

**MATERIALIZING THE CONDITIONS OF SCIENTIFIC KNOWLEDGE
PRODUCTION: (DE/RE)CONSTRUCTING, TRANSFORMING, AND ANIMATING
NEUROSCIENCE DATA WITH INTERDISCIPLINARY FRAMEWORKS**

by

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Abstract

Scholars have spent decades critiquing modern Euro-centric scientific knowledge production, documenting its strengths and harms for scientific practitioners, the quality of knowledge produced, its enmeshment in the social and political conditions of its production, and its positive and negative impacts at local and global scales. Despite this, sociopolitical ideologies have been codified into the structures and norms of how science is practiced, invisibilizing biases and harm. This thesis counters institutional silencing by revealing ongoing problems in Euro-centric academic scientific knowledge production practices in order to expand contemporary scientific education. Autotheory and reflexive methodologies link personal narratives with systemic prejudices, documenting the impact of biased structural institutions on individuals, communities, and practices. Thinking with science, technology, and society scholars (STS), and feminist, postcolonial, race, and queer theorists, I propose an interdisciplinary and relational model that entangles and complicates scientific practices. This entanglement reduces unnecessary hierarchies, holds contradictions in tension, and refuses to reproduce politics of domination, instead creating horizontality; space for more and other. Additionally, I demonstrate one methodology that processes visual neuroscience data with an embodied artmaking practice, integrating that which modern science excludes: ill-fitting data, the affective and subjective, the animals and bodies, the illogical and uncertain. Data collected in an avian visual neuroscience laboratory is subjected to a multi-step protocol resulting in animations and objects that are emergent and unpredictable, and that integrate multiple and marginalized forms of data. Collectively, the thesis simultaneously dissects academic scientific knowledge production, demands and describes other ways of thinking, working, and being, and demonstrates what is

possible when science is freed from capital and colonial instrumental goals and instead embraces ambiguity and multiplicity. Radically altering Euro-centric scientific knowledge production can open science up to other types of data, questions, and methodologies, undo some of its codified -isms, allow for imaginative, proximal, and attuned modes of knowledge and pedagogy, and ultimately create space for the participation of more and different practitioners.

Lay Summary

This thesis aims to integrate ideas and theories from the humanities and activist scholars, and practitioner body, affect, and experience, with scientific practice in order to produce knowledge and methodologies that are expansive and inclusive. By pairing critique of modern Euro-centric scientific practices with personal narratives—grounding critique within personal practice—a framework emerges that creates space for a multitude of ways of engaging in science without the exclusion produced under the influence of capitalism and colonialism. Applying this emergent framework to data produced in a neuroscience laboratory results in unpredictable and ambiguous animations and sculptural objects that can hold nuance, complication, and entanglement through proximity and intimacy with the scientific knowledge production process. Radically altering modern Euro-centric scientific practices and education holds the potential to allow for the participation of more and different practitioners who are then able to create additional and divergent knowledges.

Preface

This dissertation is an original intellectual product of the author, M. Armstrong.

Chapter 2. Laboratory work on animals reported in Chapter 2, referenced throughout the thesis, and included in the vivarium in the appendix was conducted under UBC animal use certificates A15-0113 Altshuler Avian Studies Protocol 2015-2019, A19-0013 Altshuler Avian Studies Protocol 2019-2023, and A21-0095 Armstrong Avian Studies Protocol 2019-2023. This work was also conducted under UBC Biosafety certificates B16-0118 Avian Optogenetics, and B21-0075 Avian Optogenetics and Chemogenetics. Though there is a reference to the published R package Pathviewr, no material from the peer-reviewed package is included in this text. I created all the data, figures, and tables, though some panels have been used in grant proposals. Experiments were designed by Douglas Altshuler and myself and I performed all experiments and data analysis. Behavioural flight data was collected by me with assistance from undergraduate researchers Kirianne Ashley, Francesca Ciocca, Elsa Cyr, and Sarah Scratch.

Chapter 5. A version of *Transmute II* was shown on the outdoor screen at The Morris and Helen Belkin Gallery in Vancouver, BC in conjunction with *Things that do not come by the road: UBC Master of Fine Arts Graduate Exhibition 2023* from May 5 - June 4, 2023. The version included in this thesis, titled *Transmute ([5.19:11.20] Δ [7.22:2.23])/[5.23:6.23]*, is the same version that was shown at the Belkin: each exhibition of a Transmute animation will have a different title and may take on a different form in collaboration with the specificities of each screening.

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List of Abbreviations

ACC	Animal Care Committee (UBC)
AUP	Animal use protocol (UBC)
CCA	Canada Council for the Arts
CIHR	Canadian Institute of Health Research
EDI	Equity, diversity, and inclusion
EIO	Equity and Inclusion Office (UBC)
FOI	Freedom of information
FSU	Florida State University
GFP	Green fluorescent protein
GPS	Faculty of Graduate and Postdoctoral Studies (UBC)
GRA	Graduate research assistant
GSS	Graduate Student Society (UBC)
LM	Lentiformis mesencephali
MOU	Memorandum of understanding
nBOR	Nucleus of the basal optic root
NDA	Non-disclosure agreement
NIH	National Institute of Health (US)
NSERC	Natural Sciences and Engineering Research Council (CA)
HQP	Highly qualified personnel
NSF	National Science Foundation (US)
PTSD	Post-traumatic stress disorder

R&D	Research and development
RA	Research assistant
SDBRI	San Diego Biomedical Research Institute
SftP	Science for the People
SSHRC	Social Sciences and Humanities Research Council (CA)
SSK	Sociology of scientific knowledge
STAIR	Support for teams to advance interdisciplinary research
STEM	Science, technology, engineering, and math
STS	Science, technology, and society studies
UBC	University of British Columbia
VPRI	Office of the Vice-President Research and Innovation (UBC)

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For those who leave and those who remain

For those who speak up and those who stay silent

For those who survive and those who thrive

For those who are no longer with us

Chapter 1: Introduction

Written in partial fulfilment for the Doctor of Philosophy in the Zoology Department at the University of British Columbia, this dissertation is unlikely to adhere to the disciplinary expectations of the department in which it was originally conceived and within which the work occurred. Perhaps one of the reasons dissertations are caveated with the line “in partial fulfilment of...” is because so much of the work of a thesis occurs outside the writing of the text you are currently reading. In experimental biology—the type of science I have been practicing for the majority of my PhD—this means experiments; theoretical or material/physical experiments enacted in the field or in a laboratory. Hours accumulate to days, days accumulate to months, all accumulating to years of engagement with a practice of creating, analysing, and interpreting data, creating, analysing, and interpreting data, repeated over and over until something congeals that is considered “enough” for a paper or publication. “Enough” depends on disciplinary expectations, supervisor and trainee publishing goals, specific journal standards, and potentially peer-reviewers. Several of these “publishable datasets” then accumulate to make a dissertation. In the experimental sciences, the text that ultimately makes up the dissertation is considered subordinate to the experiments themselves and often subordinate to the individual, peer-reviewed, published papers that collectively become a thesis. After all, the published papers are far more likely to be disseminated and read than the dissertation, which rarely makes it beyond the university committees required for defence and graduation. Because published papers are the cultural capital of scientific careers, many PhD students are advised to publish all chapters of their thesis as individual papers before assembling them into a dissertation. This way the work contained within the thesis becomes irrefutable when it undergoes university examination; it has

already been peer reviewed so what could dissertation examiners add or question that has not already been considered? Dissertation text as “partial fulfilment” feels appropriate in this context of emphasis on different and other forms of data, information, knowledge production, and dissemination, all of which are secondary to the text itself, and yet production of the text often dominates the conclusion of the PhD acquisition process.

No part of this thesis has been published in advance of its existence in this form. While five years was spent in the cycle of creating, analysing, and interpreting data in an avian visual neuroscience laboratory, the totality of that data will not be summarized and analysed in these pages in a form that is recognizable to colleagues engaged in similar data production and interpretation practices. While you will encounter examples of data from the laboratory here, there will be no statistical analyses, no results and conclusions drawn based on that data alone. Here, at the beginning, you may need to set aside expectations you might have of a Zoology or Biology Department thesis in the typical sense of units of data produced, analysed, and interpreted, rinse and repeat. Instead, I will draw your attention to the conditions of production in a typical biology PhD thesis. We will explore those conditions (health, provisions, ailments, requirements, restrictions, training, adjustments, and so on) with the help of many other activists, artists, critics, and scholars, in collaboration with my own lived experiences through an artmaking process. The artworks manifest—make material—aspects of those conditions that were most salient to my experience in the laboratory, transforming the data I produced—inclusive of my embodied experiences—into another form of knowledge, with its own provisions and limitations. This thesis is a passionate speculative fabulation arising from an ongoing conflict between myself and academic scientific knowledge production. It starts with the recent past, the five years of bench work conducted in neuroscience from January 2016 to June 2021,

and re-configures that work through artistic tools—visual art and creative non-fiction—rather than the mathematical or statistical analyses typical of a scientific thesis. This re-configuration occurs in the present, 2022 – 2024, with an eye towards the future. It proposes practices and objects to think/feel with scientifically produced data towards unexpected and generative intimacies and alliances.

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While we are thinking about “partial fulfilment,” let us consider for a moment some of the other work that occurs outside of the text that represents the end of a PhD. There were the hours in the laboratory mentioned above, the days of sifting through the data collected, organizing it for analysis. Months spent writing code to manage and analyse that data, trainings of every type—lab safety, chemical safety, biosafety, bullying and harassment, animal handling, animal husbandry—day-to-day operations, equipment management, tool creation, rig maintenance, chamber construction, software updates, hardware trouble-shooting, technologies and protocols to learn, surgical techniques, aseptic techniques, microscopy, histology, image analysis, tissue care, disposal of materials, lab maintenance and cleaning, animal care, meetings, seminars, classes, homework assignments, presentations, conferences, posters, talks, grant writing, proposal editing, figure creation, teaching and training others, literature reviews, paper writing, comprehensive exams, and on and on. Some of these things might show up in a material and methods section of a typical paper or thesis, but the vast majority of this work will go unaccounted for. So many things simultaneously captured and ignored by the “partial fulfilment” moniker.

In this thesis, there is also a studio art component, where again, the vast majority of the work occurs outside of this text. Hours, days, and months spent (de)constructing laboratory

notebooks page-by-page, scanning and preserving each one digitally before defiling them with drawings, paintings, texts, actions, and rituals. Every day a new layer added, with materials and actions related to the data and information contained on each page. Day-by-day, layer-by-layer, a slow accumulation of a physical manifestation of the work documented within; the surgeries, the experiments, the animals, the recordings, the microscopy, the images, the behaviour, the flights, the data. An at once obstructed and elaborated upon archive of the years spent in the laboratory. And then, as if this was not enough labour by itself, an additional process of sanding through the layered lab books, filming each image as it re-emerges in altered form and assembling those images into a sort of stop-motion animated film/flip book. Hours, days, and months spent sanding the books to obliteration, meticulously photographing every step. No text can capture that process, those days and months spent (de)constructing, (re)constructing, transforming, and animating. And no text can show the resultant animations: they cannot stand in for watching the film/flip books yourself—the time and movement, the images, go unaccounted for. Only you can engage (or not) with that part of the process—this text cannot do it for you.

Then there is the labour that underlies the text itself. This thesis engages with critical cultural theory in order to deconstruct and understand some of what occurred in the laboratory and why the artwork is relevant to a scientist. I have done my best to teach myself as quickly as possible the most relevant aspects of cultural theory, specifically science, technology, and society studies (STS) with a critical race, postcolonial, feminist, and queer bent. I will get things wrong and have certainly missed many equally relevant fields and scholars—sometimes purposefully and sometimes as a side-effect of being new to the field(s). These topics of inquiry were specifically chosen because they reflect aspects of my own experience in zoology and the sciences in general. Hours and days and months of reading, processing, and synthesizing texts by

other scientists, writers, activists, and academics, days lost in the words of another, days exploring someone else's world, days spent finding parallels, reflections, and reverberations in the experiences and works of others. This led to the work of note-taking and organizing, of developing structures and textual methodologies, and of working to understand and develop my own writing process. Days of struggling to find words to put to the work, the process, the thinking and feeling and being that this dissertation would ultimately try to encompass. This text is expected to make space for and hold the other types of work—the science and the art—in tension with one another even as the text itself can only represent those works with limited means. It is at times sprawling in its effort to create that space, to reach outwards, to ignore bounds and expand as far beyond limitations as possible.

And then there is a different kind of labour that underwrites every part of this text and the scientific and artistic works it holds together. Conversations with family, friends, colleagues, and mentors inform every aspect of this work but cannot always be directly cited they have so completely inoculated my thinking. I do not always know where their thoughts end and mine begin. There have been days (months?) spent confused, lost, and in-between; days of exhaustion, trauma, and an inability to engage with any of it; days of rest, rejuvenation, and joy; days of rage, sorrow, and fear. There have been times during the creation of this thesis—occurring in every part of it, the science, the art, and the writing—where I would disappear into a fugue state, where time went unaccounted for, where I was so lost in the material or the action or the content that hours slipped by unnoticed before I would “snap out of it” and realize I had forgotten who I am, what I was doing, why I am here. Sometimes the whole PhD, all 8 years of it, feels like one giant fugue state in which I have forgotten who I am, what I am doing, why I am here. And that is part of the “partial fulfilment” of a PhD as well.

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If you are confused about why we are talking about art and the humanities in a zoology thesis, I will let you know now that there are three major components to this thesis: the science conducted in a laboratory represented in the text by anecdotes and sample data; the art created after the laboratory represented in the text by images and links to animations; and the text itself, which attempts to tie these two components together with the help of the critical cultural theory mentioned above. While the science and the artwork occurred chronologically separate from one another—first there were 5.5 years in a lab, then there were 2.5 years in a studio—the overall work of the dissertation entangles them together at every opportunity. Other than a chronological separation of first lab, then art, the work itself aims to break down distinctions between the two, complicating any line drawn in the sand between “art” and “science.”

1.1 Some Confessions

Before we go further into the methodology of this text, I would like to start by sharing a few confessions. First was the warning to set aside your expectations for a “science” thesis. Second, is the confession that I am an artist; always have been and always will be. I started graduate school as an MSc student, completely new to lab work, scientific protocols, and running experiments. I did not have an undergraduate degree in a scientific field and had never worked in a science lab or even adjacent to one. I had no formal background in the sciences or a science, technology, engineering, and math (STEM) field. While I was initially overwhelmed by the massive learning curve, I took to it immediately, soaking up as much information as I could through reading, coursework, shadowing my peers, and eventually running experiments myself;

so much so that I rolled up into a PhD part way through my second year. In retrospect, this may have been a hasty decision as I did not actually have an interest in pursuing a scientific career at the time. I came to graduate school looking for an education. I wanted to learn about science by doing it, but I did not have a specific post-graduation job in mind that required a PhD in the sciences. I, naively it would seem, just wanted to learn and thought that is what these institutions—the PhD, the university—were for. In those first two to three years, I put in gruelling hours. I wanted to get up to speed as quickly as possible due to a chip that developed on my shoulder from all the surprised and questioning looks every time someone learned about my (lack of) educational background. How could an artist waltz in here and do science with no previous experience?

In fact, I was surprised by how much my art education directly benefited my work in the lab: visual and aural pattern recognition during electrophysiological neural recordings linked back to decades spent making visual art and music; working with a microscope and other optically based apparatuses was a breeze as was identifying trends and coming up with useful visualizations of complicated data. Understanding the three-dimensional shape of brain anatomy to build a conceptual map based on consecutive images under the microscope came naturally, as did aiming for those regions during surgeries in which I could not “see” where I was going. Designing and building behaviour chambers and rigs to hold and track animal movement, no problem. Utilizing 3D scanning and printing devices, arranging and calibrating motion capture cameras, programming dynamic and static visual stimuli and appreciating how they did (or did not) replicate aspects of the visual environment, developing VR systems, and so on were challenging but nowhere near impossible. There were even things I came to attribute to my art education that I was surprised to find the scientists around me were not necessarily trained in:

things like giving and receiving critique and feedback without defensiveness, generating ideas without judgement, working collaboratively and communicating clearly, and celebrating colleagues' strengths and differences. At times, the pros and cons of my art education next to the scientific education of most of my peers made it seem like science education was doing something wrong.

But before I digress too much, a third confession, which may seem like an odd one. I love science, in spite of it all. I would have quit in year five, would not have bothered to construct the text you now read, would not continue to dedicate time and energy to thinking about what science could be doing differently, how it might be expanded, would not continue to imagine other ways of thinking and doing science, if I did not love the *idea* of science and the physical practice of it. I have loved learning about and exploring our world with the tools of scientific methodologies. A fascination and curiosity about the world and how it works is often shared by artists and scientists; a drive to explore, understand, and represent what we find in the world. I bring this up now because it is important to remind myself, and you, that the dissections and demands and dreams that are to come are driven by this love, by my proximity and entanglement with scientific practices. Feminist STS scholar Donna Haraway summarizes it well when she writes:

Biology is a political discourse, one in which we should engage at every level of the practice—technically, semiotically, morally, economically, institutionally. And besides all that, biology is a source of intense intellectual, emotional, social, and physical pleasure. Nothing like that should be given up lightly—or approached only in a scolding mode.¹

1. Donna J. Haraway, *Modest_Witness@Second_Millennium. Femaleman@_Meets_Oncomousem: Feminism and Technoscience*, 2nd ed. (Routledge, 2018), 104-5.

While I will do my best not to scold, there will be times when the critiques and dissections of scientific practice in this thesis may inspire a defensive reaction. Despite my battles with ongoing post-traumatic stress (PTSD) from my time in the lab—a fourth confession—I am ultimately pro-knowledge, not anti-science. I will attempt to argue throughout this text that modern Euro-centric science as it is currently practiced is just one form of scientific knowledge production. Science is also just one form of knowledge production amongst many, so while I will outline a few critiques of academic scientific practice, those critiques are first and foremost driven by the desire for a science that is more expansive and inclusive of other forms of practice and other forms of knowledge. While I will fully admit to harbouring a lot of anger, rage, and pain with respect to modern Western scientific practices and practitioners, that anger and rage is related to a love made foul by betrayal and disappointment. This disappointment resulted from my expectation² that science was already expansive and inclusive and my discovery through embeddedness in the discipline that it is more often narrow, limiting, and biased. Thus, a feeling of betrayal upon learning that Euro-centric science did not love me or my ideas and perspectives, it primarily loved my cheap labour and the image of me that it could utilize for its own benefit.

Which leads to an elaboration of the fourth confession, the trauma of my experience in academic science. The (de/re)construction of my neuroscience data into an interdisciplinary thesis was not entirely voluntary. In what should have been my final year of experiments in the lab, I acquired a new supervisor and very slowly and painfully shut down my long-term experiments in the avian visual system that had made up my scientific career to date. The move

2. A therapist once told me that disappointment is the flower of expectation.

out of the lab was driven by and the result of a series of traumatic experiences, ultimately forcing me to abandon the PhD I had originally proposed. This part is still very painful to work through, three years later, and the textual body of this thesis has come to represent one site of that struggle. While the content of these experiences is personally disturbing to revisit, the larger struggle lies in deciding what to include, when, where, why, and how. As Audre Lorde states quite clearly, “oppressed peoples are always being asked to stretch a little more, to bridge the gap between blindness and humanity.”³ I am not interested in performing the role of Person of Colour educating institution(s) in white supremacy so that said institutions can allay their guilt and move on with business as usual. I do not wish to perform my trauma for you. However, this text, the proposed methodologies and framings, and the artworks, would not exist without the traumatic lab exit. There are many aspects of scientific knowledge production and the institution of academia that can be dissected, called out, and changed, but the ones I focus on here are ones with which I have direct personal experience. The moves I make are grounded in events that happened to me, at this institution, during this PhD. One of my goals is to, as often as possible, use a personal experience as evidence of a symptom or manifestation of colonialism, sexism, racism, ableism—in short heteropatriarchal white supremacy—in science and in academia. To take the personal and broaden it, to zoom out to a systemic or structural view, a sociopolitical view. Since I am not trained in sociology or anthropology or cultural theory, I am not necessarily equipped with the tools to start broad; the only way I know how to do this is to use my own experience as a starting point, a type of autotheory. Unfortunately, this means sharing some of that trauma to make the connection between my body and my politics, my personal experience

3. Audre Lorde, *Sister Outsider: Essays and Speeches* (Berkeley, Calif: Crossing Press, 2007), 132.

and structural problems. While I will share and use my own stories throughout this text, the point I am trying to make with them is that the problem is and was much bigger than me. The problems I experienced continue to this day in similar and different forms, in similar and different places, to similar and different people.

The fifth confession then, is also a content warning: this thesis will be laced with descriptions of personal experiences that occurred during my PhD. I am working, as I write this, on how to do this in a way that feels fair to my experience, makes space for and holds the pain of what I endured, without slipping into a performance of pain for your pleasure, what bell hooks famously termed “eating the other.”⁴ The struggle is to find a balance between revealing and refusing, to avoid a lack of affect that aligns with “normative whiteness,” while also not participating in “a translation of Black suffering into white pedagogy.”⁵ This part is a work in progress and no doubt there will be sections in this text that are more successful in this respect than others. I also hope that I have written these anecdotes in a way that does not cause harm to you, dear reader, but I do not know what stories you have lived and bring to your reading, and so include a content warning. There will be parts of this text that discuss racism, sexism, and colonialism as enacted in scientific practices by scientific practitioners at academic institutions. Animals were absolutely harmed in the production of the data that lurks just behind the curtain of this thesis (listed in a vivarium in the appendix), but all, of course, in accordance with the guidelines set out by the Canadian Council on Animal Care and in procedures that were

4. bell hooks, "Eating the Other Desire and Resistance," in *Black Looks* (Routledge, 2015).

