looks like ahead of time, I would argue, is impossible. One graduate student in VAR experienced equipment failure in the field, seasonal weather delays, and delayed timelines, which curtailed his original plan to finish his degree in two years.

While environmental contingencies and challenges emerged from the field, the team also felt that the issues that arose in the field did not challenge the team as much as having to adequately deal with the conditions that they set out in the original proposals. Diego reflected,

[It is] really hard to plan, because there are a lot of things happening, and I think that the interesting tension about planning and deliverables is a challenge, and also speaks well about the group because some people get stuff [done] when the timing doesn't work... and the fact that we were able to deal with the tension and move forward, *and deliver*, you know, outcomes or products was good... So, I think from the onset, doing all that we have done in three years is super ambitious, you know, and I would like a five year thing next time, but again, it was the first time in my career that somebody was saying, “Write a proposal for transdisciplinary project.” That was positive, [but also] a tension because it [was] not perfect. I would say it was more about the planning. It doesn't mean that environmental issues don't happen. Yes, they happen.

The planning and writing process for VAR was a complicated ordeal. Since writing a transdisciplinary grant that involved multiple stakeholders was new for the team, the final grant proposal reflected a multitude of ambitious goals and objectives. Consequently, the final grant proposal for the Food Systems Spire emerged out of this early, messy process of planning, and since it achieved success in attaining the Food Systems grant, it also came to represent the metric of success to evaluate VAR with. Naturally, as the process

of transdisciplinary work unfolded, uncertainty about these objectives began to seep in. I surveyed the team in the beginning of the second year, asking them what they thought of the main objectives original proposed. These objectives were:

1. Develop a typology of existing farming management practices that contribute to climate change mitigation and/or adaption goals (CCBMPs).
2. Analyze farmers' interest in pursuing specific farm management strategies under different climate change and policy response scenarios.
3. Determine how current responses to climate change could be improved through agroecological, outreach and policy innovations.
4. Provide decision support for policy makers and extension outreach programs related to climate change mitigation and adaptation in the agricultural landscape of Vermont.

The survey responses I received were in accordance that the objectives, especially the last two, needed to be re-assessed. These responses included:

- The last two have not been worked on very much yet.
- Healthy to revisit objectives to consider progress, where we may need to change direction, etc.
- I think it's always a good idea to keep revisiting objectives as projects progress as an important part of the learning process as well as keeping the work relevant.
- Not sure where innovation fits in relation to activities to date.
- Sometimes I get the impression team members are not on the same page (or clear about) our broad level aims.

These open-ended responses were also congruent with the Likert scale responses I received about each objective. The team felt like they were meeting the first objective (16 agree, 0 disagree/don't know), meeting the second objective to a lesser extent (13 agree, 3 don't know), did not feel like they were meeting the third objective (4 agree, 6 disagree, 6 don't know), and were uncertain whether the fourth objective was being met (8 agree, 2 disagree, 6 don't know). Thus, while some of the research activities planned

at the outset of the initiative were seeing progress, others were being perceived with doubt, uncertainty and/or ambivalence.

Discursive practices, seen here through the practices enacted to articulate a neat, three-year plan with four distinct and ambitious objects, produced a problematic sense of needing to fulfill these specific objectives, when perhaps the objectives needed re-evaluating given the plethora of matters of concern at play and the processual nature of transdisciplinary work. Because of this nature, complications invariably arose, impacting the ability of VAR to meet all of the objectives in a three-year period.

VAR's initial planning process, notably represented in the grant proposal that delineated the team's outcomes, impacted the perceptions of success by team members who were judging VAR based on these original objectives, which set high expectations for what VAR would accomplish. The original proposal indicates that VAR would "develop a transdisciplinary research methodology", and as we've seen, this alone is an emergent process, requiring extensive reflection. In the team survey, I asked team members what they had envisioned being the mode of participatory action research in VAR prior to joining the team – a more collaborative way of working with farmers or a more contractual way – and most believed it would end up being collaborative. When I asked the team what mode they thought VAR was currently operating in, many answered that VAR was contracting farmers and not working with them collaboratively, flipping their original responses.

As many team members described to me, writing the VAR proposal was a challenging process, and the end result was a document that could ostensibly explain what everyone was going to do, why the research was necessary, and the possible

outcomes that would emerge. Despite the problems that may have emerged later on because of this early codification of the initiative, it still offered a kind of unity, even if it was only temporary. The coherence provided by the proposal, while reflecting a significant moment of self-organization, may have limited the flexibility required by the nature of transdisciplinary research, which innately presents unpredictable challenges.

6.1.2. Strategy #2: Boundary Objects

One objective from the original proposal stands apart from the rest as being perceived as successful. The first objective, to “develop a typology of existing farming management practices that contribute to climate change mitigation and/or adaption goals (CCBMPs),” was viewed very positively by the team as a success. In this section, I argue that this success is a double-edged sword: that by constructing a “boundary object” through CCBMPs that was contained enough to be coherent yet fluid enough to be dynamic and multiple, team members in VAR were able to approach their work through their respective lenses (ontological, epistemological, and methodological approaches), while contributing to the collective construction of the CCBMP. Briefly, a climate change best management practice is an agricultural practice that can be implemented to either adapt to or mitigate climate change. Adapting to climate change, for example, may mean being able to withstand harsher climate events, while mitigating climate change may mean, for example, emitting less greenhouse gasses and capturing more carbon in the soil. One of the central tasks of the team was to initially define what these CCBMPs were.

Recall that when “tempers flared” for a brief moment in the initial stages of VAR, I drew attention to the multitude of matters of concern that were complicating the

space and possibly bubbling to the service. The subject of the conversation was around the list of CCBMPs to include, since they ranged from more ecological practices to more business and economic practices, and required an initial deliberation process. A team member explained,

We were figuring out the list of best management practices that we wanted to focus on, and the tension that was going on was between the hardcore ecologists, who were like, “Why would you suggest that drainage tiles is a best management practice?” and the people who are more business oriented were very clear like, “Because it’s a management strategy for increasing profits.”

Since VAR’s research was predicated on utilizing the knowledge of the disparate PIs while also following a tight research schedule, choosing a select group of CCBMPs was a critical part of meeting different needs. In the vignette above, we see a tension between the drainage tiles and how it serves the group. If we frame the issue as a matter of concern, asking ‘*for whom*’ or ‘*for what*’ (Latour, 2008) it matters, then on the one hand, ecologists might question its relevance for the natural processes on the farm in relation to agricultural resilience, while on the other, the business oriented people are suggesting that the drainage tiles impact farmers’ bottom lines, pointing to the need that economic resilience is also a significant contributor to resilience overall.