5. Robyn Maynard and Leanne Betasamosake Simpson, *Rehearsals for Living* (Chicago, Illinois: Haymarket Books, 2022), 257. Maynard and Simpson are quoting Saidiya Hartman with this phrase.

approved by the University of British Columbia Animal Care Committee.⁶ In fact, I was the first—and so far to my knowledge only—graduate student at UBC to have their own Animal Use Protocol (AUP), separate from their supervisor(s), thanks to the conflict that led to my departure from the lab.

Lastly, while most of this text is quite academic, citing academic writers, theorists, and texts in an academic style that attempts to make claims backed with evidence for the sake of an argument, I am also interested in alternative forms and non-academic community. I will cite non-academic texts like memoirs and popular articles, and as mentioned above, there will be many personal anecdotes that only cite my own experience. Thinking through who decides what counts as evidence, for whom, and to what end, has led to the inclusion of my own anecdotes as a form of evidence. At many points during the conflict that defined the final years of my PhD, both authorities and advocates demanded evidence: what documentation did I have to back my claims? And of course, quite often, there was no acceptable documentation to provide. These anecdotes are just that; my own understanding of what was going on, my interpretation of actions and words, my perspective on impacts. My interpretations are backed by conversations with peers, by shared experiences of similar problems, by recognition of patterns through solidarity. These forms of evidence are ephemeral, undocumented, and rarely considered legitimate by those receiving a claim. What is transparent to us remains opaque to them. This thesis integrates these ephemeral forms of evidence, both in the text and in the artwork. One of the overall claims

6. Armstrong Avian Studies Protocol 2019-2023, #A21-0095 and biosafety certificate Avian Optogenetics and Chemogenetics B21-0075.

of the thesis is that these are data, information, and evidence as well, regardless of whether anyone else will grant them evidentiary status or power.

This thesis is also very much about opening science up to more and other, to affect and subjectivity, to intuition and the unknowable, to broader perspectives and practices, for its own enhancement. If other forms of data, information, and evidence deserve a seat at the juridical table, this thesis will attempt to take Euro-centric science off its pedestal in order to level the playing field so that other forms of knowledge production might be considered equally legitimate. Euro-centric academic science is just one form of scientific knowledge-production; there could be many others if Euro-centric science could collectively acknowledge its own conditionality and no longer claim authority over other forms. Some aspects of this thesis may seem very far afield from what you think of when you think “science,” but my hope is to share something subversive as an example of one of many possibilities. This thesis proposes that perhaps if we push ourselves outside of our comfort zones and imagine something radical, then our comfort zones expand, allowing more and different capabilities going forward.

1.2 A Frame or Protocol

However, this thesis is in a zoology department and so it is important that it speak to scientists engaged in modern Western scientific knowledge production practices. My work since physically stepping out of the lab has kept the lab as its gravitational center, thinking through the development of framings and methodologies that might aid in expanding how and why science is practiced the way it is. While orbiting the lab space, I have drawn in additional resources from other fields that felt necessary to understand the lab more fully, its practices and people, and my

specific experience within and outside of the lab. For the former, I learned of the field of STS, which has provided many tools, resources, ideas, texts, and people to think with about what happens in, through, during, and after scientific practice. For the latter, I returned to my background in the liberal and visual arts, updating myself on feminist and queer theories and digging deeper into postcolonial and race theories, while simultaneously (re)developing my art practice. These cultural theories helped me reckon with my personal experiences; my complicity and engagement in disciplinary expectations, the effects on my work and personal life before and after I physically left the lab, and the specific circumstances of my departure. With time, these materials began to congeal with and into an art practice, a writing practice, and a transformation of my relations to working and learning, all in the pursuit of new methodologies for scientific knowledge production.

First, science: the scientific method describes a recipe—a protocol—for creating knowledge in a cycle that can be applied to questions and methodologies large or small and in many different fields. There is an observation or question out of which a hypothesis can be created. The hypothesis is then tested with an experiment that produces data, which is then analysed and used to develop a conclusion related to the initial observation/question/hypothesis. Conclusions can be re-framed as observations, allowing the cycle to repeat itself. Similarly, this thesis has been built on a series of moves that can be applied to many possible topics or questions, at large and small scales. The steps for this protocol are as follows: deconstruct or dissect what we think we know or how we practice; add in elements or perspectives that we identify as missing from the frame, transform this (de/re)constructed set of materials into another form, usually one that is easier for us to see/hear/think with or that might lead in new/different directions; assess where we are post-transformation; and discern what we have learned through

the process. One advantage of this slightly varied protocol is that it is much broader and makes space for other ways of thinking and doing. It is less prescriptive and it aims to expand outward rather than narrow inward by both looking outside of its own frame for more and other, and using transformation as an opportunity to change, grow, or move in a new direction. While some variations of the scientific method could fit within this broader protocol, much that would fall outside of “science” as it is often described can still produce knowledge in this framing. Table 1 lists the primary ways this thesis makes use of this protocol as an example; in the structure of the text itself, in the creation and description of the *Transmute* series of animations, in my own life as I (re)built my way of working and thinking after the lab, in typical mathematical data analysis, and in the scientific method as it was utilized in my neuroscience experiments. In this framing, the central (and center) step is transformation, the hinge around which productive engagements swing. Actions before the hinge are in preparation for the transformation and actions after the hinge are interpretive, or aid in the development of an understanding of what occurred during the transformation. As an example, in the experimental biology lab in which I worked, the hinge would be the experiment itself, the act or moment that transforms an animal into data points. What occurs before the experiment is preparatory⁷ for the experiment itself and what occurs after aims to interpret and understand the data produced. To think through the methodology of this thesis, I will quickly walk you through each of the ways this framing is used.

7. An early reader misread this as “predatory,” a slippage that is not entirely incorrect.

	pick what we know apart	add what is missing	transform	speak, see, or hear	interpret
<i>Text</i>	dissect	demand	science -> art	demonstrate	conclude
<i>Art</i>	deconstruct	reconstruct	object -> image	animate	present
<i>Data</i>	clean and tidy	model	linear -> logarithm	visualize	narrate
<i>Science</i>	question/hypothesis	methodology	animals -> data	accumulate	interpret
<i>Life</i>	deconstruct	reconstruct	triggers -> glimmers	act	assess

Table 1. Framing table. Example uses of an open-ended protocol or framework. The grey at the center indicates the hinge: a point around which what came before transforms into something new that can be assessed and interpreted.

1.2.1 Text

Chapter one of this thesis introduces the methodology that will be repeated in different media, disciplines, and scales. By itself, it does not represent a step within the protocol though it could be considered part of step one where we gather together everything we already know. Chapter two, Dissect, is where we begin dissecting a topic, idea, or question. In the text of this thesis, we will consider academic scientific knowledge production itself by dissecting the contemporary culture of modern Western science and a few of its standard practices. We will also apply this dissection to academic culture, specifically how it responds to conflict within its walls. These topics were chosen for this thesis because I have personal experience with both and because they answer a question I have been asked many times throughout the production of this thesis: why I refuse to analyse my data according to scientific standards. They also provide important background information for the artwork that is to come in later chapters. Chapter three, Demand, adds in elements that were missing from my engagement with scientific knowledge production. It entangles and complicates dichotomies and boundaries that are common in scientific and academic work and begins to demand other ways of thinking, feeling, and being. Chapter four, Describe, delineates the creation of the *Transmute* animations and objects, themselves an enactment of the protocol. These representations transform physical acts, movements, and materials from the art studio into concepts and ideas, words and images, in order to communicate what is occurring behind the scenes in the art practice. Chapter five, Demonstrate, is the artwork(s) itself, a direct demonstration of the protocol that “speaks” outside the limitations of language. Chapter five also serves as an example of possible outputs from the protocol. Chapter six is our conclusion, where we attempt to interpret our results or understand

what occurred during the transformation and its aftermath. What did we learn here? How might we adjust our expectations, methods, and interpretations if we were to repeat this protocol? What about the protocol should or could change and why? Are there ways to expand the protocol even further or make it accessible to more and different people, places, and ideas?

1.2.2 Art

The process that produced the *Transmute* animations and objects described in Chapter 4 is also the process that created the protocol as it currently exists. The creation of the animations required the (de)construction of my neuroscience laboratory notebooks, page-by-page. As each page was dissected out of its binding, notes were made about what was captured on each page: specific dates and times, experimental protocols, animal IDs, collaborations with colleagues, personal notes, coffee and grease stains, and so on. This (de)construction is then followed by (re)construction, where materials related to each page are layered on top of that page: painted images, feathers from the animals, a ritual memorializing a terminal experiment, a gesture or action that expresses a strong emotion from that time, and so on. Each layer adds things that were left out of the notebooks during their initial creation like affect, elements of the body, my personal subjective experience conducting an experiment, current sociopolitical events, and more. When one layer is complete, the next page is added, then another layer of exiled material, then a page, then a layer, until the lab book is fully (re)constructed as a block of solid material. The (de/re)constructed book-now-blocks are sanded through from top to bottom while photographing the images revealed along the way. The photographs are then assembled into an animation: the (de/re)constructed lab book transformed into a moving image. Presentations of the

animations and objects remaining from the sanding process in screenings or exhibitions are part of the final step of the protocol; presenting and interpreting the results of the transformative process that occurred during the execution of the protocol.

1.2.3 Data

During the creation of the *Transmute* animations, I came to realize that I had intuitively been developing a process that paralleled a standard mathematic analysis pipeline. In order to analyse most of the data created during my time in the lab, a series of repeatable steps were typically worked through. Step one would clean up or “tidy” the data, which might include removing outliers or “irrelevant” pieces of data and information, fitting the data into a computer-readable table, rearranging columns, rows, and so on. This is the dissection or deconstruction step. Step two, reconstruction, might be renamed “modelling” as many forms of mathematical and statistical analyses rely on modelling that adds in metadata or combines the newly created data with other forms of data and information in order to develop a model relevant to the question the data is meant to answer. This concatenated data is often transformed next, for example a logarithmic transformation to make trends and patterns more easily discernible. In fact, the first definition of transform, the noun, is “a mathematical element obtained from another by transformation,”⁸ and these mathematical transformations are quite common in any quantitative data analysis pipeline. After transformation, data is often visualized with charts or

8. “Transform,” Merriam-Webster Dictionary, March 7, 2024, <https://www.merriam-webster.com/dictionary/transform>.

graphs to aid in interpreting or gleaning results from a given dataset. These results then lend themselves to various interpretive frames that lead practitioners to conclusions that lean towards or away from their initial hypothesis and question.

1.2.4 Experimental biology

Similarly, the typical experimental biology pipeline could fit into this protocol as well and I will use my own field of avian visual neuroscience as an example. In the dissect/deconstruct step we might develop a question and hypothesis based on what we find is already published in the field or based on our own previously acquired pilot data. Here we use what we already know or have already tried and we dissect or deconstruct that knowledge to find holes, low hanging fruit, or unanswered questions. I was interested in the visual guidance of avian flight and while there were behavioural studies of visual guidance and neuroscience studies of neural responses to visual stimuli, there was nothing that directly linked the two. I aimed to use optogenetics—a genetic tool that allows the manipulation of neurons during behaviour through the delivery of light stimuli—to bridge the gap between these previous neuroscience and behaviour studies. While optogenetics had been used in birds before,⁹ it had not been used in the

9. Erin Hisey, Matthew Gene Kearney, and Richard Mooney, "A Common Neural Circuit Mechanism for Internally Guided and Externally Reinforced Forms of Motor Learning," *Nature Neuroscience* 21, no. 4 (2018); Matthew Gene Kearney et al., "Discrete Evaluative and Premotor Circuits Enable Vocal Learning in Songbirds," *Neuron* 104, no. 3 (2019); T. F. Roberts et al., "Identification of a Motor-to-Auditory Pathway Important for Vocal Learning," *Nat Neurosci* 20, no. 7 (2017).

visual system yet,¹⁰ so I shadowed graduate students in a bird song laboratory who regularly used optogenetics in the song system to learn the technique and then apply it to the avian visual system. From there I conducted various experiments, which transformed animals into measurable data points with the help of various apparatuses and technologies. Specifically, this meant multiple neurosurgeries on a single animal to inject the genetic constructs, recover the animal, and then a month later chronically implant a device—LED or fibre optic—through which to deliver light to the transfected cells and manipulate neural activity in an awake behaving animal. This transformation resulted in a pile of raw data that would later be analysed and interpreted to determine whether or not our hypotheses held true and what steps should be taken next. While the genetic constructs resulted in light responsive neurons in our birds, I did not see behavioural changes after various forms of light stimuli were delivered in multiple behavioural paradigms.

1.2.5 Life

In many respects, I have also inadvertently applied this framing to my own life, especially my relationship to work and the creation of the contents of this thesis. I used this time to dissect and deconstruct my own relationship to work, picking apart the underlying assumptions, fears, and joys that drove why I worked the way I did. After this period of intense critique and dismantling of myself, I began to slowly and carefully build a new way of working

10. Later in my PhD I peer-reviewed a paper that used optogenetics in the pigeon visual system, the first to use optogenetics in the avian visual system: Noemi Rook et al., "Aav1 Is the Optimal Viral Vector for Optogenetic Experiments in Pigeons (*Columba Livia*)," *Communications Biology* 4, no. 1 (2021).

that attempted to subvert some of my own tendencies. As an example, perfectionism in the past sometimes prevented me from finishing a project—things could never be complete because there was always the possibility of revision, reworking, and so on. Sometimes this perfectionism would stop me from starting in the first place, preventing me from running with or exploring some of my favourite ideas. As I began to reconstruct my way of working, I strove to develop processes that undermined my own perfectionism, as with the layering of images within the pages of the lab books that eventually became the *Transmute* animations. In the process of working on an individual page, the resultant image, ritual, or action would never be visible to anyone else or exist on its own as an independent artwork; as soon as one page was complete the next one would be laid directly on top, hiding the work I had just completed. This freed me from concerns about how an individual image or action might be judged later: was it a “good” image, did I use the “right” colours or textures or materials, how might a viewer receive it, and so on. Perfectionism could not take up space in my psyche since no individual image mattered more than the overall process. This transformed my old way of working into something quite different, a new relationship with work and practice that freed me to act in ways that built community and produced processes and materials that supported me. This framework, applicable to many things—writing, art-making, data analysis, experiment design, work practice—became a recursive loop for me, an ongoing cycle of (de/re)construct, transform, enact, and reflect.

1.3 Chapter by chapter

This thesis is focused specifically on academic scientific knowledge-production. Both the academy and science have their own social and professionalized norms that overlap and interact

with one another. The second chapter of this thesis, Dissection, will look at just a few of these norms and expectations in both academia and western Euro-centric science. Much of my thinking through this process is grounded in the works of feminist STS scholars who have dedicated their careers to analysing aspects of scientific practices and impacts, and Black and Indigenous scholars writing about white supremacist systems of oppression. Patricia Hill Collins' work in *Black Feminist Thought* on the concept of the matrix of domination,¹¹ which explains with four domains how systems of power are configured and experienced, will ground how I work through these topics. Universities fall into the structural domain, by organizing and codifying oppression, working hand-in-hand with other institutions like governments that implement laws and policies. The next domains are the disciplinary domain and the hegemonic domain, which administer and manage oppression and circulate oppressive ideas through culture and media, respectively. Academia, tasked with teaching the next generation in addition to producing knowledge, culture, and media, plays a role in both of these domains. Science produced within the academy contributes to all three of these domains in different ways; as part of an educational system, it has its own laws and policies, it influences the development of governmental laws and policies, and it manages oppression by circulating ideas in its own form of knowledge production. As an example, we can think about the power of "scientific racism" and its ability to dramatically shape and support the structural domain of racist laws and policies, while also circulating racist ideas which aid in the management and maintenance of the

11. Patricia Hill Collins, *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment*, 2 ed., vol. 2.;2; (Boston: Unwin Hyman, 1990).

hegemonic and disciplinary domains.¹² Lastly, the interpersonal domain contains individual experiences of oppression, which will appear in this thesis in the form of personal anecdotes in the text and in the artwork. Queer feminist scholar Sara Ahmed reminds us that “universities too are colonial archives,”¹³ sites of power through acts of accumulation, categorization, and indexing, where the who that decides what counts and what does not and how it is accessed has material consequences. As we will see with the help of Ahmed’s thorough study of academic complaints, much of academia’s management of oppression occurs through silencing problems and pathologizing individuals to evade responsibility for those problems. Accumulation, categorization, and indexing that occurs in academic administration is often one of obfuscation, the creation of an archive walled off by a “confidentiality” that protects those within. With Collins’ and Ahmed’s framings, the second chapter of this thesis will think through some of the ways in which both academia and scientific knowledge-production gain the power to codify, organize, and circulate oppression.

Chapter three, Demand, begins the work of picking up the pieces post-dissection to develop a means of moving forward. It begins with a refusal of what came before, a refusal of things as they are, a refusal of systems as they are currently designed. Having determined through personal experience as symptom of systemic problem that the way things are is not acceptable, we think through methods of sabotage and subversion while remembering that our

12. For an overview of the role of science in shaping the structural, hegemonic, and disciplinary domains with respect to race, listen to Scene on Radio’s *Seeing White* podcast series, especially episode 8 titled “Skulls and Skin,” produced by the Center for Documentary Studies at Duke University: Cdsduke, “S2 E8: Skulls and Skin,” Scene on Radio, December 9, 2020, <https://sceneonradio.org/episode-38-skulls-and-skins-seeing-white-part-8/>.

13. Sara Ahmed, *Complaint!* (Duke University Press, 2021), 292.

critiques must be matched in equal part with new ways forward; that for each pillar we tear down, we develop the tools and blueprints for another foundation. Chapter three begins to lay that foundation by considering what and how we refuse and subvert, while complicating categories and dichotomies that undermine our new foundation. This foundation is built on entanglement, on tension, on complexity rather than simple binaries of for or against. Perhaps rather than an image of a solid, stable, and fixed foundation, we would be better served with an image of a web, a network of relations, a foundation that is flexible, dynamic, and capable of shift and change. One of the joys of knowledge production is that we are always learning more and other and our understanding of the world and our relations within it shifts and changes across time. The language we use, the concepts we adhere to, will likely be radically different in the future in ways we cannot imagine now. Shouldn't we build foundations that can accommodate these shifts and changes? That can flex with the dynamism that is learning and growing? Much of the language I use in this thesis, whether about science or art or race or gender, reflects my specific time and place, and that language is likely to shift significantly, probably even during my lifetime. The ideas in this thesis are a snapshot of me and my work now, but both will be different in a decade, maybe unrecognizable in two decades. Our new foundation must be responsive to these shifts in order to support growth and change, thus we demand a foundation of relations, a foundation built upon a network of tensegrities—itsself a word made of both tension and integrity.

Chapter four, *Describe*, walks us step-by-step through the process that generates the artwork included in chapter five. As mentioned earlier, the *Transmute* animations begin with the data documented in the laboratory notebooks written during my years of neuroscientific knowledge pursuit. As lab books are (de)constructed, (re)constructed with added materials,

transformed through sanding and photographing into an animation, and ultimately presented in exhibitions or in digital video form, they are simultaneously mined for information, expanded upon to include more and other, and obliterated. As the lab books in their unaltered form represented a certain type of accessibility to and of information, the animations and objects that result from the art-making process result in alternative forms of accessibility and information, with perhaps radically different conclusions than what may have been deduced from the untransformed data in its original form. This process—which I consider of equal importance to the resultant animations and objects themselves—accumulates, indexes, and archives, while also complicating categorization. It is both sedimentary and emergent, revealing and refusing. It references representative painting and works on paper next to action paintings and abstract expressionism, sculpture next to ritual and performance, straight-ahead animation next to digital media. Its foundation is a network of tensegrities layered upon one another, compressed by the oppressions of the matrix of domination and yet continuously expanding outward; rage and anger held in tension with love and passion, hope held in tension with resistance. It asks, how can scientific practice become expansive rather than reductive, layered rather than stripped, nuanced and complicated rather than simplified and limited, emergent and unpredictable rather than decisive and deterministic.

Chapter five, *Demonstrate*, is the artwork itself. In the text of this thesis, it will simply be links to the animations to be viewed in their digital form as well as photographs of the remnant objects; jars of dust and book-block remains.

1.4 Autotheory and Reflexivity

Throughout the entirety of this text, there is an emphasis on thinking with feminist STS scholars, especially where their work overlaps with or brushes up against postcolonial, race, and queer theories in addition to gender theory.¹⁴ I focus on the work of Donna Haraway, Sandra Harding, Isabelle Stengers, Vinciane Despret, Kavita Philip, and Deboleena Roy as a matter of alignment and resonance. Haraway wrote, “it matters what thoughts think thoughts. It matters what knowledges know knowledges. It matters what relations relate relations. It matters what worlds world worlds.”¹⁵ I have chosen these women and gender non-conforming scholars as primary sources because it matters who I think with, who I put my own work in relation to, whose knowledge systems I take up. Many of these scholars started their academic careers in scientific fields—in labs practicing STEM methodologies—before finding their way to STS, critiquing and analysing the practices they were initially engaged in. There is something here, in this generation of brilliant scholars who started in STEM, presumably with the intention to

14. Sandra G. Harding, *The Postcolonial Science and Technology Studies Reader*, 1 ed. (Durham: Duke University Press, 2011); Dilshani Sarathchandra, "Making Room for a Postcolonial Critique in the Introductory STS Curriculum," in *Teaching Economic Inequality and Capitalism in Contemporary America*, ed. Kristin Haltinner and Leontina Hormel (Cham: Springer International Publishing, 2018); Kristen A. Kolenz, Krista L. Benson, and Judy Tzu-Chun Wu, "Combahee River Collective Statement," *Frontiers* (Boulder) 38, no. 3 (2017); Devon W. Carbado et al., "Intersectionality: Mapping the Movements of a Theory," *Du Bois review* 10, no. 2 (2013); Kimberly TallBear, *Native American DNA: Tribal Belonging and the False Promise of Genetic Science*, 1 ed. (Minneapolis, MN: University of Minnesota Press, 2013); Anne Pollock and Banu Subramaniam, "Resisting Power, Retooling Justice: Promises of Feminist Postcolonial Technosciences," *Science, technology, & human values* 41, no. 6 (2016). And more that will be quoted throughout this thesis.