This tacit negotiation process was a key element in the early stages of VAR. The CCBMPs would need to adequately serve the research methods of each PI, which ranged from economic cost, to behavior/decision making, to visual landscape impact, to soil health impact. The landscape designer in the group, for example, required CCBMPs that could be visualized, which required thinking about CCBMPs that had a visual landscape impact. Not only would these selected CCBMPs need to meet the respective approaches of the researchers, but they would also determine which field sites (i.e. farms)

could be considered for research. The target farms were already limited by certain conditions – they had to be a certain size (gross more than \$10,000/year), be located within an hour of Burlington, and be a producer of veggie or meat. Farms then had to meet another set of criteria, being required to have one or more of the CCBMPs that were decided on. The team composed a broad list of 23 CCBMPs as an index for all possible practices that could inform agricultural resilience, but decided to focus on five in particular that each PI could research autonomously: cover cropping, no till, wetlands conservation, storm water runoff management, and rotational grazing. These practices covered a range of socio-ecological services like nutrient retention, carbon sequestration, and soil structure.

Complications did arise as a result of these limiting factors since finding and narrowing the farms and farmers that met these criteria took longer than expected. Because the team included social science methods, farmers not only had to use one of the CCBMPs, but also be willing to be participants in the research process. Qualitative interviews, for example, looked at their perceptions of climate change, agricultural resiliency, and CCBMPs; and economic analyses, another example, looked at their budgeting and willingness to change based on various subsidies, requiring a certain degree of budget management. The multiple considerations involved in selecting farms delayed the actual research process, since more time than was originally anticipated was required to successfully assess and vet the farmers. One graduate student, who moved to Burlington days after graduating college to begin research with his new advisor (a VAR PI), was unable to start research until the next year, since the field seasons in Vermont are much shorter than in other locations.

At the beginning of the third year, Elizabeth was happy to announce that VAR had exceeded the number of academic outputs initially anticipated in the proposals. In the Food Systems Spire grant, the team proposed eight total academic publications, and now anticipated 11, and they were also far exceeding the number of individual outputs that were initially thought possible: on-farm sampling was occurring on five farms instead of one, six landscape visualizations were in the works instead of the proposed two, and eight more grant proposals were being pursued. I argue that this success in publishing and research, which if we are to recall was the same metric of success for Fitzgerald et al.'s (2014) transdisciplinary group, was in part enabled by the successful mediation of disparate research needs by the CCBMPs as boundary objects.

Star and Griesmer (1989) experimentally suggest four different types of boundary objects. I will characterize VAR's process using these types, and see how success may have come as a result of this process of 'boundary work'.

Repositories are "built to deal with problems of heterogeneity caused by differences in unit of analysis" (p. 410) and are "piles" that can hold different types of objects. *Repositories* are places where objects of differing units of analysis (or enacted via different methodologies) can be listed adjacently or contained together but not integrated. In VAR, these include grant proposals where the individual approach to CCBMPs are listed, the team's database where all of the information is stored, and even the farms, where multiple enactments of the CCBMPs are made possible.

Ideal types are objects that do not "accurately describe the details of any one locality or thing. It is abstracted from all domains, and may be fairly vague" (p. 410). The unifying concepts that inform VAR – like agricultural resilience and climate change

– could be seen as discursive constructs that are ideal types, and are not specific in outlining the entities they refer to. Since all team members are knowledgeable about both these terms in their own way, these ideal types can hold the multifarious definitions of each team member. This does not mean, however, that these definitions are shared. One team member mentioned that her work was informed by making the system of soils more ‘resistant’ to system shocks (increasing the amount of stress a system can withstand before losing functionality), rather than more ‘resilient’ to them (improving the ability for a system to successfully bounce back after losing functionality). This stirred greater reflection about the terms, and catalyzed clarification on the ideal types at play in VAR.

Coincident boundaries are “common objects which have the same boundaries but different internal contents... the result is that work in different sites and with different perspectives can be conducted autonomously while cooperating parties share a common referent” (p. 411). These follow the CCBMPs themselves, where team members can work autonomously while still contributing to the same referent (a particular CCBMP like cover cropping). Team members can work in different sites, on a computer manipulating landscape scenes or modeling different agents, on-farm, in soils taking GHG measurements, in the living rooms of farmers asking them questions, in the budgeting spreadsheets of farmers, and so on. These coincident boundaries gave each PI just enough autonomy to go about their own normal research practice (subject to the normal complications that each researcher was used to), leading to a higher than anticipated number of outputs that satisfied a variety of matters of concern discussed earlier such as administrative expectations, pre-tenure pressures, graduate student careers, and the respective communities of researchers.

And finally, *standardized forms* are “boundary objects devised as methods of common communication across dispersed work groups,” and include standardized methods of collection. These also follow Latour’s (1987) ‘immutable mobiles’, which are “objects which can be transported over a long distance and convey unchanging information” (Star & Griesmer, 1989, p. 411). In VAR, the standardized forms that enabled all of the boundary work to occur could be seen through the standardized mode of conduct for team members to engage with farmers, to compensate them, the periodic check-in points, and the sampling criteria that a farm had to meet to be researched.

During the research phase of VAR, the construction of CCBMPs as boundary objects led to just enough coordination for researchers to work as a team, but gave enough flexibility to allow PIs to autonomously pursue their own research questions. Thus, the early tensions around research integration were temporarily resolved by creating systems where the PI’s activities did not have to be commensurate from the outset. I mentioned the different lenses PIs operated through in their research, and these, in some cases, were radically different. In terms of scale, both the microscopic and the macro-economic were considered. In terms of timeline, some activities were finished by the close of year one while others had not yet begun, while others were still being sorted out. And having five possible CCBMPs enabled researchers to select the one that most aligned with their research approach.

Were we to consider academic outputs the main determinant of transdisciplinary success, we might end here by saying that transdisciplinary groups need to manage themselves as “boundary organizations”, in following Parker and Crona (2012), while constructing the boundary objects that best allow the individual researchers to flourish in

their own respective paradigms. We could say that as a transdisciplinary initiative serving to bolster UVM's status as a renowned research institution, VAR has exceeded expectations and should be recognized for its transdisciplinary approach. But as we've seen, Diego conceived of success much more broadly than mere academic outputs, and while CCBMPs successfully led to early publications, many of the later integration challenges in VAR relate to the perception that the connection between CCBMPs and VAR's larger goal of agricultural resilience remains difficult to conceptualize. As one team member responded, "I think it is too early to know whether VAR's efforts have resulted in improved practices."

While CCBMPs may have served the individual research agendas of the PIs, the nature of doing transdisciplinary work on farms also springs forth questions of ethics and politics that don't normally emerge in a disciplinary scientific agenda. As a way of addressing these issues, participatory action research was implemented in VAR to foster greater co-construction of knowledge with farmers, to attend to power dynamics in the research cycle, and to ensure equitable modes of conduct during the transdisciplinary research process. In the next section, I look at how participatory action research has been practiced in VAR, examining the ethical and political issues that are unique to VAR's transdisciplinary work.

6.2. Problematizing Integration: Moving Beyond Mere Knowledge Production

6.2.1. Addressing the Ethical and Political through Participatory Action Research

Nigel Clark (2011) writes, "There is nothing new about scientists with worldly concerns, but clearly, climate change and related issues are drawing scientific 'witnesses' into unfamiliar ethical-political quandaries and affective intensities" (p. xix). VAR's

principal investigators, following our look at how Irene was an unforeseen, ‘inhuman’ event that drew us into unfamiliar territories, could also be seen as being drawn into such ‘quandaries.’ Science is not just called on to say what the world ‘is’ anymore, merely reporting back on the ‘state of the environment’, but rather, as Anders Blok (2011) writes, “Science is nowadays deeply embroiled in a conflict-ridden ontological cosmopolitics of ordering human and nonhuman entanglements” (p. 47). Following Karen Barad (2007), whose notion of “intra-action” features methodologically in this thesis, we can also say that VAR’s researchers themselves ‘intra-act’ with the world. Through their research activities, like asking farmers about climate change, showing stakeholders altered photos of reality, asking what the proper subsidies would be to implement a CCBMP, VAR’s researchers have engaged in a complicated process of ‘ordering human and nonhuman entanglements’ that have profound ethical questions attached to them. Given Barad’s understanding that discourse (or knowledge) and materiality (or the world) are not separate entities, we can say that VAR’s research interventions not only create knowledge, but also “radically construct” (Stengers, 2008a) the world.

In *The Body Multiple*, Annemarie Mol (2002) describes how a seemingly straightforward disease in atherosclerosis is actually a highly complex, mediated and enacted affair that requires the coordination of multiple kinds of doctors, nurses, and technicians to give it ‘form’. This ‘form’ of the disease, however, becomes multiple: ontologically, it takes on a different shape, diagnosis, or prognosis depending on whom the patient with the disease is seeing. Patients, then, become subject to a kind of ontological politics that “has to do with the way in which problems are framed, bodies are

shaped, and lives are pushed and pulled into one shape or another” (Mol, 2002, p. viii). In Mol’s situation, doctors become the primary mediator of the disease, determining the questions to ask, what other specialists need to be consulted, and what needs to be done to relieve the disease’s symptoms (as Mol indicates, there is no universally agreed upon ‘cure’ for atherosclerosis).

In a chapter called a “Politics of Who,” Mol critically analyzes the dynamic between diagnosticians and those they diagnose. In this ontological politics, it is up to the doctor to determine the primary reality of the disease, and what form it takes. All of the questions asked emanate from the point of view of the “expert,” while the patient must trust the better judgment of the one schooled in science and medicine. But Mol asks what would happen if these ontological politics were made equal, if the patient was allowed to weigh into the analysis. She writes, “What is it to differ? How many styles of differing are there, how may different entities or actors both clash and show interdependence, what is the character of the “sides” involved, what kind of materials (and socials) are they made of?” (p. 115). Similar to broadening the ‘scenography’ of Latour’s (2008) matters of concern, Mol wishes to fully open the dynamic that occurs when atherosclerosis is enacted, not only seeking to empirically analyze the active moment when it is enacted, but also the preceding and following issues that should inform the enactment.

Applying Mol’s critical lens to VAR, we see that in a similar way to the team members’ own subjectivities being bracketed off from the research process, so are the subjectivities of the stakeholders whose research VAR directly touches on and impacts in unforeseeable ways. VAR’s researchers, in moving outside of the university, are

working in complicated ethical situations of enactment. Even before the more explicit, ‘action’ outreach activities are implemented, VAR’s research methods actively engage with the world, enacting new realities. Landscape visualizations, for example, are deliberate enactments of different realities – some scenes, without any CCBMPs, reflect ‘do nothing’ scenarios, while others, scenes where CCBMPs have been used, represent a sufficiently adapted farm to climate change. Qualitative interviews with farmers, in similar ways that my own interviews have catalyzed deeper reflection on VAR, can enact perceived realities about climate change between the researcher and the researched that would not have otherwise occurred. Thus, there are ethical assumptions present in the research that have political ramifications in what type of world is considered ‘good’, what individual farmers should be doing, and who determines the nature of these enactments.

In the normal disciplinary research process for PIs, these enactments might not need to be given any second thought, but in a transdisciplinary setting where research entails studying real, complex problems, PIs are now involved in an expanding set of entanglements. And in VAR, where the research decisions are to be guided not only by the PIs but also by local stakeholders in a participatory action research (PAR) approach, we need to look at the politics of PAR as it has existed in the group, and whether this has been an adequate political mechanism for giving voice to outside stakeholders.

“Participatory action research (PAR) and related approaches seek to involve a diversity of stakeholders as active participants of an iterative process that integrates research, reflection, and action, and which seeks to provide voice to actors that have been traditionally excluded from the research process” (Mendez, Bacon, & Cohen, 2013, p. 9).

The stakeholder groups VAR explicitly outlined in the proposal include farmers, agricultural service-providers, and policy makers, and though their needs may have

theoretically been met in the proposal process, in my inquiries with team members, the opinion was widely shared that these voices were not prominent in the research process.

One team member spoke on VAR's implementation of participatory action research,

In this project there are so many diverse components and some need more collaborative, some may be more contractual...I feel like I am always striving for, or that my hope and my vision was that it would be collaborative—that was my expectation, but I feel like there is sort of this inertia that keeps pulling us more towards the contractual and it's unclear to me how much of that is because we are so busy in the university world and participation [from farmers] takes time. But I also think that there is a busyness in the farmer and stakeholder role too where they just kind of want us to come in, and do it, and just give them the answer. So, it's been interesting in reality watching that, almost like, gravitational pull away from collaboration. I feel like we have to work at it and be very intentional.

PAR, like transdisciplinarity, can be seen as a process. One team member suggested that VAR was moving all the time between different forms of participation, indicating the fluid and processual nature of PAR work. Other team members believed VAR had become less participatory over time, seeing it as a failure to overcome certain challenges to collaborate more closely. Participatory action research, like transdisciplinarity, has a greater discourse associated with what it is and how it should be implemented. A notable discursive feature of PAR is that it encourages reflections on power and domination in the research process. At an integration team meeting, Diego's graduate student, a farmer herself, was quick to caution the group about over-simplifying the process of change amongst farmers, critiquing the notion that mere knowledge and information transfer from research to farmers would result in behavior change. She suggested the team would be better served by employing more nuance for both the farmer and the researcher.

This raises a significant challenge to the notion that the CCBMPs were successful at contributing to agricultural resilience. Diego openly acknowledged that he

felt nervous about focusing on CCBMPs, referring to the tensions between a research agenda and a farmer agenda. While PIs flourished in the ‘boundary object’ framing of integration, in looking at PAR, and the ways that VAR’s researchers are necessarily implicated beyond the mere knowledge they generate, these underlying questions of change (what is the nature of this change) and knowledge (what are the forms of knowledge that matter) remained absent from the team. And while farms participated in VAR’s research and contributed to VAR’s success, the deeper political and ethical processes of PAR for negotiating power, matters of concern, and inequality were largely unattended to.