15. Donna J. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Duke University Press, 2016), 35.

become scientists in their respective fields, who ultimately built careers outside of STEM looking back at it with criticality. Why did this happen? What did science lose (or gain) when these folks left their STEM fields? STEM fields continue to harp on the repair of their leaky pipeline when it comes to gender, and is constantly developing “new” mentorship programs to “show” girls that STEM fields are for them, but this pipeline is not accidentally leaky.¹⁶ The problematic metaphor of the leaky pipeline emphasizes individual choice—the decision to start a family, the decision to move into another field—as the driver of women out of STEM rather than addressing the systemic barriers and biases codified into scientific knowledge-production.¹⁷ Rather than trying to repair a “leaky” pipeline, we need to address the fact that the pipeline was designed for the progress and success of a certain type of person and women, people of colour, queer, and disabled folks are just a few of the historically underrepresented groups that hit barriers at every step.

Situating myself in relation to the work of the thesis—not just my narrative experience of working within the sciences but all of the positionalities I bring to anything I put my mind and

16. Ainur Almukhambetova, Daniel Hernandez Torrano, and Alexandra Nam, "Fixing the Leaky Pipeline for Talented Women in Stem," *International Journal of Science and Mathematics Education* 21, no. 1 (2023).; Kathleen E. Grogan, "How the Entire Scientific Community Can Confront Gender Bias in the Workplace," *Nature Ecology & Evolution* 3, no. 1 (2019).

17. Jason M. Sheltzer and Joan C. Smith, "Elite Male Faculty in the Life Sciences Employ Fewer Women," *Proceedings of the National Academy of Sciences* 111, no. 28 (2014); Joan C. Williams, "The 5 Biases Pushing Women Out of STEM," *Harvard Business Review*, September 2, 2020, <https://hbr.org/2015/03/the-5-biases-pushing-women-out-of-stem>; Linda Calhoun, Shruthi Jayaram, and Natasha Madorsky, "Leaky Pipelines or Broken Scaffolding? Supporting Women's Leadership in Stem," (2022); A. Shah et al., "Turning the Tide for Academic Women in Stem: A Postpandemic Vision for Supporting Female Scientists," *ACS Nano* 15, no. 12 (2021).

body to—requires acknowledging that I am an immigrant settler scholar in so-called Canada of mixed-race ancestry, specifically Irish/Scottish and Korean, and that I identify as trans non-binary. This has meant that it is important to me to read and cite Black and Indigenous scholars, activists, writers, and artists as I work to unlearn my own settler colonial indoctrinations and acknowledge the privileges and links I carry to slavery and genocide. Postcolonial theorists help me de-center the Global North in my understandings of modern Western scientific practices as well as think through science’s entanglement in Indigenous genocide, chattel slavery, and the outsourcing of science’s harms onto the Global South. Trans and queer theory, especially in the form of memoirs, have been a salve and guide through my own internal/external reconciliation as I work to understand myself as a non-binary gestational parent simultaneous to working on this thesis.¹⁸ Some might argue that my positionality would be better left to therapy sessions and journaling, but I would have quit this PhD if not for my child’s ties to Canada and the need to maintain status according to the State during her earliest years. I am not interested in pretending these aspects of me do not impact the work you find here.

This thesis is also arguably a type of autotheoretic work in that it builds off of my personal experiences in a form that becomes entangled with academic “theory.” The visual

18. Kryss Malcolm Belc, *The Natural Mother of the Child: A Memoir of Nonbinary Parenthood* (Catapult, 2021); Kai Cheng Thom, *I Hope We Choose Love: A Trans Girl’s Notes from the End of the World* (Arsenal Pulp Press, 2019); Joshua Whitehead, *Johnny Appleseed* (Vancouver: Arsenal Pulp Press, 2018); Maggie Nelson, *The Argonauts* (Minneapolis, Minnesota: Graywolf Press, 2015); Daniel M Lavery, *Something That May Shock and Discredit You* (Simon and Schuster, 2020); Carmen Maria Machado, *In the Dream House: A Memoir* (Minneapolis, Minnesota: Graywolf Press, 2019); Jordan Abel, *Nishga* (McClelland & Stewart, 2021); Harry Dodge, *My Meteorite: Or, without the Random There Can Be No New Thing* (Penguin, 2020); Chanda Prescod-Weinstein, *The Disordered Cosmos: A Journey into Dark Matter, Spacetime, and Dreams Deferred*, First ed. (New York, NY: Bold Type Books, 2021), and more that will be cited in this thesis.

artworks and the texts based on personal anecdote collectively form an autobiographical creative non-fiction, expanding out from my specific embodied experience while documenting or crystallizing a form of think/feeling. They theorize visually and textually on my personal experiences, thoughts, and feelings in space-time, while also thinking through the larger birds-eye view of that position in relation to other aspects of the world I occupy. So much of my personal narrative in academic science has required me to actively silence and set aside these experiences, thoughts, and feelings, my own embodiment, physicality, and position, that the moment an alternative route presents itself, things pour out nearly unbidden. This pouring out is captured in the artwork and the text, and elaborated upon with all the scholars, activists, writers, artists, and thinkers I resonate with. The majority of the written portion of the thesis you are reading is a struggle between letting these parts out, giving them room to breathe and grow, placing them next to collaborators they may reverberate with, and editing them into some sort of arrangement that is accessible to you, the reader.

Lauren Fournier, in *Autotheory as Feminist Practice in Art, Writing, and Criticism*, describes autotheory as “theory and performance, autobiography and philosophy, research and creation, knowledge that emerges from lived experience and material-conceptual experiments in the studio and the classroom.”¹⁹ While I hesitate to fully claim the term “autotheory” for my own work due to “theory’s” association with “vertical pipelines of colonial thinking... which values above all logic, hegemony, and the still-frequent citation of works written by white men,”²⁰

19. Lauren Fournier, *Autotheory as Feminist Practice in Art, Writing, and Criticism* (MIT Press, 2021), 29.

20. Rea McNamara, “A Deep, Feminist Dive Into Autotheory,” *Hyperallergic*, November 1, 2021, <https://hyperallergic.com/647014/autotheory-as-feminist-practice-lauren-fournier-mit/>.

many of Fournier’s formulations resonate too much with the work presented here for me to disregard the term. While we will discuss theory versus practice in Chapter three, Demand, the entirety of this thesis is in tension with the academic construction of “theory,” which bell hooks described as used “to set up unnecessary and competing hierarchies of thought which reinscribe the politics of domination by designating work as either inferior, superior, or more or less worthy of attention.”²¹ Remembering Collins’ matrix of domination, “theory” in the academy becomes a means of elevating or denigrating disciplines and individuals, types of work and labour as “in partial fulfilment of” or not, and oftentimes becomes a means of excluding knowledge producers who are uninterested in engaging with canonical theory²² according to the academy’s terms and conditions. The practices enclosed in this thesis strive for a different kind of academy—a different kind of scientific education and practice—one of decolonial freedom and expansion. As parts of this thesis slip into memoir and I argue that lived experience is a valid form of evidence and mode of knowledge production, I hope that these tactics to undercut a mostly academic text will result in something a bit more horizontal, where many different ways of thinking and forms of knowledge can co-exist, co-habitate, and *co-labour* with one another.

A side-note for a moment on reflexivity as it is part of the methodology of this thesis, in both its textual and visual forms. In 1989, Malcolm Ashmore published his PhD dissertation, *The Reflexive Thesis: Wrioting the Sociology of Scientific Knowledge*, with Chicago University Press, one of the hubs of STS discourse at the time. His thesis claims to study reflexivity itself by turning the eye of sociological study back on itself using a range of literary devices that are not

21. bell hooks, *Teaching to Transgress: Education as the Practice of Freedom* (New York: Routledge, 1994), 64.

22. “Canonical” usually meaning created by white men.

typically included in academic texts—transcripts of lectures, an encyclopaedia, a PhD oral defence, etc.—to critically examine the sociology of scientific knowledge (SSK), which would later come to be known as the field of STS. Celebrated for its thorough and creative exploration of both a range of textual forms and reflexivity itself, its satirical tone undermines any good faith effort at critically reflecting on one’s own work and processes, especially for readers with a genuine interest in reflexivity as a tool for creating more expansive knowledge claims and practices. Ashmore’s thesis engages with a small circle of British white men now considered canonical in the field of STS, sometimes refuting their sociological claims and sometimes supporting them. The closed circularity of only engaging with a handful of white male peers when there were many others publishing in the field of SSK at the time is problematic on its own, as is his use of alternative textual forms. Zaheer Baber reviewed a handful of texts published in 1988-89 including Ashmore’s thesis, stating that “those who hope to connect ‘personal troubles’ with ‘public issues of social structure,’ ... will have to look to more ‘traditional’ sociological analyses of science.”²³ In other words, reflexivity in Ashmore’s hands simultaneously undermines the feminist stance of connecting the personal with the political *and* weakened creative interventions as a meaningful methodology. In Ashmore’s framing, reflexivity cranked to 11 becomes reflexivity for its own sake, a circularity in which canonically celebrated white men reflect on one another’s achievements, to the exclusion of other perspectives. It is not an expansive reflexivity, it is a narrow one; one that makes a mockery of methods that might aid in the generation of an understanding of the practices in which ones is

23. Zaheer Baber, "Review Essay - the Reflexive Thesis: Wrihting the Sociology of Scientific Knowledge," (1992), 119.

engaged. The extent to which Ashmore’s reflexivity evades genuine relations—accountability, responsibility, vulnerability—with their subject matter, reminds me of the “reflexivity trap:” the “implicit, and sometimes explicit, idea that professing awareness of a fault absolves you of that fault—that lip service equals resistance.”²⁴ Ashmore’s thesis “casts self-awareness as a finish line, not a starting point.”²⁵ While reading Ashmore’s thesis and reflecting on how I hope to use reflexivity differently—in community and collaboration with a wide range of thinkers as a starting point towards expansion—a Charles Mills quote came to mind from *Black rights/white wrongs*: “whites will cite other whites in a closed circuit of epistemic authority that reproduces white delusions.”²⁶

1.5 Inhabiting the In-between

For all of these reasons and more, this thesis is not the scientific thesis that the Zoology Department or any Faculty of Science at the University of British Columbia would expect to see. It is also not a STS analysis of the scientific thesis I might have written, or a thorough STS critique of the scientific practices in which I was engaged. It is also not an MFA in visual art or creative writing thesis; the former would have come with multiple studio visits, exhibitions, and critique opportunities, and the latter workshops, critiques, and publication opportunities, none of

24. Katy Waldman, “Has Self-Awareness Gone Too Far in Fiction?,” *The New Yorker*, August 19, 2020, <https://www.newyorker.com/books/under-review/has-self-awareness-gone-too-far-in-fiction>.

25. *Ibid.*

26. Charles W Mills, *Black Rights/White Wrongs: The Critique of Racial Liberalism* (Oxford University Press, 2017), 21.

which I have completed start to finish.²⁷ This thesis is no longer interested in participating in the social or scientific norms of science or academia other than “in partial fulfilment for the Doctor of Philosophy.” My experiences with both institutions have led me to develop my own means of refusing discipline and instead focusing on becoming a “subversive intellectual” to use Jack Halberstam’s framing. Halberstam writes, “the subversive intellectual, we learn, is unprofessional, uncollegial, passionate and disloyal,”²⁸ and this thesis strives to be all those while still meeting the requirements for graduation. I have been called all of these at various points during my time in Zoology at UBC; this thesis reclaims these negative traits and wields them proudly to see what new formulations might arise by inhabiting the space in-between disciplines as a subversive intellectual.

In this in-between space—the cracks created by negation and refusal—new and other ways forward can be seeded. This thesis is not science, STS, or visual art exclusively, but it is emergent, undisciplined, resistant, and full of trauma, hope, and joy. I will use this space to think through my own praxis, a thinking/feeling theory and practice. This embodied practice does not ignore the affective body but instead embraces it and necessarily acknowledges the presence of trauma(s) by listening to ghosts and monsters, those who have been cast out or who manifest as a reminder of a troubled past. It will entangle subject and object, internal and external, mind and body as the definitions and lines between these dichotomies are purposefully blurred. Throughout, I will remind myself and you that in resistance there is hope; we would not bother to

27. However, many of these requirements I have completed in my time as a graduate student, sometimes through the University and sometimes on my own or with the assistance of supportive faculty.

28. Jack Halberstam, "The Wild Beyond: With and for the Undercommons," *The undercommons: Fugitive planning and Black study* (2013), 6.

resist if we did not hope for something different. The inclination to resist and refuse is not born only of rage, frustration, and disappointment, though these are all important affects, nor is it the result of selfish stubbornness or a desire to turn the world upside down for no reason. It is an expression of hope for another way, a reflection of the knowledge that it does not have to be like this, a reminder that we are capable of so much more and a hope that one day we might live in a world that supports our larger capacities.

Chapter 2: Dissect

“Anything not decided in the presence of the Authority is war; Science (singular and capitalized) is the Authority; the Authority conducts police actions. In contrast, sciences (always rooted in practices) are war.”²⁹

~ Donna Haraway

Donna Haraway’s use of “Science” here—singular and capitalized—is one that I relate to and have used myself in the past. In a short critical response, I once wrote in a footnote: “I’ll use capital ‘S’ to indicate ‘modern Western science’ that places itself above other knowledge practices, both Western and non-Western, that should also carry the label of ‘science,’ but instead are considered illegitimate for a number of reasons, while acknowledging that this reinforces a notion of one ‘true’ science above all others. I think of my use of capital ‘S’ science as making fun of Science’s own self-importance.” While I still think of my use of the capital “S” as a purposeful poke, a prod at Science to think, do, and be better, the more urgent part of the above quote is the reference to policing and Authority (capital “A”). Science’s defence of its own self-importance results in a hierarchical view of knowledge-producing practices as well as the practitioners, the people, who embody and enact that knowledge. This defence of its own Authority can be quite violent and has resulted in the loss of many a promising scientist, myself included, through the policing of social, scientific, and academic/pedagogical norms.

29. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene*, 42.

This chapter documents a war with Science³⁰ the Authority and its police actions. As mentioned in the introduction, I do love science and scientific practices, and I have experienced joy in knowledge production with scientific tools. I am not anti-science. I believe science has valuable methods and is capable of producing important knowledge. I am against upper-case Science the Authority conducting police actions at its borders to kick out and keep out those who do not play by its rules, dictating which practices are acceptable and who can engage in them. I spent many years gladly embedded in the field of neuroscience, doing my best to learn and uphold academic scientific social norms before reaching a point where I realized I had unconsciously been at war with those norms for some time. I was fighting so hard for something I thought I wanted, until I woke up one morning, looked around at the shambles my life had become, and knew I had given up too much, gone too far. In the beginning, I naively thought I could change things, could work from within to make small shifts in lab culture, could rally with my peers to chip away at internalized biases, that we could use our collectivity to push the lab in a different direction. In the beginning I, we, worked slowly and quietly, organizing our own mini-workshop, talking through when and how we might speak up for and with each other, thinking through lab power dynamics and each others' precarity. We created and held space for one another's fears and anxieties, and collectively wondered if joy was still achievable—it was the first year of the COVID-19 pandemic and we were all working from home after euthanizing

30. The capital "S" is purposeful to differentiate between an Authoritative Science propped up by Euro-centric historical origins, capitalism, and the neoliberal academy in opposition to scientific practices that are multitudinous in terms of ways of creating scientific knowledge. As with any contrast, the middle gets messy and there will be sciences that fall into a grey zone where deciding whether a practice should be capitalized or not is up for discussion.

our animals, locked out of the lab and away from our experiments. While these actions, initiated in solidarity, would have outsized consequences for many of our scientific careers, and our tentative collectivity would crumble in the face of actions that would divide and conquer us, I do not regret anything. There were moments when we felt empowered, moments when we had hope, moments when we could imagine something better for ourselves, while still conducting the scientific work that would get some of us through our degree programs. In the end, not all of us would have the privilege of remaining, of continuing and eventually finishing our research. Even with this knowledge of how dramatically things would change—more dramatically for some than for others—I do not wish to go back to the way things were before. Once my eyes were opened and I could imagine the possibility of something different, it was impossible to close them again.

Leaving the lab after experiencing the backlash of trying to change it has meant reconciling a war within myself between what I pursued for years and how I pursued it, and the dream of a different way of being and working. None of my attempts to conceptualize a thesis that set the war aside, wrote around it, or put blinders on to push forward, ever gained traction. I could not make myself write up the work I had already completed according to academic scientific standards and expectations. If Science was going to deny me a place, I had to deny it right back. This sometimes felt juvenile—meeting denial with denial or feeling like I was not capable of a “better” response at the time—but judging myself as juvenile was internalized white supremacy. Instead, I remind myself that if I was white and a man, my refusal to play along would be justified as standing my ground, but because I am neither of those things, I am labelled juvenile and depressed—childish and mentally ill.

The field of STS, in addition to the scientists, philosophers, historians, and more who studied the practice and foundations of science before STS was named thus, works to historicize

and understand scientific practice as embedded within a sociopolitical context. Many of the foundational aspects of Science that enable its Authoritarian status have been the subject of deep and long study; universality/objectivity, determinacy/reductionism, statistics/accounting, funding/political economies, just to name a few. In this chapter and the thesis overall, I primarily focus on feminist and postcolonial STS as a matter of resonance. I feel validation when reading the work of these scholars, many of whom have fought marginalization in their field(s) and many of whom began their academic careers in STEM. Reading their work, I feel seen and understood and I recognize myself and my own situations in their stories even as the specifics may be quite different. I also feel sadness, as if nothing has changed, their work fallen on a community with its back turned, a Scientific community that often purposefully looks away. The Scientific knowledge production system has been designed to keep them and their critiques out—how else can it maintain its Authority? There is no time in “fast Science” as Isabelle Stengers has put it, to slow down and look around at what is being done, at the system itself, at one’s role within that system. There is no time to think/feel other ways of working, thinking, being in the Scientific system and so the system charges forward in the name of “progress” and “innovation” irrespective of who it tramples or leaves behind. I am sure there are some in the Scientific community who know these scholars’ work and have made strides in their own practices towards engaging with it in a meaningful and deep way, but they are few enough that I have never met one. My guess is that many who try to engage meaningfully with the recommendations of feminist and postcolonial STS scholars are pushed out of Science because they are not productive enough by Scientific standards. Engaging meaningfully with feminist and postcolonial STS takes time and resources, and there are very few incentives in the Scientific knowledge production system for taking that time.

2.1 History = Haunting

Historians of science have done much to link Science's moral economies—its value systems and norms—to its historical origins in an educated aristocracy of men taking Christian values and transforming them into Scientific ones. The ascetic self-denial required of a successful Scientist is just one example of an image—that of the monk or priest deep in contemplation, isolated from the world and his own physical desires and needs—taken straight from religious values and reinterpreted for the Scientist. If the nascent field of science needed a boost from an authoritative source in order to claim credibility, organized religion had an established and influential Authority from which to borrow tactics and strategies. In 1995, Lorraine Daston historicized the contemporary uses of quantification, empiricism, and objectivity in Science as rooted in 17th century aristocratic European Christianity in “The Moral Economy of Science.” Daston thinks through empiricism, for example, as based on three intertwined aspects—“testimony upon trust, selectively extended; facticity upon academic civility; novelty upon the rehabilitation and transformation of curiosity”³¹—traced back to a genealogy of values shared by the educated, exclusively male and white, European aristocracy. On trust, Daston wrote, “trust among natural philosophers, as well as access to the places where experimental particulars were produced, was extended to gentlemen, following codes of honour and courtesy that sanctified a gentleman's word, however implausible his report, and opened his home (where most experiments took place) to other gentlemen.”³² This reliance on gentlemanly

31. Lorraine Daston, "The Moral Economy of Science," *Osiris (Bruges)* 10 (1995), 12.

32. *Ibid.* 15.

trust is exemplified in the infamous story of the birds sacrificed in bell jars to demonstrate the necessity of air for life. When Robert Boyle, the “father of experimental life,” shared this demonstration with upper-class women, some interrupted and demanded the bird be rescued, at which point justification for the exclusion of women as witness due to their emotional sensitivities became standard practice. As Donna Haraway describes it, “women couldn’t give authoritative witness. They could see but not witness; they could be there but what they had to say did not count.”³³ Only certain people could be trusted as potential witnesses and women, a source of irrational emotionality, became exiled in the face of a value system built on rational affectlessness. Daston continues, “trust, rather than replicability, made the collaborative empiricism of particulars possible among natural philosophers. Belief in natural regularities wavered before belief in the testimony of trusted witnesses.”³⁴

Robert K. Merton, writing about the ethos of Science around the same time as Daston but with a focus on his contemporaries rather than history, wrote:

Scientists may assimilate caste standards and close their ranks to those of inferior status, irrespective of capacity or achievement. But this provokes an unstable situation. Elaborate ideologies are called forth to obscure the incompatibility of caste-mores and the institutional goal of science. Caste-inferiors must be shown to be inherently incapable of scientific work, or, at the very least, their contributions must be systematically devaluated.”³⁵

33. Haraway, *Modest_Witness@Second_Millennium. Femaleman@_Meets_Oncomousem: Feminism and Technoscience*, xvii.

34. Daston, "The Moral Economy of Science," 15.

35. Robert K Merton, *On Social Structure and Science* (University of Chicago Press, 1996), 270.

We see these values, these moral economies, continue to play out to this day in the ways in which women and other historically marginalized groups are pushed out of the Sciences, or kept out through systemic barriers and gate-keeping, in explicit and implicit ways. Steven Epstein, in his case study of AIDS activism, writes, “knowledge hierarchies are rarely ‘accidental’ in their origins: They tend both to build upon and reinforce social cleavages based on other markers of difference—class, formal education, race, gender, sexuality, and nationality.”³⁶ All of these markers have a history to them, and the ways in which the genealogies of these markers continue to impact scientists from these groups continues, relatively unobstructed, thanks in part to Science’s insistence on its “apolitical” status. Science does not have to address these markers and their impacts because Science has apriori decided it is above all that, since that would be irrational and not based on reason or evidence, the foundations of scientific empiricism. The ongoing inability of most STEM fields to recruit and retain practitioners that reflect the demographics of the populations they serve is a glaring piece of evidence to this effect. Music and film theorist Max Fisher, thinking about hauntology, writes “the quality of (dis)possession that is proper to human existence as such, the way in which the past has a way of using us to repeat itself.”³⁷ This repetition, the ways in which Science’s origins continue to haunt its practices today, is why studying and understanding those origins is so important for contemporary practitioners. How else might we slow or stop the cycle of repetition, of reproducing the norms and values that require exclusion, the assimilation of caste standards, the

36. Steven Epstein, *Impure Science: Aids, Activism, and the Politics of Knowledge*, vol. 7 (Univ of California Press, 1996), 352.