In the previous chapter, I mentioned that things ‘broke open’ once Diego stated that the data might not be able to be used. The aftermath of this conversation was lively and creative: some exciting new ideas were presented on how to integrate the research, but ultimately these lacked farmers’ voices, and were still framed in a context of generalizable, academic knowledge. Even the attempts by some team members to speak more on behalf of the farmers were unable to fully convey the imbalances assumed in the discussion. These concerns for equal representation emerged more prominently in individual interviews rather than group meetings, prompting my reflection that perhaps ‘speaking frankly’ about participation and politics must still be fostered. Like transdisciplinarity, however, the team indicated movement in thinking more about PAR, from the idealization phase when the grant was written, to the challenges in the field, to the reflection that PAR is a varied form of practice that can take different shapes even within a single research project. In the next section, I continue looking at issues of ethics and politics, moving towards more theoretical and experimental ground.

6.2.2. Cosmopolitics

In moving towards a posthumanist stance, I argue that human stakeholders are not the only ones implicated (or made absent) in VAR's research. Rather, in reflecting on the radical ways that humans and nonhumans are entangled in climate change and agriculture, and in following Clark's (2011) notion that humans are not always in the drivers seat of their destiny, I argue that we must expand the voices involved in these new "unfamiliar ethical-political quandaries" (Clark, 2011, p. xix), to include the nonhuman entities that are being radically re-ordered and composed during this process. As Anders Blok (2011) asks, how can we address the "conflict-ridden ontological cosmopolitics of ordering human and nonhuman entanglements"? (p. 47). VAR's researchers, through the material-discursive practices of their research, are enacting new phenomenon, constructing new understandings of CCBMPs, and re-thinking/arranging previous entanglements between, for example, soils, microbes, greenhouse gases, and landscapes. Latour (2004) writes, "Cosmopolitans may dream of the time when citizens of the world come to recognize that they all inhabit the same world, but cosmopolitics are up against a somewhat more daunting task: to see how this "same world" can be slowly *composed*" (p. 457). In an era of climate change, when a shared understanding of the world seems so important for tackling the largest environmental crisis of the day, VAR's researchers are each enacting a *new* world, in a form it's never been in before, with new understandings and arrangements catalyzed by their research activities.

The term *cosmopolitics* (Stengers, 2010) joins together the idea of "cosmos", which to Latour (2004) means "literally, everything—including all the vast numbers of

nonhuman entities making humans act” (p. 454) with a notion of “politics,” indicating the “many associations continually forged and broken between humans and nonhumans” (Robbert & Mickey, 2013, p. 1). To unpack what this means, Stengers seeks to move past a bifurcated worldview in which language, discourse, and society are separate from nature and the world, leading to the viewpoint that knowledge is an accurate reflection of the world. Cosmopolitics, however, far from seeing the world as set in these two buckets,

Suggests that there are as many modes of reality as there are entities. The task is to trace the multiplicity of associations between entities as they participate in a common, ecological collective – where nonhumans also have a voice in society – rather than to deliberate between the vacuous abstractions of nature and culture (Robbert & Mickey, 2013, p. 1-2).

In the Vermont Agricultural Resilience initiative, the multiple modes of reality and multiplicity of associations are vast. In recognizing the unknowable modes of reality of, say, Earth’s geological cycle and Vermont’s microbial life, it becomes even more complex once we recognize the radical entanglements between these modes of existence. Tropical storm Irene disrupted our previous way of doing things and demonstrated Earth’s undeniable power – yet at the same time, terms like the ‘Anthropocene’ also reflect our own impact on Earth’s systems. And the little microbe, similarly to how Latour (1988) demonstrated its significance in Louis Pasteur’s experiments, has become an important player in mitigating the dangerous greenhouse gases we have emitted. Cosmopolitics seeks to trace these associations while ending the habit of privileging human agency and rationality, in the form, for example, of scientists who are seen as universal bridge builders to truth.

Scientific knowledge in cosmopolitics, “is not what is achieved when

researchers are able to detach from the world they study like disinterested observers; rather, knowledge is a powerful link between researchers and the subjects of research” (Robbert & Mickey, 2013, p. 4). This knowledge, far from existing as ideas in a vacuum, is according to Donna Haraway (2008), actual “technologies for pursuing inquiries” (p. 282). In VAR, when PIs generate agent-based models, landscape visualizations, economic analyses, qualitative data, greenhouse gas results, and so on, these forms of knowledge become values that shape the future direction of VAR, and of climate change and agricultural resilience action overall. Researching, for example, the most efficient subsidy to effect adoption of CCBMPs creates a value proposition that, once constructed, becomes a part of the ecology of practices that constitute that particular researcher[s]’ ‘mode of reality’. And where cosmopolitics continues, is in its commitment to action:

While the ecology of practices points to the entangled, coinvention of identities, it does not suggest a consensus of conflicting parts brought into an ideal peace or overarching harmony—but this lack of consensus between modes of value does not foreclose the possibility of mutually enhancing relationships. For Stengers “symbiotic agreements” describe the events in which different modes of existence render one another stable (Stengers, 2010, p. 35). When a practice maintains a certain set of values that in turn stabilize the practice, a symbiotic agreement has formed. Symbiotic agreements bear upon ethical practices of knowledge and decision-making, calling for responsibility—a “sharing of suffering” (Haraway, 2008, p. 72)— wherein our practices participate in the struggles and challenges of whatever modes of existence we are engaging. (Robbert & Mickey, 2013, p. 4)

The goal is not to create consensus, but instead to attend to the ‘modes of existence’ or realities that our practice is entangled with. What sorts of modes of existence is VAR enacting? Far be it from me to determine, but in the last chapter we’ve at least elucidated that there are deeper, more subjective commitments that inform the principal investigators’ ecology of practices. And these practices, as we’ve seen, are processes that are immanent to the situation: the move to Vermont’s unique agricultural systems

presented an initial discontinuity for Susan, who required time and energy to slowly adapt her own ecology of practices to the New England topology. In this example, we see two modes of existence: the ecology of practices that constitute climate science for Susan, and the ecology of practices that govern the soils and microbes on farms in Vermont. “Symbiotic agreements” must therefore emerge through Susan’s entanglement with the microbes in the soil: just as Pasteur was dependent on his microbes to discover pasteurization, Susan relies on the activity of her own microbes to sequester carbon in the soil. Yet simultaneously, Susan must attend to the microbes’ own modes of existence, entangling with them so as to optimize their own flourishing.

In recognizing the irreducible complexity of life, cosmopolitics suggests that our responses to ecological phenomena “are not determined from on high by detached observers, but emerge in the act of companioning with as many species as possible—participating in the material semiotic networks of all the beings involved in the situation, human and nonhuman, corporeal and incorporeal, natural and artificial, familiar and uncanny” (Robbert & Mickey, 2013, p. 6). I argue that this requires a radical humility. In the previous chapter, we observed the humility that enabled a sense of trust and respect amongst VAR’s researchers, and in the cosmopolitical context, humility must also be extended beyond the human researchers, to the myriad ways that we are able or unable to entangle with other entities. We must be humbled when scientific practices *do not* end with the results we’d like, and we must readily acknowledge the ecology of practices of others, including humans and nonhumans.

If part of the aims of transdisciplinarity and participatory action research is to co-construct knowledge across various ways of knowing and to open up the gates for

those that are allowed to participate, how would cosmopolitics help? I believe that a cosmopolitical understanding can enhance and nuance these two frameworks. For transdisciplinarity, cosmopolitics addresses the mere ‘knowledge creation’ aims, looking at the entanglements that ripple out from the practice of doing research on farms. Cosmopolitics would articulate that no transdisciplinary meta-language could encapsulate the complexities of a situation, and shared modes of communication would emerge over time: “All meta-languages are terms that unite different entities from the *inside* at a cost; and, like conditions, they are immanent to events, rather than external to them” (Robbert & Mickey, 2013, p. 3). Cosmopolitics would also look at the ecologies of practices in VAR, from each individual PI, to each stakeholder, to the landscapes themselves, and understanding these ecologies of practices to necessarily evolve as the values of those involved shaped the changes these practices enacted. And for participatory action research, cosmopolitics would say, ‘Look further, at those other entities that also participate.’ The subjects in the relations of power and domination that PAR aims to address would be extended in a political ecological sense to include other beings and entities involved in the situation (Latour, 2004). The task is to develop the “symbiotic agreements” that would best allow different modes of existence to flourish. These moves towards broadening participation, however, might not be harmonious, but be marked by contention and incommensurability.

In recognizing the theoretical and experimental nature of cosmopolitics, especially in light of all the empirically observed challenges facing VAR, I suggest that far from operationalizing cosmopolitics, it can lure us into new patterns of thought that recognize the ways in which VAR implores an array of humans and nonhumans to elicit

new phenomena. In recognizing this ontological pluralism, we can openly grapple with the complexity of their situation, understanding that their knowledge is both experimental and enactive, that is, always wrestling to align their ecology of practices with the emergent realities of the world. Given the terra incognita that VAR has already found itself in, and the provisional solutions that have been drawn up to address new challenges, cosmopolitically charged thinking in transdisciplinarity and PAR may not be too far off from the future.

CHAPTER 7: LOOKING BACK AND MOVING FORWARD

7.1. Reflecting on Enactment

One major goal throughout my experience with VAR has been to be as reflexive as possible, being as straight forward and transparent in my intentions with the team, readily accepting my inherent biases and predilections, and grappling with the idea that I did not want this project simply to be a written recording of my activities with the team. It took a challenging comprehensive exam on material feminism to see the situation differently: whether or not I outlined some explicit form of action to take place out of this thesis (as an ‘action research’ approach), my methodological and personal enactments with the team have already shaped the composition, nature, and thinking of VAR. While I never intended to be a ‘fly on the wall’ ethnographer, quietly observing in the corner of the room, I also never anticipated the ways that theory, relationship, and this project would intersect in such a lively manner (though admittedly, I was still fairly quiet during meetings). In this final chapter, I conclude by reflecting on my interventions in VAR, their repercussions and effects on the team, and the concepts of enactment and ‘intra-action’ as they played out in my research.

At every team meeting, I was always welcomed and introduced as a graduate student studying the process of transdisciplinary collaboration in VAR. At my first meeting, my introduction immediately triggered ripples. I was already nervous, with sweaty palms, observing the team meeting and waiting for my slot in the agenda to introduce my interests in the team. I had pages of notes written down: do I talk about my advisor? My field? My background? My preliminary thoughts or ideas, perhaps? I had built up this moment as a hyper-important crux in my research, thinking to myself, “The

tone I set now will determine the quality of my data for the next year,” and with that pressure sinking to the bottom of my stomach, I finally reached my spot in the agenda and launched into my introduction. Needless to say, my introduction ended up lasting quite a few pages less than what I had prepared, because I forgot most of what I wanted to say, but my speech was enough to trigger immediate responses. I remember one team member exclaiming excitedly, “Oh, you’ll have to go to the farm with me!”

But almost immediately, another team member, who had been completely silent for the duration of the team meeting, burst into a minor diatribe, “We need to have a serious conversation about what transdisciplinary means in the context of this team, because it is not transdisciplinary, and certainly not as transdisciplinary as another research project I’m on.” This was my first experienced methodological enactment – the simple act of introducing my work prompted one team member to give his thoughts, in a public forum, on the success of VAR’s transdisciplinary goal. Later, I would learn that this reaction sparked some discussion between the facilitators (another ripple effect of my intervention).

In my interview with this same team member, he encouraged me to “hold the mirror up” to the team and to consider taking an action research approach with my thesis. This led me to thinking about another dynamic that I had never anticipated: my own research being operationalized by the team so that they could improve. When I finally met Diego, after his sabbatical in VAR’s second year, he encouraged Elizabeth and me to survey the team to figure out, first, who would participate, and second, how the team felt about progress in VAR. A survey seemed useful for some information, but I was also interested in fleshing it out – since there’s only so much a Likert scale can tell you – and I

proposed a follow-up focus group to reflect on the survey and survey responses.

This has been how many of my research activities have been planned, as co-conceived ideas between the research team and myself. When planning the focus group, I practiced the delivery on Diego's research group before VAR. His group, with many dedicated PAR practitioners, gave the idea of using the focus group as an actual VAR team tool to incorporate the reflection process that is so vital to participatory action research, which could also elicit better data for me. Incorporating their feedback, I ran the focus group as if it were part of the reflection phase of PAR, and the team reflected like I'd never heard before. One team member said to the group,

I think that we have had tensions at moments, you know around survey design and other moments where there was maybe not consensus among the group, but it was facilitated, and I feel like what seems to have carried it through is both a deep respect for everyone here around the table.

This type of deeper reflection and honesty was new to the team meeting setting, and using the focus group as an opportunity for team members to say things more openly had the effect not only of intimating more details for my research, but also set a different tone for the last semester of VAR. The realizations that data might not be able to be integrated, that PAR is a long process, and that agendas are different across the board emerged in this last period of collaboration.