37. Mark Fisher, "What Is Hauntology?," *Film quarterly* 66, no. 1 (2012), 19.

devaluing of scientific contributions from folks presumed incompetent, incapable, or untrustworthy? How might we both allow ourselves to be haunted—as a means of acknowledging the often ugly historical origins of our practices—and break away from being used as a means of repetition? Perhaps by holding our ghosts close, purposefully reaching across the veil, we can develop new ways to proceed forward, hand-in-hand with the spectres of our pasts as a means of imagining a different future.

This chapter will work to bring forward some of the uglier origins of common Euro-centric Scientific concepts and practices as a means of understanding their historical origins and how that lineage continues to haunt contemporary Scientific knowledge production. We will begin somewhat specialized, with a few of the pillars on which Scientific practice is currently built—objectivity and universality, determinacy and reductionism, and statistics and accounting—and then broaden out to cultural norms and values within scientific knowledge produced within the academy. This will mean addressing the role of disciplines and disciplinary measures, as well as academic and scientific funding structures and how those structures affect both practitioners and the knowledge produced. Lastly, we will look at the ways in which academia responds to conflict within its ranks through professionalism and collegiality, and how it invisibilizes and pathologizes negative affect as a means of control, exclusion, and discipline. With Daston in mind, we will think of these example topics as evidence of the moral economies of Science (and academia). We will explore the ways in which, “moral economies... are integral to science: to its sources of inspiration, its choice of subject matter and procedures, its sifting of evidence, and its standards of explanation. ... values do not distort science; they are science.”³⁸

38. Daston, "The Moral Economy of Science," 6.

Anecdotes of experiences with each of these concepts and values will be interlaced throughout as both additional evidence of the ways in which values haunt practices and as a means of cutting through sometimes abstract academic theorizing with personal and collective stories from the ground.

2.2 Objectivity and Universality

“Now you ask a question about your leaf. Guess what? You are now a scientist. People will tell you that you have to know math to be a scientist, or physics or chemistry. They’re wrong. That’s like saying you have to know how to knit to be a housewife, or that you have to know Latin to study the Bible. Sure, it helps, but there will be time for that. What comes first is a question, and you’re already there.”³⁹

~ Hope Jahren

A lot of science occurs in a laboratory, which is a constructed space that not so much mimics an environment or natural condition but strives to remove as many variables as possible. The laboratory is designed to be a controllable space where each element that is present is one that can be accounted for and ideally under the control of the experimenter. Some have argued that the laboratory is so constructed, it creates phenomena in and of itself; largely “artificial” phenomena that may or may not have a close relationship with the “natural” phenomena it is meant to study.⁴⁰ When it comes to the messiness of biology, where phenomena tend to occur

39. Hope Jahren, *Lab Girl*, First ed. (New York: Alfred A. Knopf, 2016), 4.

40. Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Milton Keynes: Open University Press, 1987); Karin Knorr Cetina, "Laboratory Studies: The Cultural Approach to the Study of Science," in *Handbook of Science and Technology Studies*, ed. Sheila Jasanoff, et al. (Thousand Oaks, California: SAGE Publications, Inc, 1995); Sharon Traweek, *Beamtimes and Lifetimes: The World of High Energy Physicists*

along a spectrum or continuum, this effort to transform biology into a clean and clear “view from nowhere” is maybe not so beneficial at best, misguided and harmful at worst. In 1992, Thomas Porter wrote in *Quantification and the accounting ideal in science*, “every scientific result begins its career as a view from somewhere—say some particular laboratory—and it is really the most fundamental task of every scientist to transform as much as possible into a view from nowhere, at least nowhere in particular.”⁴¹ Porter here is arguing that Science strives to un-situate itself, to remove its particularities and positionalities, to become abstract and therefore universal and objective. He writes, “there is a considerable premium in science on the objective and the mechanical, on replacing personal judgement and private wisdom with public standards and formal knowledge. That is, science enshrines objectivity, meaning (here) not truth to nature, but impersonality, standardization—reducing subjectivity to a minimum.”⁴²

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My first solo forays in the lab pursuing my own questions—after shadowing postdoctoral researchers to understand their questions and methods, after co-producing data for a conference presentation, after visiting Duke University to learn the basics of optogenetics in birds—were thrilling. I was a year into my MSc and had just completed my required coursework, meaning I was finally able to focus on producing data in the lab without also juggling a full graduate level course load in a field in which I had no previous formal training. With the help of the graduate

(Cambridge, Mass: Harvard University Press, 1988); Bruno Latour, "Give Me a Laboratory and I Will Raise the World," *Science observed: Perspectives on the social study of science* (1983).

41. Theodore M Porter, "Quantification and the Accounting Ideal in Science," *Social studies of science* 22, no. 4 (1992), 646-7.

42. Ibid. 645-6. “Truth to nature” is a reference to prior meanings of “objectivity.” See Daston and Galison’s volume: Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007).

students at Duke, I ordered a couple thousand dollars worth of materials, tools, and reagents to get my own injections of genetic constructs up and running. I felt simultaneously terrified—there was no one in our lab who had done this before—and empowered. I was being trusted to move forward on my own after just a year of transition from artistic to scientific practice—someone, namely my supervisor, must think I am capable and competent—and I knew I could do it. As I waited for components to arrive, I began teaching myself to use hand-me-down equipment from other labs that had been collecting dust for years by reading manuals and running mini-experiments to be sure I understood how they worked. As new parts and pieces began to trickle in to the lab, I hand-made tools based on notes from the Duke students and 3D printed tool holders to fit our stereotax and electrophysiology recording equipment. While I had become familiar with using the stereotax to hold our bird’s heads in position during a neurosurgery and the electrophysiology (e-phys for short) rig for recording neural responses while co-producing data with a postdoc, using both for optogenetics required integrating new and different tools for both recording neural responses and injecting the genetic constructs into our regions of interest. With each tool made, each piece of the rig integrated, each system test successfully completed, my confidence grew that in spite of it all, I did somehow know what I was doing and this was going to be awesome.

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Similar to many phenomena in biology, it may be more helpful to think about the “artificial” space of the laboratory vs. the “natural” phenomena it hopes to study as itself a continuum. We might place some things on one end closer to the “artificial” side—maybe the abstract apparatuses of quantum physics or a high security biohazard lab—and others closer to the “natural” side—an observation-based field lab or a kit of tools that goes into the field—but

we could not claim that any of these examples are entirely “artificial” or entirely “natural” and most experimental work is going to occur somewhere in the middle. Trying to think through this continuum and where we might place various tools, methods, spaces, places, or questions could be an interesting exercise, but perhaps one that would ultimately lead us to the conclusion that the artificial/natural divide itself is not so helpful. Similarly, where might we place some of the most influential ideas and ideologies? Where do judgements, wisdom, public standards, impersonality, standardization, objectivity, and subjectivity go? How do we separate these ideas from one another? Where is the line between personal judgement and public standard, between private wisdom and formal knowledge? Who gets to decide where those thresholds lie and what are the impacts of those decisions and delineations?

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The first step in developing optogenetic tools in the visual system of our birds was to inject an adeno-associated virus (AAV) containing our genetic tool: a circle of DNA that once in the nucleus of our neuron would guide the production of proteins in the cell membrane that respond to a light stimulus. After the initial neurosurgery during which I would inject a micro-dose of viral particles to a specific location—the goal was to only infect a specific population of neurons rather than all the neurons in the brain—the bird would awaken from anaesthesia and recover in our lab, living normally with its peers for at least four weeks. During those four weeks, the virus would infect cells in the region with our new protein encoding DNA, resulting in the production of our light responsive membrane channels called opsins. In this early stage, I needed to confirm whether or not the virus was successfully transfecting our neurons of interest,

so I would sacrifice the bird around the four week mark with a trans-cardial perfusion,⁴³ which would clear the bird's tissues of blood with first a saline drip, then begin to fix its tissues with a formaldehyde drip. I would then dissect out the brain and take the tissue through a multi-day process of preparation for histology, which would allow me to slice the brain into sections that could be placed under the microscope for analysis. My opsins each had a fluorescent tag—I often imagine them as tiny neon flags waving on the outside of the cell, one for each protein poking through the membrane, though this image is not entirely scientifically accurate—so that with the help of fluorescent filters on a microscope, I could see exactly where my opsins were expressed after the experiment was complete. The joy of finding those neon flags waving, confirming transfection, after the first few injections of AAVs, the month-long wait, the perfusion and histology, and the search in the dark of the microscope room, is hard to articulate even now, years later.

43. This meant putting the animal in a deeply anesthetized state, cutting open its chest and removing the keel to access the still-beating heart, inserting a needle attached to a pump into the heart, and then running the pump to circulate saline through the body in the place of blood circulation. After the body was cleared of blood, I would switch the pump to paraformaldehyde to then circulate formaldehyde through all the tissues of the body.

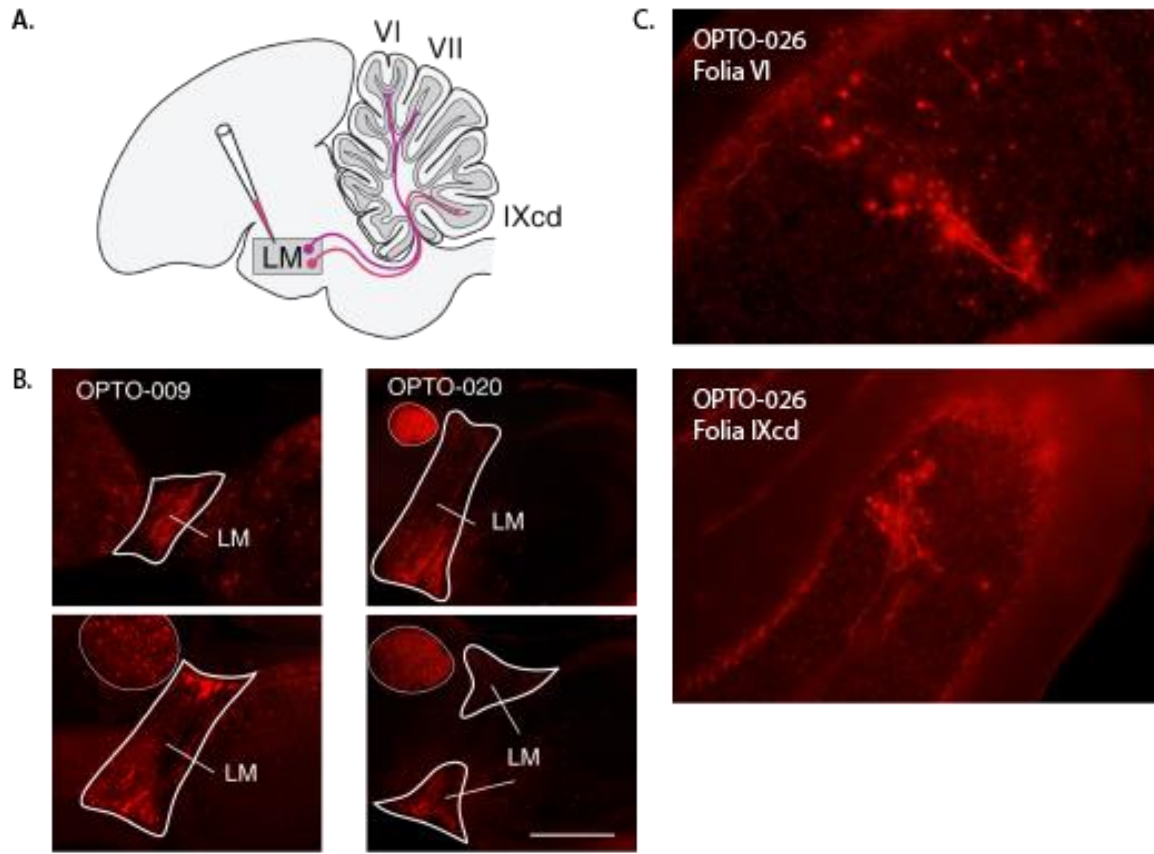


Figure 1. *Opsin expression in lentiform mesencephali (LM) cell bodies and in axon terminals in cerebellar folia.* **A.** Schematic illustration of injections of optogenetic construct containing viruses in the LM, an area hypothesized to be necessary for optic flow processing and visually mediated flight behaviours. Injections in the LM resulted in expression of opsins along the length of neurons from the cell body in the LM to terminal fibers in folia VI, VII, and IXcd of the cerebellum. **B.** Fluorescence microscopy images of opsins tagged with mCherry expressed in the cell membranes of LM neurons and neighboring anatomical structures in serial sections from two different animals. **C.** Fluorescence microscopy images of mCherry tagged opsins expressed in terminal fibers, characterized as mossy rosettes, in cerebellar folia VI and IXcd. Images are from an injection of AAV9-CAG-hChR2-mCherry in the LM with imaging occurring 90 days after injection to allow extra time for transport of membrane proteins down the full length of the axon.

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This refusal to acknowledge a discipline or lab's sociopolitical context is itself a choice. After all, choosing *not* to do something is still a choice. In 1988 Donna Haraway introduced her concept of "situated knowledges" in response to Sandra Harding's 1986 book *The Science Question in Feminism*, which coined "standpoint theory" as a means of emphasizing epistemologies originating from women's knowledge. Haraway warned that "there also lies a serious danger of romanticizing and/or appropriating the vision of the less powerful."⁴⁴ Situated knowledges became "an argument against various forms of unlocatable, and so irresponsible, knowledge claims,"⁴⁵ regardless of where those claims originate—whether from the center or the periphery. This would come to be known as second-wave standpoint theory as the theory expanded to include social positions such as race, social class, culture, and economic status. In sum, situated knowledge promoted the idea that "the standpoints of the subjugated are not 'innocent positions... they are preferred because in principle... they are knowledgeable of modes of denial through repression, forgetting, and disappearing acts—ways of being nowhere while claiming to see comprehensively.'⁴⁶ Feminist science scholars would continue to iterate on positions and intersections, thinking through whether it is ever possible (or desirable) to hold a non-position, a non-view, and produce knowledge at the same time. As Sandra Harding later wrote:

It turns out that abstractness and formality express distinctive cultural features, not the absence of any culture at all. ...Modern sciences' 'neutrality' devalues not only local

44. Donna J. Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist studies* 14, no. 3 (1988), 583-4.

45. Ibid. 583

46. Ibid. 584

scientific traditions, but also the culturally defining values and interests that make a tradition Confucian rather than Protestant or Islamic. Claims for modern sciences' universality and objectivity are 'a politics of devaluing local concerns and knowledge and legitimates 'outside experts.'⁴⁷

Postcolonial science scholars would continue to build on the ways in which Science devalues local knowledge in favour of a "universal" ideal as one of many ways that Science participates in colonialism. Colonizers use Science, especially biology, to render Others null—often through definition and categorization—and therefore subject to conquest. Haraway would go on to write in *Modest_Witness@Second_Millennium. Femaleman@_Meets_Oncomouse*, "the institutions, research projects, measuring instruments, publication practices, and circuits of money and people that made up the life sciences were the machine tools that crafted 'race' as an object of scientific knowledge over the past 200 years."⁴⁸ The use of biology to support the "inventions and reworkings of categories of nation, family, type, civility, species, sex, humanity, nature, and race"⁴⁹ continue to resonate nearly forty years after Harding's and Haraway's observations and theorizations, yet its practices remain relatively unchanged with respect to acknowledging and taking responsibility for its significant role in these ideologies.

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The long-term goal of developing optogenetics in the visual system of our birds was to use the tool to bridge the gap between brain and behaviour. Previous studies, in our lab and

47. Sandra G Harding, "Is Science Multicultural?: Challenges, Resources, Opportunities, Uncertainties," *Configurations* 2, no. 2 (1994), 319.

48. Haraway, *Modest_Witness@Second_Millennium. Femaleman@_Meets_Oncomouse*: *Feminism and Technoscience*, 217.

49. *Ibid.* 217

others, had investigated visually mediated behaviours during flight and found that birds were quite susceptible to visual perturbations; they could be “pushed” in different directions during flight with visual stimuli alone.⁵⁰ Other studies, also in our lab and others, had described neurons that responded to large-field visual motion, known in the field as optic flow, associated with self-motion.⁵¹ In other words, brain regions had been identified that responded to the same type of visual stimuli that was also being used to “push” birds around in behavioural experiments. Optogenetics, a tool that had already been used for over a decade to manipulate neurons by causing them to fire or go silent with the help of a light stimulus, seemed like a great way to

50. Benjamin Goller et al., "Spatial and Temporal Resolution of the Visual System of the Anna's Hummingbird (Calypte Anna) Relative to Other Birds," *Physiological and Biochemical Zoology* 92, no. 5 (2019); R. Dakin, T. K. Fellows, and D. L. Altshuler, "Visual Guidance of Forward Flight in Hummingbirds Reveals Control Based on Image Features Instead of Pattern Velocity," *Proc Natl Acad Sci U S A* 113, no. 31 (2016); Ivo G. Ros et al., "Rules to Fly By: Pigeons Navigating Horizontal Obstacles Limit Steering by Selecting Gaps Most Aligned to Their Flight Direction," *Interface Focus* 7, no. 1 (2017); P. S. Bhagavatula et al., "Optic Flow Cues Guide Flight in Birds," *Curr Biol* 21, no. 21 (2011); M. N. O. Davies and P. R. Green, "Optic Flow-Field Variables Trigger Landing in Hawk but Not in Pigeons," *Naturwissenschaften* 77, no. 3 (1990).

51. Nathan A. Crowder et al., "The Accessory Optic System Contributes to the Spatio-Temporal Tuning of Motion-Sensitive Pretectal Neurons," *Journal of Neurophysiology* 90, no. 2 (2003); N. A. Crowder, M. R. Dawson, and D. R. Wylie, "Temporal Frequency and Velocity-Like Tuning in the Pigeon Accessory Optic System," *J Neurophysiol* 90, no. 3 (2003); D. Eckmeier et al., "Encoding of Naturalistic Optic Flow by Motion Sensitive Neurons of Nucleus Rotundus in the Zebra Finch (Taeniopygia Guttata)," *Front Integr Neurosci* 7 (2013); D. Eckmeier et al., "Gaze Strategy in the Free Flying Zebra Finch (Taeniopygia Guttata)," *PLoS One* 3, no. 12 (2008); Andrea H. Gaede et al., "Pretectal Projections to the Oculomotor Cerebellum in Hummingbirds (Calypte Anna), Zebra Finches (Taeniopygia Guttata), and Pigeons (Columba Livia)," *Journal of Comparative Neurology* 527, no. 16 (2019); Andrea H. Gaede et al., "Neurons Responsive to Global Visual Motion Have Unique Tuning Properties in Hummingbirds," *Current Biology* 27, no. 2 (2017); Wylie and B.J. Frost, "Responses of Neurons in the Nucleus of the Basal Optic Root to Translational and Rotational Flowfields," *Journal of Neurophysiology* 81, no. 1 (1999); Wylie et al., "Telencephalic Projections to the Nucleus of the Basal Optic Root and Pretectal Nucleus Lentiformis Mesencephali in Pigeons," *Vis Neurosci* 22, no. 2 (2005); Wylie, "Processing of Visual Signals Related to Self-Motion in the Cerebellum of Pigeons," *Front Behav Neurosci* 7 (2013).

bridge the gap between brain and behaviour. If we could silence or activate the brain regions that responded to optic flow *during* flight and record a resultant behavioural change, we might be able to claim that these brain regions were “necessary and/or sufficient” for visually mediated flight behaviours. Claims of “necessity” and/or “sufficiency” were neuroscientific gold: if you turned neurons off and lost a function, then you could claim those neurons are “necessary” for the function. Conversely, if you activated those neurons and gained a function, then you could claim those neurons are “sufficient” for that function. With optogenetics dangled the carrot of both a necessity *and* a sufficiency claim, the kind of claim that would get us into the highest impact journals. As my experiments showed immediate promise due to the presence of our neon flags under the microscope, we excitedly moved forward as fast as possible; with both a roll-up into a PhD for me and with more and different types of transfection experiments, showing that I could drive expression of the opsins throughout the full length of the neuron and in various regions of the brain that were potentially important for visually guided flight.