Thus, I would also argue against the notion that I am the sole author of this thesis. My data is everyone's data: Diego's research group, Diego himself, Elizabeth, and VAR's team members – many of whom were well versed in transdisciplinary discourse and gave me valuable insights – were all part of the 'intra-action' that allowed the phenomena in this thesis to emerge. I asked Diego what he thought the impacts of my

research presence and enactments were on him,

It's been really positive for me because – I think that you've probably seen this even in my directions with the team since you started – you brought an emphasis on transdisciplinarity that wasn't there before...So I think that what you've done more for me than for the rest of the team is just reminded me of the importance of going deeper into transdisciplinarity and by doing that realizing, "Okay, I've forgotten how complex it is."

Diego in turn shaped my thinking on transdisciplinarity, always making sure I kept participatory action research in the picture as well. Early on, at our first meeting together, he stressed the importance of transparency in research, and that theme was woven through my process: in IRB approval, interviews, research purposes, and even the methodology in this thesis. In my introduction, I touched on Lather's (1993) notion of validity, who writes,

Rather than take refuge in the futility of self-critique, however, I want to attempt it as aware as possible of its inevitable shortcomings, all that which remains opaque to myself. There is much in my performance as a researcher that I cannot reach, much that eludes the logic of the self-present subject (p. 685).

And it is true that much remains out of grasp, still in the hinterland of what I have not made present (Law, 2004), but for those enactments that I have made present, Diego, Elizabeth, my committee, and the numerous theorists who have appeared are all to thank – and I believe some of the 'inevitable shortcomings' that Lather cautions me about were improved by this cadre of individuals, for drawing my awareness to places I would not have explored otherwise and making this thesis's thinking more rigorous.

But, in following Clark, Mol, Stengers, Latour, and the others that have shaped the ontological thinking in this thesis, my data has not solely been the work of humans. Microbes, gasses, farming practices, landscapes, models, plants, forests, tropical storms, warming temperatures – these are the lifeblood of VAR's work, and though I accessed

these through team members, the team's own material enactment and entanglement with these nonhuman agencies are real and impactful. Recall that, "the argument is no longer that methods *discover* and depict realities. Instead, it is that they participate in the *enactment* of those realities" (Law, 2004, p. 45). In the previous chapter, I looked at how VAR's researchers' own enactments of the world are embedded in complex ethical and political situations. This thesis is not bereft of those same issues. Speaking on the effects that my research had on the team, Diego mentioned that my thesis, with VAR as its case study, brought "additional layers of validity" to what they were doing, and also added,

I do think that a lot of your questions and interviews have made everyone not only think deeper, but also understand better what transdisciplinarity is. It really helped us in that level of understanding – not for resolution – but just advancing everyone...the focus groups, the questions, and the interviews – they're forcing me to think and I might not have done that.

The question that I repeatedly asked myself, which informed the ethical and political stance taken in this thesis, was, "Will this, to the best of my knowledge, be constructive for the team?" Transdisciplinary practice is plural, and the approach that I have adopted is to see the practice of transdisciplinarity as a *process of becoming*. Others would disagree; perhaps there are specific variables that determine transdisciplinary success. What I would argue is that my ethical and political questions were shaped in close concert with the team, and were motivated by my desire to see them flourish. As an expression of Stengers's (2010) 'symbiotic agreements', the methodological enactments I produced in this thesis always had VAR's 'matters of concern' at heart.

7.2. Becoming

By now, the reader is no doubt wondering how we ended up here. Over the last several chapters, this thesis has addressed transdisciplinarity and PAR, climate change

and inhuman nature, matters of concern and cosmopolitics, affect and subjectivity, process and becoming, enactment and posthumanism, among many other things. When I began this project, I never intended to construct the circuitous path that exists here, but as new challenges arose, and as my advisor continued to prompt new patterns of thought, the Vermont Agricultural Resilience initiative became a powerful vessel for thinking through all manners of problems that I was working through. Borrowing another Whiteheadian (1967) phrase, VAR has led me through ‘adventures of ideas’, and this thesis marks a concrescence of processes, a momentarily stabilized assemblage that will soon become something else. The efforts of the Vermont Agricultural Resilience team, I sincerely believe, have taken us in a positive direction, and as part of our own species’ process of ‘becoming with’ the world, my goal has been to unsettle and diffractively interpret this transdisciplinary endeavor to re-frame the challenges, problems, and solutions that are now endemic to our new realities.

CHAPTER 8: BIBLIOGRAPHY

- Barad, K. (2003). Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter. *Signs: Journal of Women in Culture and Society*, 28(3).
- Barad, K. (2007). *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham, NC: Duke University Press.
- Barnes, B. (1974/2013). *Scientific Knowledge and Sociological Theory*. London: Routledge.
- Betts, A. (2011). Climate Change in Vermont. *Climate Change Adaptation White Paper Series*. Vermont Agency of Natural Resources.
- Bhaskar, R. F., Cheryl; Hoyer, K. G.; Naess, Petter; Parker, Jenneth (Ed.). (2010). *Interdisciplinarity and Climate Change*. New York: Routledge.
- Blackman, L. (2012). *Immaterial Bodies: Affect, Embodiment, Mediation*. London: University of London Press.
- Blaser, M. (2013). Ontological Conflicts and the Stories of Peoples in Spite of Europe: Toward a Conversation on Political Ontology. *Current Anthropology*, 54(5).
- Blok, A. (2010). Topologies of climate change: actor-network theory, relational-scalar analytics, and carbon-market overflows. *Environment and Planning D: Society and Space*, 28(5), 896-912.
- Blok, A. (2011). War of the Whales: Post-Sovereign Science and Agonistic Cosmopolitics in Japanese-Global Whaling Assemblages. *Science, Technology, & Human Values*, 36(1), 55-81.
- Bloor, D. (1976/1991). *Knowledge and Social Imagery*. Chicago, IL: University of Chicago Press.
- Brinkmann, S. (2014). Doing Without Data. *Qualitative Inquiry*, 20(6).
- Callon, M. (1986). Some elements of a sociology of translation: domestication of the scallops and the fishermen of St Brieuc Bay. In J. Law (Ed.), *Power, action and belief: a new sociology of knowledge?* (pp. 196-223). London: Routledge.
- Calvert, J., & Martin, P. (2009). The role of social scientists in synthetic biology. *Science & Society Series on Convergence Research. EMBO Reports*, 10(3), 201-204.
- Carolan, M. S. (2006). Science, Expertise, and the Democratization of the Decision-Making Process. *Society & Natural Resources*, 19(7), 661-668.

- Carolan, M. S. (2009). Process Sub-politics: Placing Empirical Flesh on Whiteheadian Thought. *Ethics, Place & Environment: A Journal of Philosophy & Geography*, 12(2).
- Community & Economic Development Office. (2015). History | City of Burlington, VT. Retrieved from <https://www.burlingtonvt.gov/CEDO/History>
- Childers, S. (2013). The Materiality of Fieldwork: An Ontology of Feminist Becoming. *International Journal of Qualitative Studies in Education*, 26(5).
- Clark, N. (2011). *Inhuman Nature: Sociable Life on a Dynamic Planet*. New York: Sage Publications.
- Clark/Keefe, K. (2014). Suspended Animation: Attuning to Material-Discursive Data and Attending via Poesis During Somatographic Inquiry. *Qualitative Inquiry*, 20(6).
- Clarke, A. (2005). *Situational Analysis: Grounded Theory After the Postmodern Turn*. Thousand Oaks, CA: Sage Publications.
- Collins, H. M., & Evans, R. (2002). The Third Wave of Science Studies: Studies of Expertise and Experience. *Social Studies of Science*, 32(2), 235-296.
- Coole, D., Frost, S., Bennett, J., Cheah, P., Orlie, M. A., & Grosz, E. (2010). *New Materialisms: Ontology, Agency, and Politics*. Durham, NC: Duke University Press.
- Coopmans, C., Vertesi, J., Lynch, M. E., & Woolgar, S. (2013). *Representation in Scientific Practice Revisited*. Cambridge, MA: MIT Press.
- Deleuze, G., & Guattari, F. (1980/2004). *A Thousand Plateaus: Capitalism and Schizophrenia*. Minneapolis: University of Minnesota Press.
- Derrida, J. (1998). *Of Grammatology*. Baltimore, MD: Johns Hopkins University Press.
- Dewey, J. (1918). *Essays on Experimental Logic*. Chicago: University of Chicago Press.
- Dewey, J. (1938). *Logic: Theory of Inquiry*. New York: Henry Holt and Company.
- Escobar, A. (2007). The 'Ontological Turn' in Social Theory. A Commentary on 'Human Geography Without Scale', by Sallie Marston, John Paul Jones II and Keith Woodward. *Transactions of the Institute of British Geographers*, 32(1), 106-111.
- Fitzgerald, D., Littlefield, M. M., Knudsen, K. J., Tonks, J., & Dietz, M. J. (2014). Ambivalence, equivocation and the politics of experimental knowledge: A transdisciplinary neuroscience encounter. *Social Studies of Science*, 44(5), 701-721.

- Foucault, M. (1970). *The Order of Things*. New York: Random House.
- Foucault, M., Rabinow, P., & Rose, N. S. (2003). *The Essential Foucault: Selections from Essential Works of Foucault, 1954-1984*. New York: The New Press.
- Frodeman, R., Klein, J. T., & Mitcham, C. (2012). *The Oxford Handbook of Interdisciplinarity*. Oxford: Oxford University Press.
- Galison, P. (1997). *Image and Logic: A Material Culture of Microphysics*. Chicago: University of Chicago Press.
- Gieryn, T. F. (1983). Boundary-work and the demarcation of science from non-science: Strains and interests in professional ideologies of scientists. *American Sociological Review*, 781-795.
- Hackett, E. J., Amsterdamska, O., Lynch, M., & Wajcman, J. (2008). *The Handbook of Science and Technology Studies*. Cambridge, MA: The MIT Press.
- Haire-Joshu, D., & McBride, T. (Eds.). (2013). *Transdisciplinary Public Health: Research, Education, and Practice*. San Francisco: Jossey-Bass.
- Halewood, M. (2008). Introduction to Special Section on A.N. Whitehead. *Theory, Culture & Society*, 25(4), 1-14.
- Haraway, D. (1988). Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. *Feminist Studies*, 14(3), 575-599.
- Haraway, D. J. (1991). A Cyborg Manifesto: Science, Technology and Socialist Feminism in the Late Twentieth Century *Simians, Cyborgs, and Women: The Reinvention of Nature*. London: Routledge.
- Haraway, D. J. (1992). A Regenerative Politics for Inappropriate/d Others. In L. Grossberg, C. Nelson & P. Treichler (Eds.), *Cultural Studies*. New York: Routledge.
- Haraway, D. J. (2008). *When Species Meet*. Minneapolis: University of Minnesota Press.
- Holling, C.S. (1973). Resilience and Stability of Ecological Systems. *Annual Review of Ecology and Systematics*, Vol. 4.
- Huutoniemi, K., Klein, J. T., Bruun, H., & Hukkinen, J. (2010). Analyzing interdisciplinarity: Typology and indicators. *Research Policy*, 39(1), 79-88.
- Ivakhiv, A. (2013). *Ecologies of the Moving Image*. Waterloo, ON, Canada: Wilfrid Laurier University Press.

- Jackson, A. Y., & Mazzei, L. A. (2012). *Thinking with Theory in Qualitative Research: Viewing Data Across Multiple Perspectives*. New York: Routledge.
- Klein, J. T. (2008). Evaluation of Interdisciplinary and Transdisciplinary Research: A Literature Review. *American Journal of Preventative Medicine*, 35(2S).
- Kohn, E. (2013). *How Forests Think: Toward an Anthropology Beyond the Human*. Berkeley, CA: University of California Press.
- Koopman, C. (2013). *Genealogy as Critique: Foucault and the Problems of Modernity*. Bloomington, IN: Indiana University Press.
- Kuhn, T. S., & Hacking, I. (1962/2012). *The Structure of Scientific Revolutions: 50th Anniversary Edition*. Chicago: University of Chicago Press.
- Lather, P. (1993). Fertile Obsession: Validity After Poststructuralism. *The Sociological Quarterly*, 34(4), 673-693.
- Latour, B. (1987). *Science in Action: How to Follow Scientists and Engineers Through Society*. Cambridge, MA: Harvard University Press.
- Latour, B. (1993). *We Have Never Been Modern*. Cambridge, MA: Harvard University Press.
- Latour, B. (1997). Foreword: Stenger's Shibboleth. In I. Stengers (Ed.), *Power and Invention: Situating Science*. Minneapolis: University of Minnesota Press.
- Latour, B. (1999). *Pandora's Hope: Essays on the Reality of Science Studies*. Cambridge, MA: Harvard University Press.
- Latour, B. (2004). *Politics of Nature*. Cambridge, MA: Harvard University Press.
- Latour, B. (2007). A Plea for Earthly Sciences. In J. Burnett, S. Jeffers & G. Thomas (Eds.), *New Social Connections: Sociology's Subjects and Objects*, Palgrave Macmillan, London. London: Palgrave Macmillan.
- Latour, B. (2008). What is the Style of Matters of Concern? *Spinoza Lectures*. Amsterdam: Van Gorcum.
- Latour, B. (2012). Love Your Monsters: Why We Must Care for Our Technologies As We Do Our Children. *Breakthrough Journal*, Winter 2012. Retrieved from <http://thebreakthrough.org/index.php/journal/past-issues/issue-2/love-your-monsters>