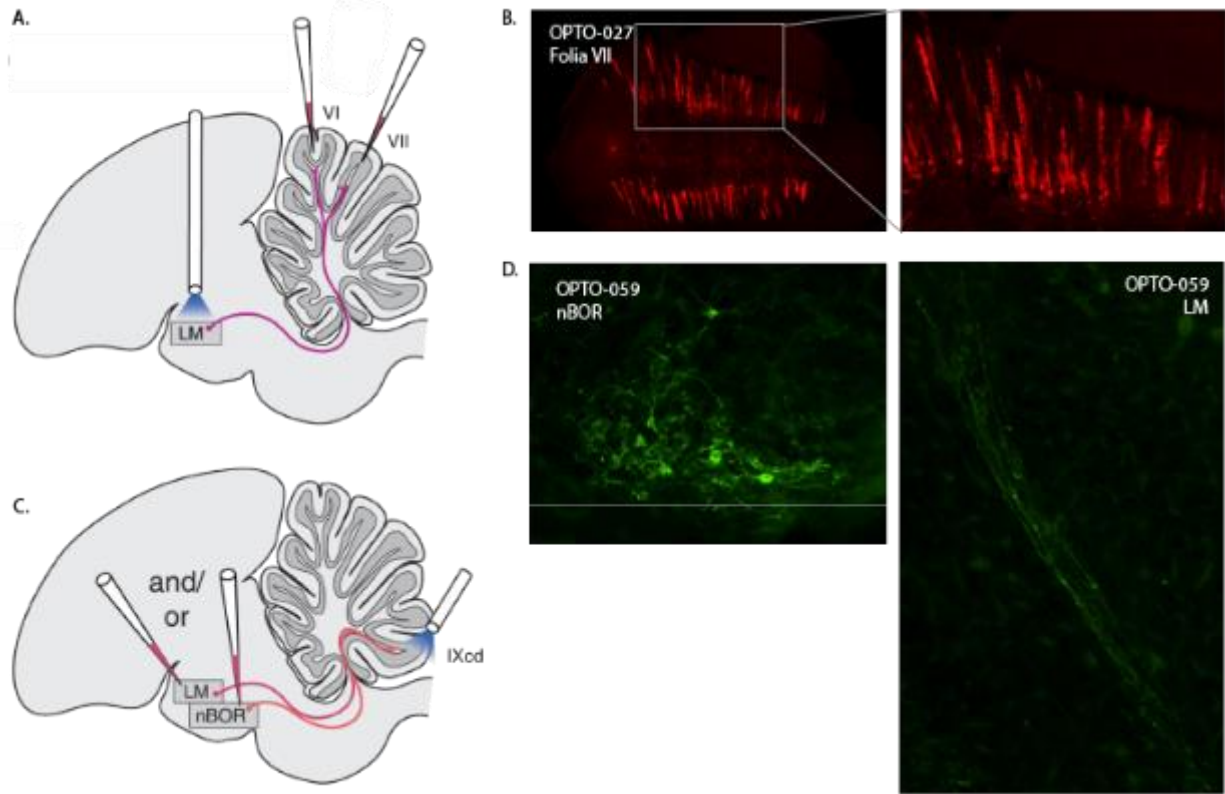


Figure 2. Opsin expression in purkinje cell bodies in the cerebellum and in nucleus of the basal optic root (nBOR) cell bodies and axon fibers in the LM. A. Schematic illustration of injections of optogenetic constructs in cerebellar folia, both to determine if retrograde transport to the LM would work and for possible future cerebellum studies. B. Fluorescence microscopy images of mCherry tagged opsin expression in cells in the Purkinje layer of folia VII of the cerebellum. C. Schematic illustration of injections of optogenetic constructs in the nBOR, a population of neurons that also responds to optic flow but with different preferred and anti-preferred directions than the LM. Reciprocal connections between the LM and nBOR have been found, and both project to the cerebellum for integration with other sensory modalities. D. Fluorescence microscopy images of green fluorescent protein (GFP) tagged opsin expression in cell bodies in the nBOR and along the length of the axon fibers in the LM where some nBOR cells terminate.

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Richard Levins and Richard Lewontin, STS scholars who often collaborate, wrote in a Sandra Harding edited volume, *The Racial Economy of Science*:

the internal mechanisms for maintaining objectivity are, at their best... able to nullify individual capricious errors and biases, but they reinforce the shared biases of the scientific community. The demand for objectivity, the separation of observation and reporting from the researchers' wishes, which is so essential for the development of science, becomes the demand for separation of thinking from feeling. This promotes moral detachment in scientists which, reinforced by specialization and bureaucratization, allows them to work on all sorts of dangerous and harmful projects with indifference to the human consequences.⁵²

This separation of thinking from feeling is one that we will spend more time on later, but the relationship between demands for objectivity and this separation of thinking and feeling is important to note at this stage. Sandra Harding would go on to propose “strong objectivity” in contrast to the weak objectivity of supposedly universal or “value-neutral” research. Harding argued that neutrality in research was impossible; instead, purposeful reflexivity would strengthen knowledge production practices and make space for critique of the knowledge produced when considered in its full context. Unfortunately, Harding herself predicted the slow uptake of “strong objectivity,” as she wrote in 1995, “it is hard to imagine this strong objectivity program effectively enacted right away within the present day culture and practices of sciences, which are largely resistant to the interpretive and critical skills and resources necessary to detect

52. Richard Levins and Richard Lewontin, "Applied Biology in the Third World: The Struggle for Revolutionary Science," in *The "Racial" Economy of Science: Towards a Democratic Future*, ed. Sandra G. Harding (Bloomington: Indiana University Press, 1993).

values and interests in the conceptual frameworks of scientific projects.”⁵³ Thirty years later and it would appear that many Scientists in academia—who are tasked with educating the next generation in interpretive and critical skills—have not heard of “strong objectivity” or “situated knowledge,” and do not strive to enact reflexivity in their practices or teach it to their students.

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When I think back on my own scientific practices throughout this degree, a separation between thinking and feeling, while perhaps a cultural goal, was never actually achievable. Certainly, there were many moments where troubles in my personal life or the world at large loomed heavy and had to be “set aside” in order to focus on the work at hand, as is the case with most workplaces under capitalism, but the work itself, at the lab bench, was full of feeling. I have already mentioned the joy of finding neon flags under the microscope, even when they were found in unexpected places; they made for some gorgeous and fascinating images. There was also the thrill of a successful neural recording, the exhilaration of eavesdropping on neurons conversing with one another, the rush of being able to directly participate in that conversation with the help of a stimulus. There was the satisfaction and exhaustion of nursing a hummingbird back to life after an invasive brain surgery, or the stifled giggles while trying to hold absolutely still so the zebra finches would forget your presence and goofily partake of bath day. There was devastation when an animal failed to recover from a surgery, when no data could be gleaned after a long day, when something that had worked perfectly yesterday, failed to perform now. The highs and lows were palpable, could vary across a single hour or day and certainly across

53. Sandra Harding, "'Strong Objectivity': A Response to the New Objectivity Question," *Synthese (Dordrecht)* 104, no. 3 (1995), 348.

months of laboriously chipping away at possibilities. Science under these conditions is hard. As was told to me often, *if it was easy, anyone could do it*. The fact is, anyone *could* do it, everyone *already* does it: lower-case science that is. It is the specific conditions of the modern academic lab, with its constant demand for more and better data, for results and conclusions, for positive publishable output, that limit who can do it and what they can do with it. All of those failures did not have to be so devastating. They produced a different kind of data; I learned an inordinate amount from each failure and collectively they added up to null results that those who are interested in this field should know about. My “null” results could aid in the development of new questions and alternative methods. They could be appreciated as they are to understand a little bit more about the tools I was using and the animals and neural systems I was studying. But they were “null” and null results are not valued in the academic scientific knowledge production system. Sure, I could probably still publish my null results with a bit of narrative spin in a specialized journal, but even doing that would require sacrificing more animals to “prove” that the results were *truly* null. To what end would those additional lives lost be contributing? To meet a statistical, publishing, or peer-review standard invented by whom for whom? I might gain a much needed (from a Scientific career perspective) publication, but one with such little cultural value that I could not imagine a prospective employer caring. I had already sacrificed over 70 animals for my PhD alone, why on earth did I need to sacrifice more? There are many feelings that come with wrestling with my null results and what to do with them; how to think about them, how to value them exactly as they are without requiring more. How to value the work exactly as it is, without requiring more. How to value myself exactly as I am, without requiring more.

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As Isabel Stengers puts it in *Another Science is Possible*, “if relevance rather than authority or objectivity had been the name of the game, the sciences would have meant adventure, not conquest.”⁵⁴ Stengers continues, “instead of a general ideal of objectivity, a positive, radical, plurality of sciences would have been generated, each scientific practice answering the challenge of relevance associated with its own field.”⁵⁵ Without the Authority granted by objectivity as a “universal” value, Science could have become something else entirely. Science already is something else entirely for lower-case scientists engaged in local, proximate practices. Instead of insisting that the scientific method, a tool for objective and universal knowledge production, was the one and only way to enact a scientific practice, there could have been a multitude of methods and ways of doing/being/thinking deemed valid for meaningfully contributing to scientific knowledge production. If Science was open to change, objection, hesitation, it might still be so much more as Stengers argues in her manifesto for slow science. Ideas of objectivity and universality have become a crutch to prop up Science the Authority but that crutch comes at a cost. To quote Porter again, “objectivity is a technology of distance: geographical, intellectual and social. ...Objectivity empowers weak authorities, even as it constrains them.”⁵⁶

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So let’s get close, let’s get intimate—with ourselves, with our study organisms, with the work. Modern Euro-centric Science may have built a monopoly on what science can be, claimed

54. Isabelle Stengers, *Another Science Is Possible: A Manifesto for Slow Science*, trans. Stephen Muecke, 1 ed. (Newark: Wiley, 2018), 144.

55. Ibid. 144

56. Porter, "Quantification and the Accounting Ideal in Science," 640-1.

itself as the one true Authority, but we can still learn about the world through proximity, through subjectivity, through intimacy with the land, its flora and fauna, its phenomena. Children learn about physics by falling down over and over and over again until they fall less. It may not be the most efficient way, but it doesn't need to be efficient—they have all the time in the world to keep trying and failing until they stand and walk. We don't need academia or the rules of the scientific method to develop and contribute a piece of knowledge to our understanding and experience of the world. We engage with science when we look around our world and ask questions, wonder aloud about how or why or what. Anyone sidling up to a question, inviting it in, sitting with it, giving it a comfy home in a body and mind, sleeping on it, and internalizing it until it grows into something new and different, until it presents itself as a possible answer or leads to another question, is already a scientist, developing a piece of knowledge.

2.3 Determinacy and Reductionism

“...rights, ethics, speech, freedoms, and other complex human situations cannot be predicted from axioms or a priori rules.”⁵⁷

~ Kavita Philip

Richard Lewontin and Richard Levins have written extensively about the ways in which the Euro-centric Western worldview impacted the founding of Science and its core principles.

They open their book, *The Dialectical Biologist*, with the following description:

57. Kavita Philip, "How to Stop Worrying About Clean Signals and Start Loving the Noise," in *Your Computer Is on Fire*, ed. Thomas S. Mullaney, et al. (The MIT Press, 2021), 373.

In the Cartesian world, that is, the world as a clock, phenomena are the consequences of the coming together of individual atomistic bits, each with its own intrinsic properties, determining the behaviour of the system as a whole. Lines of causality run from part to whole, from atom to molecule, from molecule to organism, from organism to collectivity. As in society, so in all of nature, the part is ontologically prior to the whole.⁵⁸

This division of part from whole with each part contributing to an additive process, reductionism, is recognized by many scientists as overly simplistic and yet it infiltrates our way of thinking and therefore the questions we ask, the methods we use, and our interpretations of results. It parallels determinism—that parts determine the actions of whole and cause and effect can be clearly delineated with events being causally inevitable—and allows us the illusion of reducing any complexity into a simple matter of summation. Biology is famously messy in that most phenomena occur along a spectrum or continuum. Pick any category, definition, or rule in biology and you will always find at least a handful of exceptions, if not many examples of organisms that refuse to cooperate with theories and labels. Whether it is the delineation and definition of species themselves, binary sex labels, or physiological responses to a stimulus, there are always some that will not fit neatly into a human constructed definition or predicted outcome. This incredible diversity—the queerness of nature—gets labelled “variation” and becomes something that must be controlled, accounted for, and/or eliminated in order to support clarity, even as we believe that this variation is the exact thing that empowers the proliferation of life on Earth. Variation in the form of biodiversity has allowed for the continuation of life on the planet, sustained across time, enabling the success of organisms in the most unlikely conditions and places. Even biologists who study organisms that do not follow the rules or that have developed

58. Richard Levins and Richard Lewontin, *The Dialectical Biologist* (Cambridge, Mass: Harvard University Press, 1985), 1-2.

radical means of survival in extraordinary conditions reduce that organism to a set of measurable traits to be averaged and normalized, with deviant data points thrown out or excluded during analysis.

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Ask any scientist and I guarantee they'll have examples from their own work of deviant organisms or bits of data that refused to cooperate, did not fit the mold, and could not be explained away in a rational simplistic way. Sometimes those are the most interesting moments, an anomaly that inspires a new question, frame, or method, even if they cannot be included in a publishable study. How do we account for those deviant moments, the irregular organism, the queer bit of data? We can tell their story, as Hope Jahren does in her memoir, *Lab Girl*, but are there other ways to include these queer friends that are sometimes far more impactful than their ordinary peers? How else might their stories thrive or their outsized impact shared? Jahren dedicates two pages of *Lab Girl* to the story of C-6, one seedling in a set of sixteen that behaved wildly compared to its peers in spite of starting as a seed of the same size and species as everyone else. She concludes the section with this description:

Our fascination with C-6 was not a scientifically legitimate experiment, we never officially 'wrote it up' for anything, and yet that small plant growing in a Dixie Cup changed my thinking more than anything I had read within my dog-eared textbooks. I had to conclude that C-6 did things—not just because he was programmed to do so, but also for reasons known only to him. He could move his 'arm' from one side of his 'body' to the other; he just did it about 22,000 times slower than I could move mine. His clock and my own were forever out of sync, a simple fact that had placed an untraversable canyon between us. While it seemed that I experienced everything, he appeared to me to passively do nothing. Perhaps, however, to him I was just buzzing around as a blur and, like the electron within an atom, exhibited too much random motion to register as alive.⁵⁹

59. Jahren, *Lab Girl*, 261.

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Philosopher Denise Ferreira da Silva, thinking back to a time when biology was called “natural history,” writes that, “the emergence of modern science can be described as a shift from a concern with forms of nature, which prevailed in scholastic thought, to an inquiry into the efficient causes of changes in the things of nature.”⁶⁰ The move from observing and describing the natural world—studying natural history—to defining and therefore constructing and limiting “nature” can be traced to the rise of determinism; the search for cause and effect. The scientific method, designed to reduce the complexities of nature into separable, compartmentalized, and therefore quantifiable units, breaks the world into elements without acknowledging this reductive act and its possible consequences. Da Silva writes:

knowing and all other activities of the mind are reduced to determinacy: namely, the assignation of value that refers to a universal (scale or grid), while the object of knowledge becomes a unity of formal qualities (properties, variables, etc.), that is, an effect of judgements that produce it through measurement (degree) and classification (position).⁶¹

This short description, clearly outlining elements of the scientific process itself and its role in reductionism and determinism is one that every scientist could spend a lot of time thinking through with respect to their own practice. A concerned practitioner might apply each element of this sentence to their own process to unearth some hidden assumptions and abstractions. What “universal” (scale or grid) assignation of value am I using? List all the properties, variables, etc. that I use when referencing my organism/inquiry. What are my measurements *doing*—what work

60. Denise Ferreira da Silva, "1 (Life) ÷ 0 (Blackness) = ∞ - ∞ or ∞ / ∞: On Matter Beyond the Equation of Value. E-Flux, 79 (February)," (2017), 5.

61. Ibid. 6.

do they accomplish—with respect to how my organism/inquiry is defined? What unspoken classifications, categories, or labels am I using that are affecting my definitions, measurements, scale/grid, and *how* do they affect? In summary, how am I producing my object of knowledge with these tools rather than listening to what this object has to say for itself?

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How much knowledge about our world are we missing because phenomena cannot be efficiently explored and described according to the scientific method? What insights are absent due to our focus on methods of production in opposition to methods of listening? Jahren's C-6 is a single example of a phenomenon, while not ignored by her, set aside by Science due to the inconvenience of trying to efficiently explain and understand what C-6 was doing. Jahren undoubtedly has other examples and I imagine most scientists could provide a similar story of surprise that could not be scientifically followed for any number of reasons. I'm not sure that I was engaged in my own scientific practice for long enough to encounter a surprise as world-changing as Jahren's, but I certainly experienced plenty of small surprises along the way. Tools working spectacularly well in an unexpected area of the brain, errant flight behaviours that were beautiful and illogical to my eye, neural recordings that didn't align with published literature. If I have any regrets about my time in academic Science, it would be not pursuing those moments further, not allowing myself to explore what might come from those unknowns. Those surprises were systematically set aside—at most noted in a lab book, documented with a photo, saved in my memory—in order to pursue the bigger question that had produced the surprise in the first place. While I understand why these moments are side-lined, I wish there was more room in scientific practice to follow those leads, to pick the sawdust up from the shop floor and let the quirky, throw-away moments take you someplace truly unexpected and unpredictable. Let the

work move you instead of always moving the work. I wish there was time and space to pick up the pieces that Science casts aside and ask what *they* know that we don't, let *them* tell us where we should go next and how to get there.

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With objectivity and determinacy as both weapon and shield, we forget the myriad ways that complexities—our own internal complexities as humans and the external complexities of the world we study—shape what we see, what we do, and how we interpret our own actions and their outcome. While philosopher Charles Mills is not thinking explicitly about science, his reminder is relevant here:

At all levels, interests may shape cognition, influencing what and how we see, what we and society choose to remember, whose testimony is solicited and whose is not, and which facts and frameworks are sought out and accepted. Thus at any given stage, it is obvious that an interaction of great complexity is involved, in which multiple factors will be affecting one another in intricate feedback loops of various kinds. So an analytic separating-out of elements for purposes of conceptual isolation and clarification will necessarily be artificial, and in a sense each element so extracted leaves a ghostly trail of all the others in its wake.⁶²

What of these trails left in Science's wake? What of the complexities that cannot be broken down, delineated cleanly, and so are set aside as too challenging to study? Even my framing of internal complexities as humans and the external complexities of the world we study is suspect as Mills' statement reminds us that our own cognition directly counters any line we might draw in the sand between one thing and another, between what is counted and how we count it, between the internal and external.

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62. Mills, *Black Rights/White Wrongs: The Critique of Racial Liberalism*, 11.

Listening is a two-way street. All of our senses are active, not passive, though some are easier to imagine as active than others. Touch for example is a bit easier to understand as active; we touch things, they touch us, the way we have been touched in the past affects how we receive touch in the present. Neuroscience has confirmed what Proust described with his famous madeleine: smell is intimately linked with memory, the two are functionally and anatomically intertwined in the brain and can dramatically affect one another, which in turn affects the body experiencing the “sense-memory.”⁶³ It is harder to remember that vision is active—that we shape what we see with our attention, with prior experience, that we have a literal blind spot our brain automatically fills in—since our *experience* of vision feels passive, like we are receiving an unmediated image of the world. The same is true with the auditory system; hearing is active and dependent on our interests, the acoustics of the space we are in and how long we’ve been in it, our previous experiences separating a specific signal from noise, and so on. Active perception has been taken up by theories of embodied cognition, which is interested in the ways that behaviour state and/or organismal capacity shape cognitive functions from perception to memory, to mental constructs and tasks like meaning-making and reasoning or judgement. Embodied cognition gives the body a significant role in mental phenomena, which was previously reserved exclusively for the mind in the disembodied Cartesian model. With cognition firmly located in a body in a specific place and time, intimately and *actively* connected to the external world through the body’s sensory capacities, it becomes increasingly difficult to justify an “objective,” Cartesian determinism, and to separate ourselves from the phenomena we

63. See Cindy Poo et al., "Spatial Maps in Piriform Cortex During Olfactory Navigation," *Nature* 601, no. 7894 (2022). for one recent example among many.

study. While I might wish for the space and time to listen to my objects/subjects of interest, what I hear and *how* I hear is just as dependent on me and my body as it is on the object/subject's body. With this in mind, it becomes important to develop means for holding myself accountable, for remembering my role in listening and seeing, reminding myself that these are not passive acts in which others speak to us, but a conversation even when we think only one of us is doing the talking.

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When we layer in the neoliberalism of scientific knowledge-production in the context of the capitalist academy that we will outline shortly, any complexity deemed irreducible is not worthy of pursuit: it is too hard to study and will not produce results fast enough. As Lewontin and Levins put it:

Those problems that yield to the attack are pursued most vigorously, precisely because the method works there. Other problems and other phenomena are left behind, walled off from understanding by the commitment to Cartesianism. The harder problems are not tackled, if for no other reason than that brilliant scientific careers are not built on persistent failure.⁶⁴

Reductionism and determinacy in the “fast science” era of late stage capitalism results in the foreclosure of ideas, questions, and methods in favour of the lowest hanging fruit that is guaranteed to produce. As Levins stated in a Science for the People conference in 2014, “one of our critiques of the existing way of doing science is its reductionism down to a narrow pattern of acceptable variables along with acceptable people to study them and acceptable answers to

64. Levins and Lewontin, *The Dialectical Biologist*, 2-3.

questions.”⁶⁵ With so much predetermined, so much limited by reductionism and determinacy, it is no wonder that Science and scientists have begun to feel trapped in an oft-cited “publish or perish” cycle with little room for exploration, wonder, or the curiosities that drew them to science in the first place.

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Listening to neurons chatter was another source of both joy and devastation during my time in the lab. After confirming successful expression of opsins in our areas of interest, namely an anatomical structure called the lentiformis mesencephali (LM), the cells of which we knew responded to optic flow, the next step was to repeat the injection of the optogenetic constructs followed by a second surgery, four weeks after injection, to record neural responses and see if we could stimulate activity with a light source. During this second surgery, I would (re)open my previous craniotomy slightly larger to make space for both a recording electrode and a fibre optic linked to a laser, collectively called an optrode. I purchased our first laser for several thousand dollars from a Chinese manufacturer who designed lasers specifically for optogenetic experiments. The laser matched the wavelength of the specific opsin I was using and had controls for adjusting the intensity of the output depending on experimental need. I designed a program that would deliver a series of light pulses at various lengths and frequencies to determine the best stimuli for eliciting a response from our neurons of interest without burning them, which would result in cell death. With the stereotax, I would lower the optrode extremely slowly into the brain, recording neural responses along the way in order to recognize the neural

65. Sigrid Schmalzer, Daniel S. Chard, and Alyssa Botelho, *Science for the People: Documents from America's Movement of Radical Scientists* (Amherst: University of Massachusetts Press, 2018), 34.

activity that marked the start of our region of interest: a response to large-field visual motion. With the bird's eye taped open, I would wave a board covered in black and white drawings in front of the open eye and listen to the electrical responses from the neurons. When a wave of the board was met with a wave of electrical activity, I knew I was getting close. If moving the board in one direction elicited a wave of activity and moving the board in the opposite direction was met with silence, I knew I was in the LM. Once I found a good recording site—"good" because I could hear activation in the preferred direction and silencing in the "anti-preferred" direction—I would begin an "official" recording in which I ran the neurons through a program of visual stimuli in all directions. After that recording concluded, I would turn off the monitor so that the bird and I were in darkness, and run my laser stimulus program to determine whether or not the laser alone was able to activate the same neurons that responded to the visual stimuli in the previous recording. There was an outbreak of silent but absolute joy in the surgery room when I heard laser activation of the same cells that had just responded to the visual stimulus program. My optogenetic injections had not only resulted in opsin expression, but light activation of those opsins was causing the transfected neurons to fire on my cue. I could turn neurons on and off at will. I could not leave the room or whoop for joy, so instead I would take video and audio recordings of the experiments and send them to peers, silently celebrating alone but together in the dark.

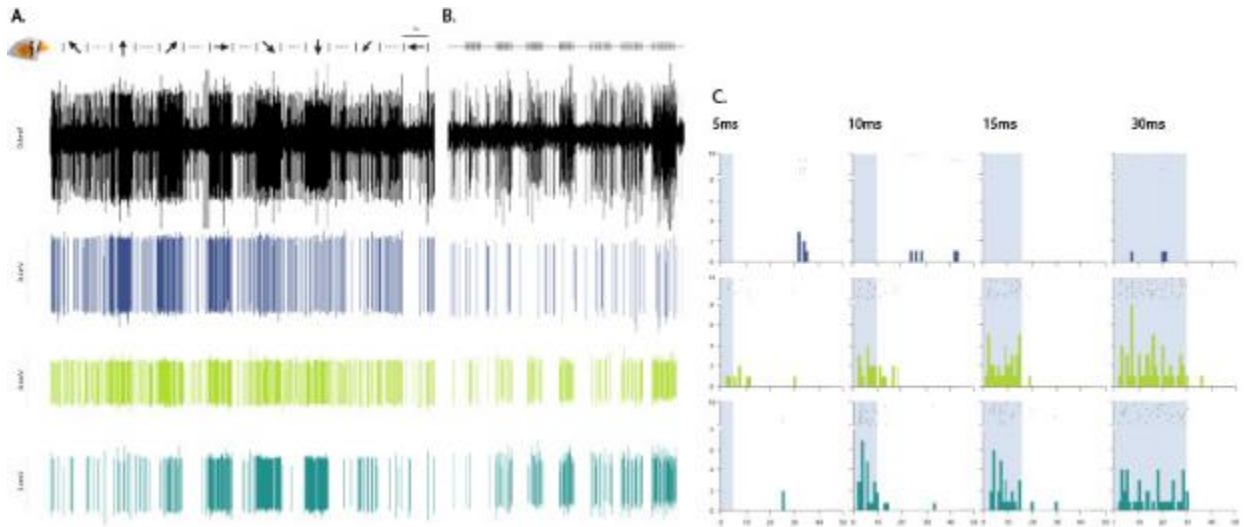


Figure 3. Optogenetically activated neurons in the LM. A. A multi-unit optrode recording in the LM in which visual stimulus in all directions at 45deg intervals was presented and neural activity in response to directional stimuli recorded. The black is the multi-unit recording, the dark blue, lime green, and teal are from the same recording, spike sorted into three possible individual cells. LM responses to visual stimuli are characterized by activation in the preferred direction and silence with respect to base firing rate in the anti-preferred direction. B. During the same recording, the visual stimulus was turned off and a series of laser stimuli run through a fiber optic. The black is the multi-unit responses to the laser pulse trains with the same spike sorting of three possible individual cells below. C. Peri-stimulus time histograms (PSTH) count and stack neural responses to laser stimuli, indicating a strong response to the laser from the lime green and teal cells and no response to the laser from the blue cell. Light grey bands in each PSTH indicate the time the laser was on. The teal cell (bottom row) shows both a strong preferred/anti-preferred response to directional visual stimuli *and* a strong response to the laser.

2.4 Statistics and Accounting

What we determine to be worthy of counting is entangled with objectivity, universality, determinism, and reductionism as well as sociopolitical factors. Here we consider *how* we count. What work is quantification itself doing in scientific practices, and how do our methods of

counting impact both what we choose to count in the first place and what we do with the data later? While statistics is often touted as a means of achieving objectivity and removing bias, the field has its own sordid history in the enclosing of the commons for capital/colonial profit.⁶⁶ Achievable research questions are determined as much by what statistical methods exist to analyse the data as by data collection methodologies. Trainees in science are often prompted to consider various statistical tools and models available to them before embarking on a data gathering/producing process, and are encouraged to analyse the data as they gather it to ensure things are headed in the “right” direction. This means statistics can shape experimental design and research question before data is produced. And yet colloquialisms in Science abound when it comes to letting data “speak for itself,” or seeing what falls out of the data as if we a) did not let statistical models influence our experiment design, b) could gather data in a bias-free way, and c) could scrutinize the results of our data/statistical analyses with an “objective” view.

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One of my favourite studies during this PhD was a behavioural study of visual guidance strategies as zebra finches flew the length of a flight tunnel with visual stimuli on the walls. In order to work towards using optogenetics in freely flying birds, I needed to know what visually mediated behaviours our birds were most susceptible to. For example, if birds ascended during flights with upward moving visual stimuli, descended during flights with downward moving visual stimuli, and maintained altitude during flights with no moving stimuli, then we might conclude that the birds were responding to the visual information by adjusting their flight altitude

66. Balie Tomar, "Information as Politics in Turbulent Times: Colonial Government and the Councils of Trade and Plantations, 1660-1696" (The University of British Columbia, 2023).

accordingly. This altitude example gave the cleanest result and replicated previous similarly designed studies in other bird species. I also ran stimuli that might “push” the birds to fly faster or slower, or to the right or the left depending on how they interpreted the visual information shown to them during flights. Flight trajectories were collected with a high speed optical motion capture system aided by tiny “helmets” I designed and printed with a 3D printer and temporarily glued to the birds’ heads to track head position. In addition to being a fun study to execute—I got to design and build a flight tunnel out of giant ultra HD TVs, print tiny helmets, use motion capture technology, and get to know each of my ten birds’ personalities from months of daily work together—the data was beautiful, fascinating to review, and weird. In addition to the expected direct perch-to-perch flights from one end of the tunnel to the other, there were flights that were a complete puzzle to my eye. Sometimes a bird flew the same loop from its starting perch and back again, over and over for the entire duration of the trial. There were flights where an individual took a circuitous, highly inefficient path, and somehow repeated that strange path over and over again with no obvious markers to know when to curve left vs. right or up vs. down. Flights where I could see the trace of the “bounce” that their flight style is named after; flap-bounding. I got to know these ten birds in a whole new way, as some individuals seemed to prefer an upward trajectory, creating a convex shaped parabola from one perch to the other, while others often went down first, creating a concave shaped flight. The plots of the raw data were fascinating to sift through, leaving me with far more questions than answers with respect to how and why they were choosing their flight paths.

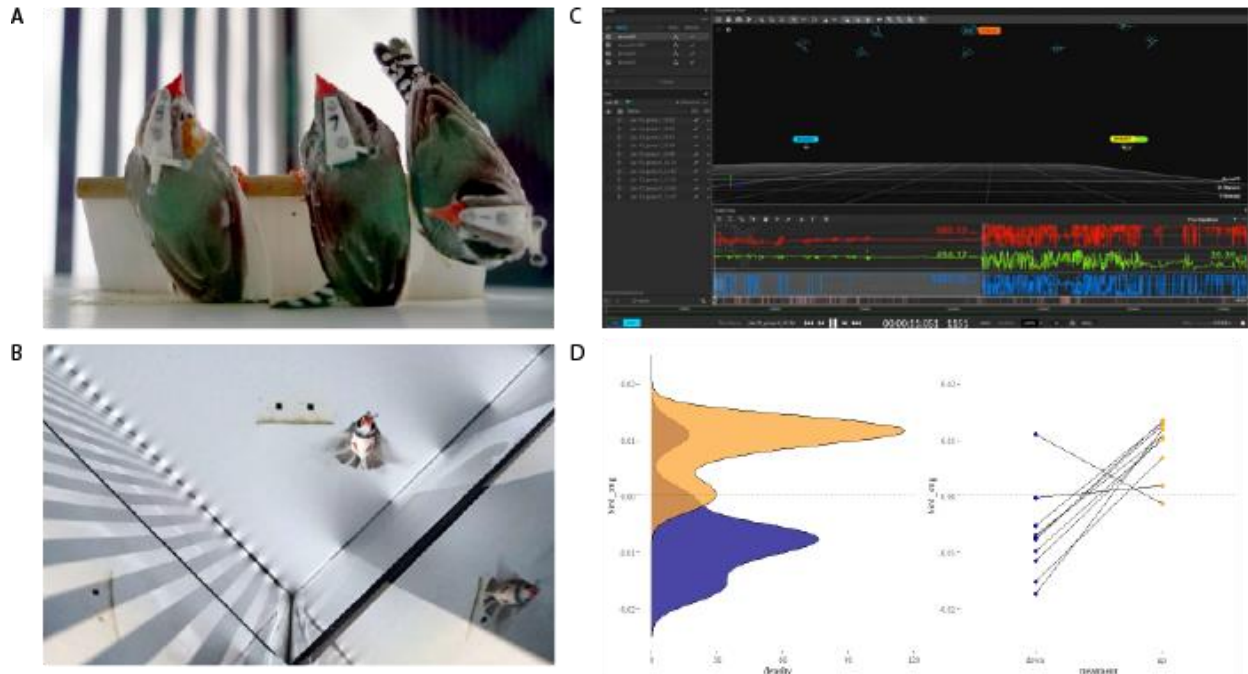


Figure 4. Zebra finch visual guidance flight chamber and trajectory tracking. A. 3D printed “helmets” with retroreflective tracking markers, each in a unique configuration to track individual movement through the chamber. B. A zebra finch in flight across the “V” shaped tunnel with visual stimuli on either side of the chamber. C. A screenshot of the motion capture software, Motive, with 8 high speed infrared cameras represented along the top of the virtual space and the locations of individual birds indicated with colored labels. At the bottom in red, green, and blue is the live tracking data of position in X, Y, Z, on the left and rotation around each of those axes on the right. Each recording session was 30 minutes long. D. Sample data after analysis, grouped based on treatment, in this case visual stimuli moving up in yellow and visual stimuli moving down in purple. On the left are density plots indicating the elevation of the flights according to treatment and on the right are the average positions of each individual bird according to treatment, connected by a line. All but one individual flew lower during visual stimuli that moved down and higher during visual stimuli that moved up.

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To quote Thomas Porter again:

Quantification is a powerful agency of standardization because it imposes some order on hazy thinking, but this depends on the license it provides to leave out much of what is

difficult or obscure. As nineteenth-century statisticians liked to point out, their science averaged away everything contingent, accidental, inexplicable or personal, and left only large-scale regularities.⁶⁷

Quantification is often a filter, a means of justifying exclusion, labelling certain data points as outliers, pulling data towards a middle, an average, a center. Even methods that claim to study variation, perhaps among populations or treatment groups or individuals, pull data towards averages, eliminate outliers, and construct thresholds between “signal” and “noise.” Lewontin and Levins write, “in the first place, statistics does not take variation as its object of study; on the contrary it consists largely of techniques for reducing, discounting, or separating ‘noise’ so that ‘real’ effects can be seen.”⁶⁸ They go on to argue that statistical techniques analyse “ideal universes;” statistics becomes a kind of extension of the controlled ideal of the experimental laboratory. Data emerging from the field or the laboratory must be wrangled into submission in order to decipher a clarifying and therefore publishable result or conclusion. Statistics are designed to not only remove human and experimental error,⁶⁹ but also anything that is messy, unclear, irregular, and so on. If everything that is challenging is removed, results can only be partially based in the data itself. How then, could they reflect a “truth” about the object of study?

Lewontin and Levins write:

The purpose is not to study the ‘error’ variance but to tame it and minimize it and finally to remove, if possible, the veil of obscurity it interposes between the observer and those ideal universes whose parameters are the object of study. ...the branches of statistics that seem at first glance to be concerned most directly with variance as an object of study...

67. Porter, "Quantification and the Accounting Ideal in Science," 645.

68. Levins and Lewontin, *The Dialectical Biologist*, 155.

69. Another topic we could explore at length; what is error and how is it defined, where does it come from and how do we identify it, once it is found, how do we “control for it?”

are, as practiced by natural and social scientists, if not by sophisticated statisticians, the most mystified by idealism.⁷⁰

There is a forgetting that statistical tools are models themselves—they impose a model on the world—and these tools that are designed to wrangle data into an interpretable shape, are doing just that; shaping the data to fit the question. The colloquialism of “data speaking for itself” is harmful in that it promotes the idea that data is itself objective rather than something created by humans, and that counting or collecting data is not a creative act subject to bias. I do not wish to make the claim that scientists should not use statistical tools, only that we must be aware of what the tools are actually doing and we should let go of the idea that they grant us impartiality or authority. Instead of striving for a view from nowhere that believes in the objective power of statistics, let us remain grounded in our own positions, recognizing that our tools have faults and come with assumptions that we must make ourselves aware of. If these faults and assumptions are brought into the light rather than ignored or purposefully hidden away, we might address them directly and either find other ways to do the work, or create works that are contingent, inexplicable, and noisy. Accepting stochasticity and developing methods to work with it rather than against it might be a more accurate representation of the biological world than a reductionist idealistic paradigm.

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Ultimately, we developed an R software package whose primary purpose was to remove all of the beautiful, weird, fascinating flight trajectories so that we could analyse the straight-

70. Levins and Lewontin, *The Dialectical Biologist*, 155.

forward perch-to-perch flights.⁷¹ In the name of “cleaning,” “tidying,” and “wrangling” my messy behaviour data into something that would answer our questions about visually mediated flight and could be fed into a statistical model, all of the most interesting flights were discarded. Hundreds of them. Since I have not published any of the data or analysis from this study, no one has seen these flights, but even if I published these results according to scientific standards and expectations, the most interesting data would be excluded. Because publication is only interested in statistically significant or clear results, there is no acceptable venue for the beautiful, the messy, or the incomprehensible to the human mind. Conclusions would have been made about zebra finch responses to visual motion after purposefully excluding a large percentage of the data, in order to focus on simplicity and signal. I include a few samples of the raw data from those trials, so that at least you, dear reader, can share in the beauty of these trajectories, these individuals presumably making split-second decisions mid-flight that defy human reason or logic and so do not have a place in Scientific knowledge production.

71. “Wrangle, Analyze, and Visualize Animal Movement Data,” n.d., <https://docs.ropensci.org/pathviewr/index.html>.

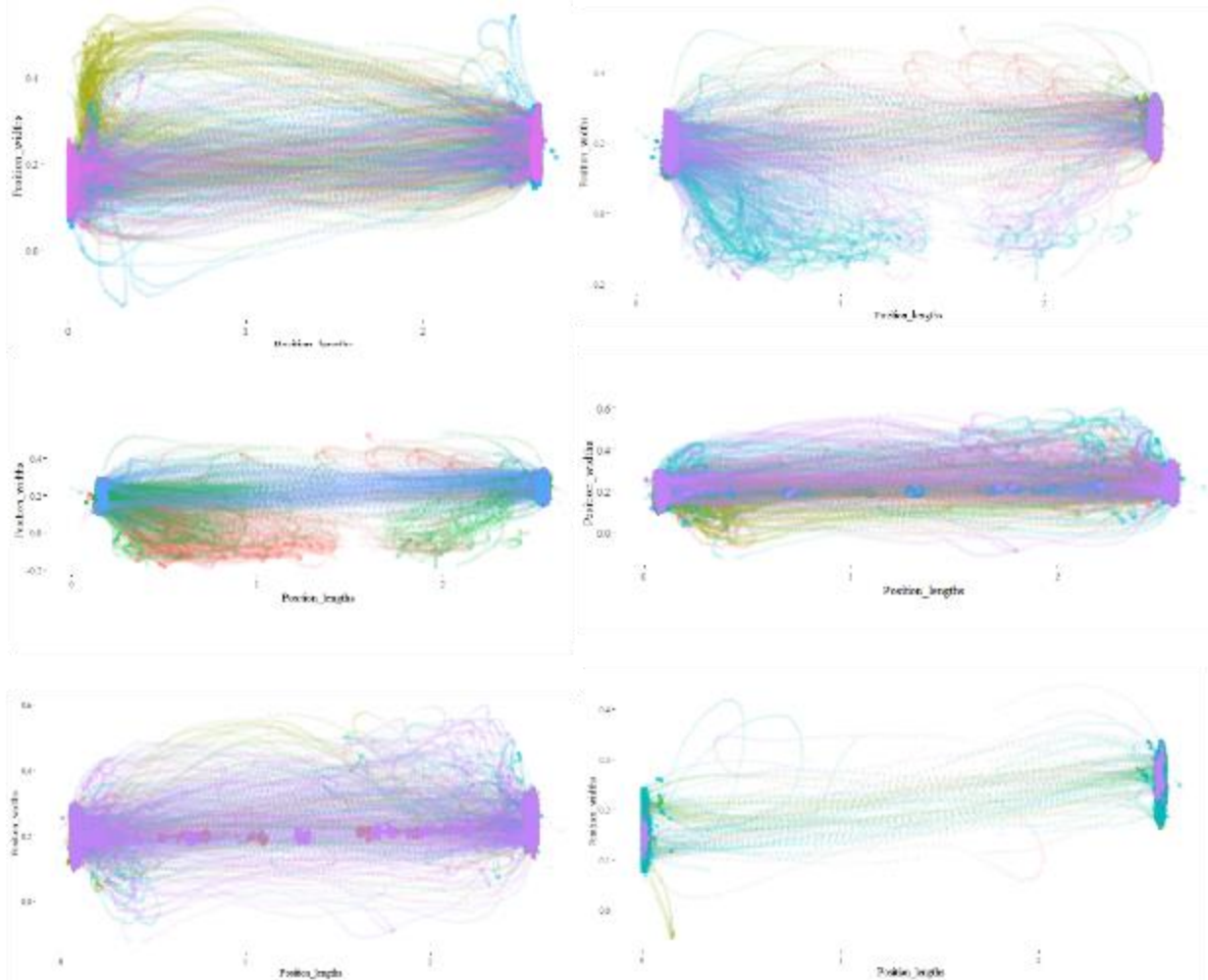


Figure 5. Raw data from the visual guidance study. Data from six sample flight tracking sessions from the zebra finch visual guidance study, unaltered by pathviewR or other statistical manipulations. Flights have only been colored according to individual bird ID and plotted as a view from above, looking down on the chamber with one perch on the left and the other perch on the right.

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There is also a theme of self-denial that comes up around discussions of the use of statistics in scientific practices. The way in which one of the purposes of statistics is the removal of the scientist, since the scientist as human cannot help but bring their own interests, views, biases, and so on. Statistics and objectivity become erasers of the personal—one’s position and

context—rather than acknowledging that while statistics and objectivity eliminate some things (which things and at what cost?) they replace what they remove with something else (what else and at what cost?). According to the story of statistics, the better your statistical power and prowess, the more significant (literally and figuratively) your findings and therefore your work. When your identity is tied to your work and Scientific careers are built on impact factors and empire building, more significant findings = more significant work = a more significant scientist. To quote Lorraine Daston's, "The Moral Economy of Science" again:

Impersonality and impartiality are cultivated by quantifiers as much for moral as for functional reasons. It is proverbial that both require dutiful self-abnegation so as to repress individuality and interest, and neither accrues automatically to quantified procedures and results... better conceived as a continuum, more or less achieved by an effort of self-imposed restraint, rather than as properties inherent in the numbers themselves.⁷²

Numbers need accumulation and the application of statistical power to gain the ability to build or topple careers in the Scientific moral economy. The ascetic Scientist must dutifully remove as much of themselves as they are able, even as the neoliberal academy requires the construction of a career, often through barely-disguised marketing language and tools. How does an ambitious scientist determined to rise through the ranks hold these contradictions? How does one develop a personal brand/website/social media/publishing/public presence based on the work while also removing oneself from the work so as to maintain "objectivity?" To quote Porter again, "this identification of quality with levels of statistical significance is silly. ... They must be understood as monuments to a scientific ethic of self-denial, as limits on what ambitious scientists can claim

72. Daston, "The Moral Economy of Science," 10.

as positive results.”⁷³ Statistics becomes yet another limiting factor to add to our list; one more tool of narrowing, bounding, and limiting possibility. The tool might remove some conflicts, make space for comparisons between labs or across fields, but is it the right tool and are we aware of the associated costs when we use it?