- Law, J. (1986). On the Methods of Long Distance Control: Vessels, Navigation and the Portuguese Route to India. In J. Law (Ed.), *Power, Action and Belief: A New Sociology of Knowledge?* London: Routledge.
- Law, J. (2004). *After Method: Mess in Social Science Research*. New York: Routledge.
- Levin, K., Cashore, B., Bernstein, S., & Auld, G. (2012). Overcoming the Tragedy of Super Wicked Problems: Constraining Our Future Selves to Ameliorate Global Climate Change. *Policy Sciences*, 45(2), 123-152.
- MacLure, M. (2003). *Discourse in Educational and Social Research*. Philadelphia, PA: Open University Press.
- Max-Neef, M. A. (2005). Foundations of Transdisciplinarity. *Ecological Economics*, 53(1), 5-16.
- Maxwell, J. A. (2013). *Qualitative Research Design: An Interactive Approach: An Interactive Approach*. Thousand Oaks, CA: Sage Publications.
- Mazzei, L. (2014). Beyond an Easy Sense: A Diffractive Analysis. *Qualitative Inquiry*, 20(6).
- Mendez, V. E., Bacon, C., & Cohen, R. (2013). Agroecology as a Transdisciplinary, Participatory, and Action-Oriented Approach. *Agroecology and Sustainable Food Systems*, 37(1).
- Merchant, S. (2011). The Body and the Senses: Visual Methods, Videography and the Submarine Sensorium. *Body & Society*, 17(1).
- Merton, R. K. (1973). *The Sociology of Science: Theoretical and Empirical Investigations*. Chicago, IL: University of Chicago Press.
- Mills, C. W. (2000). *The Sociological Imagination*. Oxford: Oxford University Press.
- Mol, A. (2002). *The Body Multiple: Ontology in Medical Practice*. Durham, NC: Duke University Press.
- National Science Foundation (NSF). (2006). *Investing in America's Future: Strategic Plan*. Retrieved from <http://www.uvm.edu/~tri/pdf/NSF-StrategicPlan2006-11.pdf>
- Parker, J., & Crona, B. (2012). On being all things to all people: Boundary organizations and the contemporary research university. *Social Studies of Science*, 42(2), 262-289.

- Pealer, S. (2012). Lessons from Irene: Building resiliency as we rebuild. *Vermont Agency of Natural Resources*. Retrieved from http://www.anr.state.vt.us/anr/climatechange/Pubs/Irene_Facts.pdf
- Pickering, A. (1995). *The Mangle of Practice: Time, Agency, and Science*. Chicago, IL: University of Chicago Press.
- Rabinow, P., & Bennett, G. (2012). *Designing Human Practices: An Experiment with Synthetic Biology*. Chicago, IL: University of Chicago Press.
- Reyers, B., Roux, D., Cowling, R., Ginsburg, A., NEL, J., & O'Farrell, P. (2010). Conservation planning as a transdisciplinary process. *Conservation Biology*, 24(4).
- Ringrose, J., & Renold, E. (2014). "F**k Rape!": Exploring Affective Intensities in a Feminist Research Assemblage. *Qualitative Inquiry*, 20(6).
- Robbert, A., & Mickey, S. (2013). "Cosmopolitics: An Ongoing Question." Paper presented at the Political Theory and Entanglement: Politics at the Overlap of Race, Class and Gender, The Center for Process Studies, Claremont, CA.
- Schattman, R., Mendez, V. E., Westdijk, K., Caswell, M., Conner, D., Koliba, C., . . . Darby, H. (2014). Vermont Agricultural Resilience in a Changing Climate: A Transdisciplinary and Participatory Action Research (PAR) Process. *Agroecology, Ecosystems and Sustainability*. Boca Raton, FL: CRC Press
- Scherr, S., & Sthapit, S. (2009). Farming and Land Use to Cool the Planet. In T. W. Institute (Ed.), *State of the World: Into a Warming World*. Washington, D.C.: World Watch.
- Schiermeier, Q. (2005). Natural disasters: The chaos to come. *Nature*, 438(7070), 903-906.
- Scholz, R. W. (2011). *Environmental Literacy in Science and Society: From Knowledge to Decisions*. Cambridge: Cambridge University Press.
- Sismondo, S. (2008). Science and Technology Studies and an Engaged Program. In Hackett et. al. (Ed.), *Handbook of Science and Technology Studies*. Cambridge, MA: MIT Press.
- St. Pierre, E., & Jackson, A. Y. (2014). Qualitative Data Analysis After Coding. *Qualitative Inquiry*, 20(6).
- Star, S. L., & Griesemer, J. (1989). Institutional Ecology, "Translations" and Coherence: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science*, 19(3).

- Stengers, I. (2008a). A Constructivist Reading of Process and Reality. *Theory, Culture & Society*, 25(4), 91-110.
- Stengers, I. (2008b). Unity Through Divergence: Whitehead's Answer to the Fallacy of Misplaced Concreteness. In M. Dibben & T. Kelly (Eds.), *Applied Process Thought: Initial Explorations in Theory and Research*. Berlin: Walter de Gruyter.
- Stengers, I. (2010). *Cosmopolitics I*. Minneapolis: University of Minnesota Press.
- van Heur, B., Leydesdorff, L., & Wyatt, S. (2013). Turning to ontology in STS? Turning to STS through 'ontology'. *Social Studies of Science*, 43(3), 341-362.
- The University of Vermont. (2009). Transdisciplinary Research Initiative: Announcement and Call for Nominations. Retrieved from http://www.uvm.edu/~tri/pdf/UVM-TRI_announcement.pdf
- The University of Vermont. (2014). 2013-14 Annual Report of the Transdisciplinary Research Initiative. Retrieved from <http://www.uvm.edu/~tri/pdf/2013-14%20TRI%20Annual%20Report.pdf>
- The University of Vermont. (2015a). Transdisciplinary Research Initiative (TRI). Retrieved from <http://www.uvm.edu/~tri/>
- The University of Vermont. (2015b). Environmental Studies at UVM. Retrieved from <http://www.uvm.edu/envprog/welcome-environmental-program>
- The University of Vermont. (2015c). Extension: Cultivating Healthy Communities. Retrieved from <http://www.uvm.edu/extension/>
- Vermont Agency of Natural Resources (ANR). (2015). Tropical Storm Irene: By the Numbers. Retrieved from <http://www.anr.state.vt.us/anr/climatechange/irenebythenumbers.html>
- Washington State University (WSU) Extension. (2009). What is a Land-Grant College? Retrieved from <http://ext.wsu.edu/documents/landgrant.pdf>
- Whitehead, A. N. (1929/1978). *Process and Reality*. New York: The Free Press.
- Whitehead, A. N. (1967). *Adventures of Ideas*. New York: The Free Press.
- Willems-Braun, B. (1997). Buried Epistemologies: The Politics of Nature in (Post)colonial British Columbia. *Annals of the Association of American Geographers*, 87(1), 3-31.
- Woolgar, S., & Lezaun, J. (2013). The wrong bin bag: A turn to ontology in science and technology studies? *Social Studies of Science*, 43(3), 321-340.