2.5 Discipline

“We must recognize the expertise that ‘ordinary’ people have that can call into question the historically laden assumptions that lie at the heart of disciplines forged during the Enlightenment.”⁷⁴

~ Kavita Philip

Both the Academy and Science divide their theoretically infinite potential into disciplinary fields, which function as constraints on practitioners, focusing efforts on the center of the field for the sake of specialization. Practitioners may explore the edges of their given fields in search of novel questions and methodologies, but by and large the expectation remains that scholars and scientists stay within one, maybe two fields, to become experts at that particular field and avoid being stretched too thin. Specialization has its place—some types of work would not be possible without the depth produced by specialization—but the policing of boundaries between disciplines and a hierarchical ranking of disciplines are a direct result of disciplinary division that can limit breadth and growth. As Natalie Loveless argues in her manifesto for the

73. Porter, "Quantification and the Accounting Ideal in Science," 645.

74. Philip, "How to Stop Worrying About Clean Signals and Start Loving the Noise," 367.

interdisciplinary⁷⁵ method of “research-creation,” “languages (discourses) precede us; research methods and disciplines precede us. We enter into them and they work to craft the possible forms of our questions.”⁷⁶ Our disciplines limit us in ways we may not always be aware of or recognize. Specialization often comes with unaddressed or hidden assumptions acquired through training in that field. Our ways of thinking, the types of questions and methodologies available to us, the very language we use are all shaped by disciplinary bounds. Loveless puts it quite simply; “disciplines discipline us.”⁷⁷ This is one of many side-effects of specialization and the desire to label and categorize ourselves and others; we limit ourselves. What in many cases is necessary for ease of communication, efficiency of production, and recognition of affinities, also prevents us from seeing, doing, thinking, and imagining more and other.

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Having come from a background in visual arts, one might be able to imagine some of the challenges that came with transitioning into a scientific field. The barriers to entry were huge: everything from not being affiliated with an academic institution and therefore not having access to technical libraries and journal collections, to a lack of biology classes on a transcript as evidence of background knowledge, to simply knowing the logistics of how one goes about

75. Loveless coins the term “polydisciplinamory” as a research-creation version of “interdisciplinary.” Polydisciplinamory claims psychoanalytic’s *eros* as the drive that brings fields together; love as the force that breaks disciplinary bounds open and tears divisions down. By making use of “polyamory” as a model for research-creation, Loveless utilizes kinship and intimacy as a means of queering the academy: research-creation for her is “...something that queers normative university discourse, propagating uncanny academic kinship structures and unexpected disciplinary intimacies and alliances.” Natalie Loveless, *How to Make Art at the End of the World: A Manifesto for Research-Creation* (Duke University Press, 2019), 57.

76. Ibid. 24

77. Ibid. 29

entering a scientific field of study. Without an undergraduate degree in a STEM field, I lacked the disciplinary specific language to speak with scientists about their work. Without access to journal collections, I could not read the latest work in the field and therefore imagine my place in it or develop feasible ideas around what I might work on. Without knowledge of the academic science system, I had no real understanding of the hierarchy of work in a lab or the pathway through a degree-granting program. Yet somehow, I thought if I could convince just one person to say “yes,” I could do the work myself. At the time, I did not really see the practice of art and science as all that different from one another. Part of this could have been pure ignorance—I had never worked in a lab after all—but didn’t we both ask questions about the world? Weren’t we both fascinated by what we saw around us, interested in learning and knowing more by doing? Not through passive means but through a physical, experimental practice? Didn’t we both engage in a process of trial and error, of trying something and seeing what would happen? We even shared the need for proposal writing and grant acquisition to fund our efforts. Sometimes our outputs could be instrumentalized to devastating effect, sometimes they could elevate human consciousness. Sometimes we suffered from a public that found our work esoteric, elitist, or unapproachable and the resultant need to justify our existence, and sometimes we had advocates and patrons who thought our work could save the world. It seemed to me that our similarities might outnumber our differences, and I was fascinated by the possibility of bringing the two more directly in alignment.

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Another side-effect of specialization into disciplinary fields is competition between fields for limited resources, resulting in a hierarchy of disciplines. There are many contributing factors to how the hierarchy presents itself including political ideologies, funding—both public and

private—relevance to or for industries outside of the Academy, community engagement, and even the individual identities of scholars and scientists in the fields themselves. The Academy and the individuals within it who uphold its status quo do so by many means including disciplining those who stray outside their discipline and using engagement with “canonical” figures and theories to elevate or denigrate individuals as well as entire fields. “Theory,” as defined by the Academy, to the exclusion of activists or scholars outside of the Academy, is one of the tools used to support a hierarchy of one field versus another, one type of thought or way of working over another, one scholar/scientist over another. Since the Academy was founded by an educated aristocracy, disciplines that align with the ideologies of that aristocracy historically received the most attention and funding. Looking beyond the monetary value of individual grants given to STEM fields vs. arts and humanities fields,⁷⁸ one need only look at the publicly available salaries of tenured professors, as well as the number of professors in a given field or the size of departments and lists of course offerings, to get a sense of which disciplines the Academy values the most. As a result, the hierarchy rewards and incentivizes certain ways of thinking and working over others, encouraging early career scholars towards or away from various disciplines. This financial structure can have an even greater effect on scholars from lower socioeconomic status, where a higher salary can make or break decisions around what type of career to pursue. Within a single discipline, the hierarchical structure of the Academy and Science often rewards scholars who think and work in ways that meet the expectations of the discipline and therefore uphold the disciplinary status quo.

78. Grant funding may not be the best indicator since one could argue a particle accelerator for a physics department requires more funding to build than a gender studies library in a critical theory department.

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When I did finally find someone willing to say “yes,” I was subsequently disappointed, but not surprised, by the reaction from would-be colleagues upon my arrival as a MSc student. As I was introduced to my department and to scientists at conferences in my first year, the conversation always took the same tired path. First the question of where I came from (usually meaning what University department/program/laboratory) and the raised eyebrow that I didn’t come from any program, then the shock that I was a working artist and designer with no institutional background in biology. Some were fascinated by me and the audacity I had to just show up as a graduate student; all were curious to see how I would do and what type of scientific work I would produce. If my supervisor was present, there would sometimes follow a sense of awe at the risk he was willing to take and in turn he would bask in the glow of his progressive ideas around student hiring. It became clear very quickly that I was considered something of an underdog: an underdog that my supervisor recognized as capable, a role that I took up with pride as I quickly learned the ropes and began producing data in the lab at record speed, while also thriving in most of my graduate level science and statistics courses. For the rest of my scientific career, it became a running joke; every time something came easily to me, or I ran a successful experiment, or I was rewarded with something where others with the proper credentials were not, I would respond with “I went to art school” in a silly voice. This personal tagline, which I am not proud of, diffused the discomfort I registered from those who wished I would stay in my place; stay in my lane. It was a way for me to tell them that I was not a threat, I was just an artist playing at science. It reassured them that I would, ultimately, stay in my art lane. And yet it was satisfying in those early years to transform the chip on my shoulder into proof of competence. In fact, I was so successful that I was “rewarded” with departmental service work, serving as

graduate representative on a faculty search committee in my second year. Me, an artist, contributing to faculty hiring in a highly regarded Science department? And with every success, my supervisor would beam, happy to take credit for being the one who said “yes.”

The extent to which my art and design background prepared me for success in science shocked even me. While I had the nerve to think I could do the work regardless of prior experience, I was surprised to find that the scientific—usually biology—backgrounds of my colleagues did not necessarily prepare them for the day-to-day realities of lab work any better than my art education. While I did spend time Googling basic concepts that my science trained peers knew by heart, I found graduate work to be so specialized that colleagues outside of our lab couldn't speak meaningfully about the details of our work without lots of questions and Googling themselves.

I have listed many of these surprises in the introduction; the ways in which my art background became a huge asset in my scientific pursuits. I already knew how to work iteratively, how to be creative under pressure, how to be resourceful with limitations, and how to move forward after defeat. But one of the most satisfying was the use of my fine motor skills, developed over years of working in detail with diverse physical materials and media. My neuroscience work on first zebra finches, then hummingbirds, required neurosurgeries on anesthetized animals; teeny tiny brain surgeries done carefully enough to ensure the animal would survive the procedure. I quickly learned to slice open the delicate skin to reveal skull, cut the tiniest window through the skull surface, remove just enough bone to apply our tools, run a recording and injection experiment for hours with tools inside the animal's brain, then close everything back up again and recover the animal for continued life in the lab. A postdoctoral researcher and I became the first people that we knew of to perform brain surgery on a

hummingbird and successfully recover it from the invasive procedure. We developed methods to hold the tongue muscle out of the way without damaging it—the muscle wrapped around the *outside* of the skull exactly where we needed access and if it was damaged, the bird would not be able to eat upon recovery—close the tissue paper skin after the procedure was complete, and encourage them to health with 24 hour monitoring. So many hours spent nursing hummingbirds back to life on a heat pad, feeding them by hand until they were able to fly and feed on their own again. I could not believe this was my life, that I had found a way to access this level of scientific knowledge production and not only that, but to do it well. In moments of success, it seemed like a surreal dream.

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Science specifically, is plagued by an ongoing belief in its ability to be apolitical through its use of the scientific method. While many disciplines within the Academy value “critical distance,” Science is perhaps unique in developing entire methodologies and apparatuses whose sole purpose is to render practitioners and their biases invisible, null, and void. The humanities have recently been allowed some room to acknowledge the use of values to decide how to proceed with scholarship and what subjects require scholarly attention, but Science and “values” are still seen as mutually exclusive. If Science has values, the first one would be that Science is not subject to values. Lorraine Daston’s important historicizing of many of Science’s core values has already been touched on, but I will remind us here of her quote, “values do not distort science; they are science.”⁷⁹ The self-image of Science and the self-image of the West were cut from the same cloth and share many of the same values, thus my insistence on capital “S”

79. Daston, "The Moral Economy of Science," 6.

science whenever I am referring specifically to modern Western Euro-centric Science. Sandra Harding wrote of this entanglement and it is important to remember that when she speaks of the West here, she is speaking of Science as well; I have replaced “the West” and “the European Self” in the following passage with “Science” because it reflects the way in which Science and the West were built hand-in-hand:

The self-image of [Science] depends on contrasts, not only between the rational and irrational, but also between civilization and the savage or primitive, the advanced or progressive and the backward, dynamic and static societies, developed and undeveloped, the historical and the natural, the rational and the irrational. Through these and other contrasts [Science] has constructed its Other, and has thereby justified its exploitative treatment of various peoples.⁸⁰

Thinking through and disrupting some of these contrasts will become the crux of later work in this thesis. For now, seeing and acknowledging these linkages between the making of “the West” and the making of Science is a necessary step before we can break through these entanglements with speculative acts that manifest other ways of working, thinking, and being.

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I cannot help but remember and relive my struggles with how I was perceived by Scientists when I read this list of contrasts from Harding. Science is “rational,” art is “irrational,” Science is “civilized,” art can be “savage” and “primitive,” Science is “advanced” and

80. Harding, "Is Science Multicultural?: Challenges, Resources, Opportunities, Uncertainties," 310. The unaltered quote is as follows: “The self-image of the West depends on contrasts, not only between the rational and irrational, but also between civilization and the savage or primitive, the advanced or progressive and the backward, dynamic and static societies, developed and undeveloped, the historical and the natural, the rational and the irrational. Through these and other contrasts the European Self has constructed its Other, and has thereby justified its exploitative treatment of various peoples.”

“progressive” while art can be “backwards.” No wonder Scientists couldn’t imagine the competencies I would bring as an artist. Looking carefully at this list now, with hindsight, the Science side of these contrasts seems sadly limited. Art can be rational OR irrational, civilized OR primitive, progressive OR backwards, dynamic OR static, while Science is restricted to only one side of each supposed binary. And of course, the reality is that not only is the restriction of Science to these binaries limiting, it is also false. There are many irrational moments in scientific knowledge production from leaning on intuition and hunches, to justifying means with ends that haven’t been confirmed. There are many examples of Science being used to support “backwards” or “primitive” views like the existence of distinct human races or strict XY-based sex differences. Science is trapped in a web of its own making, unable to open itself up to the other sides of these contrasts; other ways of thinking, working, being, and doing. Science refuses to update its scientific method despite discourse around its limitations, refuses to let go of objectivity as a founding principle, continues to rely on statistical methods even when those methods limit possible conclusions and so on. What might scientific knowledge production be like if it not only embraced all aspects of the way practitioners work, but leaned into those parts that it has historically refused? How might scientific practices change and what new ways of working and thinking might open with a radical shift in its self-image?

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The narrowing of scientific practices, for the sake of specialization and “progress,” does exactly that. It narrows, limits, and builds boundaries around questions, methods, and ways of thinking through curiosities about the world. As the quote from Hope Jahren’s *Lab Girl* beautifully illustrates, anyone can be a scientist. Anyone who has ever wondered about the world is already a scientist. You, dear reader, are probably a scientist whether you think of yourself that

way or not, and if you aren't one now, you most certainly were one as a child, during which time you would have learned about your world and yourself through experimentation, trial and error, and mistake. For many, this curiosity, this wonder, is what draws them to science in the first place. It feels limitless, open, and free according to Jahren's definition. Prior to training in practices of specialization and professionalization, all questions are equally legitimate and any process that might lead you towards an answer—even if you never reach a “conclusion”—is fair game. It is through training and education—equal parts taking on board the knowledge that was produced by creators before you and equal parts orientation in the structures and systems that define that knowledge—that the scope of inquiry begins to narrow. Questions are deemed good or bad, answerable or not, relevant to a field or outside of it, too big or too small. Methods are deemed novel and progressive, or outdated and irrelevant. Little by little, what was limitless becomes bounded, what was open becomes closed, what felt free becomes claustrophobic. As Isabelle Stengers puts it in *Another Science is Possible*, “everything that might distance them from their discipline has been excluded, deemed a ‘waste of time’ or, worse, a pathway to doubt.”⁸¹ Professionalization in the Sciences binds practitioners and practices, deems questions and peoples and answers worthy of pursuit or not. This is, of course, not true of every individual scientist, but in its current form as an institution with direct ties to academic knowledge construction and industrial product development, Science often becomes defensive of these bounds and borders, purposefully excluding disciplines that they might learn from as distractions or points of derailment.

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81. Stengers, *Another Science Is Possible: A Manifesto for Slow Science*, 38.

I was an artist, a potentially “irrational,” “primitive,” “backwards,” “static,” “undeveloped” artist, who found rapid success in scientific knowledge production without taking up its foundational pedagogies through an undergraduate degree. And while it’s true that my eventual refusal to participate in some aspects of Scientific culture would result in my departure from the field, I can still imagine an alternate future where under different circumstances, I continue along the academic science path and become a primary investigator myself. What kind of irrational science might I have developed? What would irrational methodologies look like? Where would irrational conclusions lead us? How might those methodologies and conclusions serve the scientific community or the larger public? What would a scientific practice that fully embraces all the messiness of human produced labour, acknowledges and understands the role values play in the work, and leans into the embodied and affective look and feel like? Who would embark on the unpredictable and unknown with me and what might we accomplish in community together?

2.6 Scientific Funding

Scientific practice can be quite expensive and as fields expand, public trust is compromised, and governments shut down branches of funding for political reasons, competition for limited resources becomes increasingly fierce. Since moving away from experiments occurring in the homes of the landed aristocracy, reliance on external sources of funding—patrons, public and private grants, governments, etc.—has grown. On the one hand this move can democratize scientific practice in that folks who are not independently wealthy can now practice science and publicly distributed funds can ensure that resources are placed where need or public

interest is greatest. However, much of the funding scientists now rely on is tied to industrial and military interests, while government funding might be divvied up according to political biases. Even when military or government grants do not require the creation of products that are immediately “useful,”—as is the case with many “discovery-based” grants—granting agencies still require that scientists propose a link between the work they do to a potential beneficial outcome or “broader impact.” Paul Edwards, theorizing around infrastructures, wrote:

Grant writing—frequently viewed by scientists and engineers as a kind of make-believe, in which they pretended to care about military problems... looked quite different to military sponsors, who often took it quite seriously. This led to the weird (and often willful) nearsightedness of the legions of American scientists and engineers who consumed a steady diet of military money, yet claimed their research had nothing to do with practical military goals. They could be right, on the micro level, while being totally wrong about the meso-scale process in which they were caught up.⁸²

Edwards wrote this in 2002 and it still rings true to military and industry funded Science twenty years later. In *Lab Girl*, Hope Jahren writes openly about her use of military funding to both fulfil the expectations of the grant and fund the “basic science” she was most interested in. She writes:

We were hoping to contribute to a new method of forensic analysis for the chemical aftermath of a terrorist attack... We happened to ‘sell’ the idea to the National Science Foundation in 2007... not only were we awarded the funding, but the figure had more zeros behind it than I had ever before seen on paper. I wanted to be studying plant growth, but science for war will always pay better than science for knowledge.⁸³

82. Paul N Edwards, "Infrastructure and Modernity: Force, Time, and Social Organization in the History of Sociotechnical Systems," *Modernity and technology* 1 (2003), 216.

83. Jahren, *Lab Girl*, 22.

After a decade of struggling to acquire a substantial grant, always strapped for cash, unable to pay her research assistant a living wage, this National Science Foundation (NSF) grant shifted Jahren's ability to pursue her goals and pay her employees a minimum wage. When faced with a choice between continuing her work, paying her employees, and contributing to "science for war," the honesty of Jahren's decision stands out to me the most.

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When I started in the lab in 2016, one of our biggest funders was the US Air Force. When I visited the lab for an interview, my ethical relationship to military funding was explicitly questioned alongside an explanation that our grant was Tier I, the lowest level of a four-tiered system that became increasingly applied (and weaponized) as one progressed upwards. As researchers at the Tier I level, we were engaged in "basic," "curiosity-driven" research that was as far removed from military applications as possible (conveniently forgetting that choosing not to accept military funds would be the way to remain as far from military applications as possible). Accepting the funds meant regular meetings with collaborators in front of Air Force program officers where it was expected that the lab would share its progress on questions of relevance to the Air Force program. But we did not fashion our questions and shape our research to appease these officers; oh no, we were free to pursue what we wanted and only needed to spin our work to fit their needs when a meeting was scheduled. A make-believe indeed.

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Donna Haraway wrote as far back as 1987, in *Modest_Witness@Second_Millennium.Femaleman@_Meets_Oncomouse*, "as rates of increase of federal support for basic science

declined, direct industrial support of university biological research developed strongly.”⁸⁴ This occurred and continues to occur in myriad forms, from industry supported grants and foundations, to academic/industrial collaborations and institutions, to university technology-transfer offices, which manage the formal transmission of science-based inventions. As Haraway notes, “this developing system of enclosing the commons... is driven in part by university technology-transfer offices seeking to make a profit from contracts, patenting, licensing, and royalties.”⁸⁵ Inventions and knowledge produced within a university lab can directly benefit the Academy when it then sells access to those inventions and knowledges to industry or other universities and labs. In Canada, there was an explicit drive to pour venture capital into the life sciences, purposefully boosting research and development (R&D) within universities. Simultaneous to the increase in capital for R&D, allowing for a boom in student hiring to execute the research, the minimum requirement for student stipends was fixed at a low rate, even after years of inflation and cost of living increases.⁸⁶ As governments, industry, and universities colluded to create an explosion of R&D housed within universities, the maintenance of low minimums for stipends guaranteed cheap and easily exploited labour with no matched increase in job prospects for student workers after graduation.

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84. Haraway, *Modest_Witness@Second_Millennium. Femaleman@_Meets_Oncomousem: Feminism and Technoscience*, 91.

85. *Ibid.* 91.

86. Council of Canadian Academies, "Degrees of Success," (Ottawa (ON): The Expert Panel on the Labour Market Transition of PhD Graduates, 2021).

Another massive funding pool available to a biologist are those dedicated to advancing human health. While our avian visual neuroscience studies were nowhere near clinical and to apply them to a human in any way, even abstractly, was quite a stretch, stretch we did. Every effort was made to find ways to link our studies in avian vision to possible human pathologies, even though there was no way to directly translate our findings from the world of birds and reptiles to the world of mammals. We needed that money: project grants from the Canadian Institute of Health Research (CIHR) averaged \$850,000 across four and a half years,⁸⁷ and conducting neuroscientific studies required advanced equipment and highly educated personnel, most of which we did not have and could not afford. Proposal after proposal we adjusted our storytelling, searching for new possibilities of translation from bird to human, until finally we succeeded, after two or three rounds of re-applying for the same grant at every opportunity. This desperation for funding changed how we worked, what questions we prioritized, what methodologies we used, and how we interpreted the results of our pilot studies.

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Richard Levins and Richard Lewontin include an entire chapter in *The Dialectical Biologist*, titled “The Commoditization of Science,” that carefully delineates both the R&D pathway through the academy to industry, and the roles of the various players in the Scientific hierarchy as they parallel capitalism. They argue that research itself, having become a business investment, has been transformed into a quantifiable, pragmatic product whose costs can be

87. Government of Canada, Canadian Institutes of Health Research, “Project Grant: Spring 2023 Results - CIHR,” November 3, 2023, <https://cihr-irsc.gc.ca/e/53569.html>.

minimized by placing the R&D pipeline in the academy and using scientists as “manpower;” alienated from their own labour and deskilled whenever possible. They write:

the costs of long-range research are socialized by changing the locus of the work from individual enterprises to public institutions such as universities and national institutes. ...When such socialized research comes close to producing a marketable product, the final development stages are taken back into private hands in order to realize an exclusive property.⁸⁸

While this was written in 1985, and my exposure to the breadth of scientific practice is limited to my experiences during my PhD, I know a surprising number of academic lab heads who also run a biotechnology business on the side, funnelling the outcomes of their academic research directly into their privately run companies, doubling their personal salaries or more. Scientific discoveries themselves become quantifiable through patenting and intellectual property processes, allowing “a research and development company or corporate division [to] look at scientific activity as generalized human labour, rather than as a way to solve particular problems.”⁸⁹ Managing human labour as cost-effectively as possible means increased specialization and hierarchy. They write, “the creative parts of scientific work are more and more restricted to a small fraction of the working scientists, the rest are increasingly proletarianized, losing control not only over their choice of problem and approach, but even over their day-to-day, and sometimes, their hourly, activity.”⁹⁰ As a result of this narrowing and hierarchy—“deskilling”—scientific practitioners are separated from the outcomes and impacts of their work: “deskilling scientific work makes for greater alienation—the producers do not understand the

88. Levins and Lewontin, *The Dialectical Biologist*. 201.

89. Ibid. 202.

90. Ibid. 202.

whole process, have no say over where it is going or how, and have little opportunity to exercise creative intelligence.”⁹¹ Levins and Lewontin go on to describe in detail the ranks of workers within the scientific hierarchy, relating each to the proletariat, the bourgeoisie, and the petty bourgeois, while simultaneously describing what this hierarchy means for grants, research, and other aspects of commoditization. They also link the commoditization of science to increased pragmatism as “strong feelings about the injustice of social arrangements are necessarily suspect as ideological, reflecting immaturity as against scholarly cool.”⁹²

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The proposal that ultimately received the CIHR project grant was submitted while I was on parental leave. One of the most significant aims in the proposal was the development of optogenetics and so my pilot data—microscopy images of opsin expression and behaviour data from a wireless LED light activation system—was used as proof of principle that we already had the basics working. Prior to going on leave, I trained new MSc and PhD students on neurosurgeries for optogenetic injections as well as on brain tissue processing for imaging so that they could contribute to the next round of proposal submissions while I was on leave. During leave, my supervisor sent me a last draft of the proposal, requesting feedback. After reviewing the proposal, I found a mistake in the figure of microscopy imaging of opsin expression: an opsin had been mislabelled in a way that implied that retrograde expression was working when in fact it was not. I quickly informed my supervisor of the mistake but was informed it was too late to make the change and so the submission went forward unchanged.

91. Ibid. 202.

92. Ibid. 207.

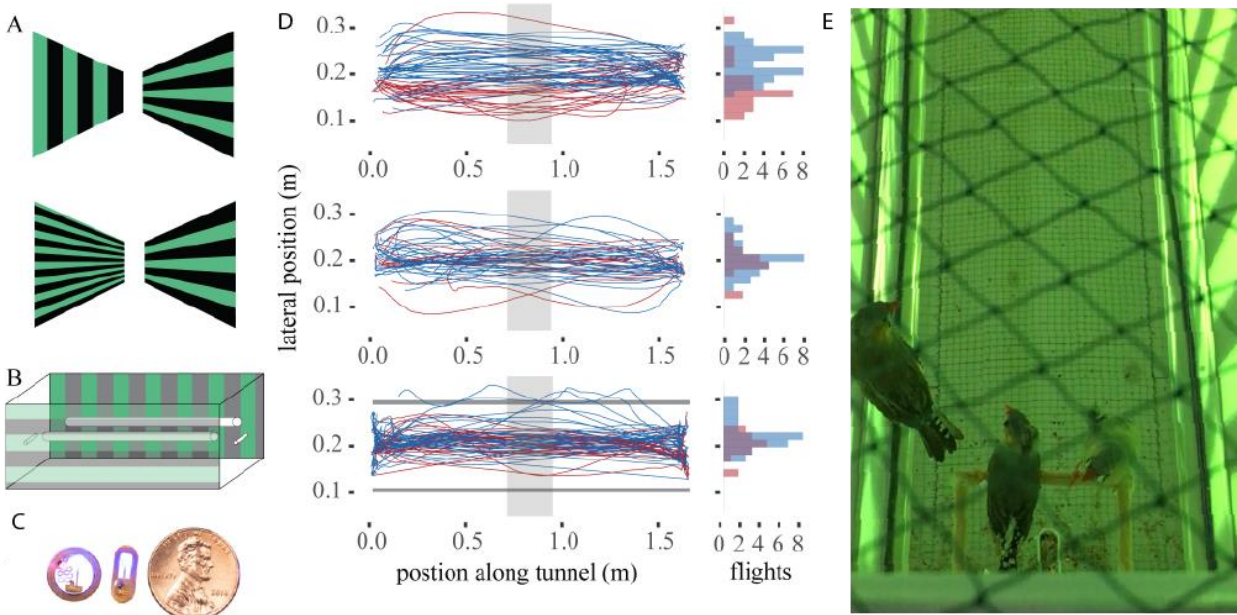


Figure 6. Wireless LED based optogenetic manipulation in flight. A. Sample gratings presented on walls on either side of a flight chamber. B. A schematic of the flight tunnel with visual stimuli and acrylic tubes which contained copper coils for powering the wireless LED implants. C. The LEDs that were chronically implanted in the birds with a penny for scale. D. Flight trajectories collected with the motion capture system in two different visual stimuli treatments, with and without the tubes and coils. E. An image of zebra finches in the flight chamber with chronically implanted LEDs.

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It is also important to note how much the Academy relies on faculty research grant acquisition to maintain its own day-to-day operations. UBC and other academic institutions take a percentage of grants acquired by faculty researchers before the funds are distributed for the work outlined in their proposals. This “overhead” is used to maintain various day-to-day operations and the specifics of what it is used for are usually a black box for the grantee. When it comes to Canadian federal granting institutions—known as the tri-agency council and including

CIHR, the Natural Sciences and Engineering Research Council (NSERC), and Social Sciences and Humanities Research Council (SSHRC) grants—there is no way to report misbehaviour directly to the granting agency. Regardless of what inappropriate acts may be occurring—data fabrication, misleading results, bullying or harassment—the agencies rely on reporting from the academic institution housing the faculty researcher, primarily through the results of in-house investigations after a formal complaint has been made. But as we shall see shortly, formal complaints are only the tip of the iceberg as many complaints are “resolved” through informal means or are never filed in the first place. Most institution’s confidentiality policies put limits on what can be shared about whom, to whom, and when, not to mention the possibility that an in-house investigation may be biased towards protecting the institution; both its reputation and its access to funds. After all, it is not in the institution’s best interest to air the results of any kind of complaint to a granting institution if it may mean a loss of funding. The case of David Gilbert at Florida State University (FSU) and San Diego Biomedical Research Institute (SDBRI) stands as a clear example of an institution’s disciplinary actions and reporting of wildly problematic behaviour being downplayed both internally and externally to the National Institutes of Health (NIH). While FSU concluded that Gilbert’s “gendered, sexualized and invasive behaviours were severe and pervasive”⁹³ in a 131-page report after an investigation prompted by an email to a graduate student in which he explicitly described an erotic dream, Gilbert was only removed from his position as chair, suspended for 10 days, and given training. After moving to SDBRI,

93. “NIH Rules Are Supposed to Stop ‘Pass the Harasser.’ in One Recent Case, They Appear to Have Failed,” Science | AAAS, March 14, 2024, <https://www.science.org/content/article/nih-rules-supposed-stop-pass-harasser-one-recent-case-appear-failed>.

Gilbert immediately resumed the behaviour with a new trainee, texting her an inappropriate image. After the trainee complained and an investigation was conducted that found no legal standard of sexual harassment, “the trainee was devastated... and soon moved to a new institution.”⁹⁴ Gilbert still has two NIH grants. The reliance on institutional reporting rather than accepting other forms of reporting like anonymous tips—as has been established in the US for the NIH and the National Academy of Sciences (NAS)—becomes a structural mechanism for ignoring problems with knowledge producers.⁹⁵ While the NIH and NAS systems are not perfect—researchers protected by non-disclosure agreements (NDAs) upon agreeing to leave an institution after an investigation can easily get jobs elsewhere, and any reporting mechanism will likely be unevenly applied in the same way laws and policies are unevenly enforced—they are a small step towards holding researchers accountable. As stated by Jeremy Berg, a former head of a branch of the NIH, “for people who are high-flying scientists—particularly well-funded ones—institutions seem to be remarkably willing to look the other way to obtain their employment.”⁹⁶

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As the lab’s first, and so far only, CIHR project grant runs out this year, it will be interesting to see how its future applications are received. NSERC has an additional required section in their proposals that discuss the Highly Qualified Personnel (HQP) developed with grant funds—these are the “trainees:” undergraduate students, graduate students, postdoctoral fellows, and research

94. Ibid.

95. “More Than 70 Lab Heads Removed From NIH Grants After Harassment Findings,” Science | AAAS, March 14, 2024, <https://www.science.org/content/article/nih-removed-more-70-lab-heads-grants-after-harassment-complaints>.

96. Ibid.

associates who are trained in scientific practices using funds from the grant. Lab heads are expected to discuss both the contributions of HQP to the grant and the ways in which the research sustained by the grant has advanced HQP careers. Pointing to the successes of your HQP and claiming them as your own—that your training with the help of the grant was able to land them their own lab head job or other hot-shot industry position—is part of “empire building.” It boosts your own career and increases the likelihood that you will receive a renewal from NSERC.⁹⁷ Conversely, CIHR does not seem to care about the results for trainees whose salaries or experimental materials are paid by the grant. While there is some gross reporting of trainee demographics at the end of the granting period, these are mostly boxes to be checked, and there is no upfront discussion of outcomes for trainees at the proposal stage. These disparate approaches to acknowledging (or not) trainee labour from granting agencies point to efforts to track the progress of trainees through the academic scientific system on the one hand, while also not taking responsibility for the conditions under which trainees work. What about the HQP who make a lateral move away from the typical professionalized path forward? Or what about those who are “fired,” pushed out, or otherwise leave on not-so-good terms? How are their outcomes assessed?

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Levins and Lewontin’s recognition of Science as commodity were written nearly 40 years ago and have only amplified with the continued explosion in pharmaceutical and biotechnology companies—big and small—so much so that the scale, weight, and longevity of the system feels impossible to shift or divert. But where else can we start if not here, with a clear understanding

97. As well as increasing the likelihood of promotions, tenure, and merit raises in the faculty advancement system.

and acknowledgement of the structures and histories of which we are a part and the impacts those structures have on our practices? If we are ignorant of the material conditions of our practices, the histories of our methods and modes of thinking, our entanglement within our sociopolitical context, we cannot create and practice knowledge production ethically or make clear-eyed decisions about how and what we are willing to lend our time, energy, and efforts towards.

As artist Beatriz da Costa wrote, “the conduct of ‘objective’ and ‘pure’ research, independent from the political ‘outside,’ becomes a less and less plausible position to hold at a time in which industrial, military, and political interests are directly tied to funding provided by the respective institutions.”⁹⁸ Science-fiction novelist Samuel R. Delaney comments on this false notion of purity in an interview; “the notion of pure science as a materialistically uncontaminated mental activity, which, as it constitutes a presumed object apart from technology, can then be infused into technology’s artifacts that proceed to manifest this mentation, is quite possibly the major conceptual disaster by which technological abuse proceeds.”⁹⁹ It is interesting that artists, writers, and cultural and political theorists can see this more clearly than many scientists themselves. Or perhaps scientists do understand this but where and how else are they supposed to get the funding required to complete their work? As Jahren writes in *Lab Girl*, “ask a science professor what she worries about. It won’t take long. She’ll look you in the eye and say one word: ‘Money.’”¹⁰⁰

98. Beatriz Da Costa, "Reaching the Limit," in *Tactical Biopolitics: Art, Activism, and Technoscience* (Cambridge, MA: MIT Press, 2008), 366.

99. Samuel R Delany and Takayuki Tatsumi, "Interview: Samuel R. Delany," *diacritics* 16, no. 3 (1986), 37-8.

100. Jahren, *Lab Girl*, 125.

2.7 Conditions and Sanctions

“In other words, Woolf situates herself in a period of transition where the question can still be posed: ‘Do we want to join this procession? And furthermore, what conditions will we accept? Where will it lead us, this procession of educated men?’”¹⁰¹

~ Isabelle Stengers and Vinciane Despret

The practice of academic scientific knowledge-production requires accepting the conditions, the norms, the moral economies, of Science and the Academy. In *Women Who Make a Fuss*, Isabelle Stengers and Vinciane Despret write with a collective of women scholars around Virginia Woolf’s questioning of women in academia (do we want a seat at their table?). Stories of misogyny and bigotry emerge, and yet most of the contributors are academics. They have found ways to work within the academic system, carved out spaces for themselves despite the violence directed at them by the Academy. Many think through the sacrifices required for that space to exist and not all are sure they should(‘ve) join(ed) the procession and accept(ed) the conditions. Sara Ahmed, a feminist queer scholar who left the Academy after her own struggles with and against the Academic system, recently created a study of the cost of entry and the impacts on those who wrestle with the Academy through complaints. For *Complaint!*, Ahmed collected stories of academic complaints, some formally submitted and some not, in order to learn what is required of those who wish to participate in Academia. Here are a few of Ahmed’s

101. Isabelle Stengers and Vinciane Despret, *Women Who Make a Fuss: The Unfaithful Daughters of Virginia Woolf* (U of Minnesota Press, 2015), 25.

conclusions from a very long list of both complaints and insights based on those complaints (310 pages to be exact) to give you a taste:

“Not complaining becomes a virtue, a kind of calm patience, a positive outlook, as if waiting is what would make something fine, as if the best way to approach a wrong is to wait for it to right itself.”¹⁰²

“Warnings can be used to remind people of the precarity of their situation. They can also be used to put people in their place, to tell someone who is bigger and who is smaller.”¹⁰³

“When you are rewarded for silence, you are rewarded for compliance.”¹⁰⁴

“To belong might require getting along or going along with something.”¹⁰⁵

“When you have to keep fighting for an existence, fighting can become your existence.”¹⁰⁶

“What you are told you need to do to progress further in a system reproduces that system.”¹⁰⁷

Reading *Complaint!* cover-to-cover and bearing witness to the struggle required for basic participation leads to surprise that anyone makes it through the Academy at all. *Complaint!* becomes an archive of the horrific ways individuals experience the Academy’s conditions and the punishment that occurs when one does not comply with those conditions. Even when compliance is impossible (for example if one’s body does not match the expected and desired body), punishment is doled out in myriad ways, from microaggressions and micromanagement to macroaggressions and blatant targeting of individuals. Not all of Ahmed’s interviewees stay in the Academy—many are pushed out in a variety of ways from firing to flexing of policy to threats (implicit and explicit) to gradual exhaustion—but some do stay and continue through the

102. Ahmed, *Complaint!* 73.

103. Ibid. 77.

104. Ibid. 100.

105. Ibid. 124.

106. Ibid. 139.

107. Ibid. 225.

system. How and why do people choose to stay in the face of being explicitly told they are not welcome? Why does one continue to strive for a seat at that table? Why is joining the procession so desirable?

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“Not complaining becomes a virtue, a kind of calm patience, a positive outlook, as if waiting is what would make something fine, as if the best way to approach a wrong is to wait for it to right itself.”¹⁰⁸

Putting blinders on to ignore the problems you see and get your work done is a version of the virtue of not complaining. Maintaining a positive outlook in the face of unprecedented challenges, acquiring a Zen-like state of peace and acceptance regardless of the dumpster fire around you—maybe in the name of self-protection, self-care—can be a convenient way to bury your head in the sand. Liberal wellness culture would have us all practice individualized meditation and yoga, acquiring a personal peace while our communities and relations are torn apart. Waiting something out, being strung along with the false hope of change, that someone will do something—anything!—becomes just another tool for the status quo to keep on status quoing.

“Warnings can be used to remind people of the precarity of their situation. They can also be used to put people in their place, to tell someone who is bigger and who is smaller.”¹⁰⁹

I long ago lost count of the number of warnings I’ve received over the years, both explicitly and implicitly. Things like not to be too ambitious, not to overstretch or overstep, that something

108. Ibid. 73.

109. Ibid. 77.

wasn't possible or wouldn't work even though there was no evidence to support the claim. But don't go too slowly either, publish or perish, data is needed before we can have another meeting. Don't show all your cards, hold some things close, scooping is real, but give enough to tell a sexy story, to be compelling. If you push too hard they'll get defensive, if you're too ambitious they'll feel threatened, if you move too fast they'll feel left behind, if you're too forceful they won't listen to you, if you're too pretty they'll dismiss you. Everything becomes a dangerous game, an impossible balancing act. I was told to file a complaint but that it wouldn't make a difference, I was told not to file a complaint because it would out me and put my peers at risk. I was told it was hard to fire a student, I was told he could make my life hell. I was told I was unprofessional, that I could be sued for libel. I was reminded that I was here on a student visa, that my family was only partially Canadian, that my salary depended on him. I was told we could continue only after trust was rebuilt. I was told to be less angry, to be smaller, to take up less space, to stop speaking, to be less emotional, to shrink, to stop using so much oxygen, to stop breathing. But keep working. And do it all with a smile.

“When you are rewarded for silence, you are rewarded for compliance.”¹¹⁰

“To belong might require getting along or going along with something.”¹¹¹

Years of going along, of feeling off but not bringing it up, of witnessing things that were inappropriate but staying silent. I was told things about my peers that I knew I shouldn't know. I witnessed verbally or emotionally abusive behaviour and brushed it off as par for the course. I knew I was elevated on a pedestal above my peers but stayed comfy in that position for longer

110. Ibid. 100.

111. Ibid. 124.

than I should have. I was being rewarded, after all, for playing my role as artistic ambitious underdog, just “punk rock” and anti-authoritarian enough to push the work harder or farther.

“When you have to keep fighting for an existence, fighting can become your existence.”¹¹²

In the end, every day for months I would go into the lab, fight through an eight or ten or twelve hour experiment, interrupted by meetings and calls and emails to and with every student support unit I could find, then go home, put my child to bed, and stay up documenting said meetings and calls and emails so that I would have the receipts later. This fight came at great cost. Any other part of my life that I loved fell away, there was no cooking, no music, no care, no friends, no community. I had little time with my family and the time I did have was often in a state of disassociation. I couldn't sleep, I barely showered or ate, I couldn't take a deep breath or I would breakdown. I lost weight, my hair fell out, I was diagnosed with a stress-induced auto-immune disorder. I became a shell, a body going through the motions, emptied out. There were some victories and there were some losses. Eventually, I barely felt either. Rage and fight became the only existence I knew.

“What you are told you need to do to progress further in a system reproduces that system.”¹¹³

I was still holding onto the idea of finishing my research, finishing my experiments, finishing my work in accordance with the disciplinary expectations of a neuroscience study. This seemed like the easiest way out—through—and so I fought and worked myself to the bone to both finish

112. Ibid. 139.

113. Ibid. 225.

those experiments and not give up my principles, not let myself be run over, pushed out, stopped. I did my best to do the work while also remaining unblinded, to progress further in the system without reproducing the system. In the end, this was impossible.

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Complaint! and other texts on the ways Academia structures itself and polices its boundaries do a thorough job of breaking down the numerous tools Academia has at its disposal to keep scholars in line. Academia in general mirrors how human's police their boundaries in any social structure or institution; it is not exempt from this tendency, regardless of tenure and "academic freedom."¹¹⁴ It is not above policing its own. Marc Bekoff and Jessica Pierce writing about animal morality in comparison with human morality put it quite simply; "we conform to norms of behaviour because otherwise we face social sanctioning, in the form of ostracism, embarrassment, shame, and payback."¹¹⁵ Mady Schutzman writing about the role of ritual performance in collectivity writes, "the agitator faces one of two fates: absorption into the fabric of the group or exclusion from it."¹¹⁶ Queer writer and scholar Sarah Schulman says in an interview, "when you refuse to accept an unjust situation and you resist it, you're then

114. Tenured professors from historically underrepresented groups are still ousted from their positions for dubious reasons, while tenured professors representative of the majority can get away with just about anything and remain largely unaffected. Early on in my own conflict, I was told that short of physically touching someone, even with a formal complaint, there would be minimal disciplinary options available to the institution. Academic freedom is equally unreliable, held up as a protective mechanism for some and used as a weapon against others. Ahmed also has a great section on how policies are unequally applied or changed to favour those in power and the maintenance of the status quo in the face of evidence that there are problems policy could address.

115. Marc Bekoff and Jessica Pierce, *Wild Justice: The Moral Lives of Animals* (University of Chicago Press, 2009), 19.

116. Mady Schutzman, *Radical Doubt: The Joker System, after Boal* (Routledge, 2018), 99.

repositioned as the negative force or the threat.”¹¹⁷ Each of these authors is not thinking specifically about Academia, but Academia is a social structure composed of humans and so it also makes use of these forms of social sanctioning. Academically produced Science, as both a social structure composed of humans and as part of the Academic system, makes use of all of these; stories of ostracism, shame, retaliation, absorption or exclusion, silencing, power struggles, and precarity abound in the sciences. All of these tools teach practitioners/scholars how to play by the rules and what the consequences of straying might be.

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We must also note the uneven application of social sanctions depending on who is in power and how they have come to that power. While I have been subject to or witnessed “ostracism, embarrassment, shame, and payback” applied to my undergraduate and graduate student peers—those on the lower rungs of the academic hierarchy—I have also witnessed how those in power are protected from having to experience these sanctions. I can see how departmental power is limited, especially over those with tenure. There is no policy that allows a department to severely sanction tenured faculty, even after an investigation has concluded there is a problem with said faculty. Most departmental power in these cases is cultural. Colleagues witnessing problematic acts might try to address them by calling out or calling in an action or behaviour, or a department might collectively work towards cultural change with the help of a cultural audit and resultant recommendations. In my efforts to push for these types of changes or any kind of direct address of a documented and acknowledged problem, I was made to

117. New York Times, “Transcript: Ezra Klein Interviews Sarah Schulman,” The New York Times, June 22, 2021, <https://www.nytimes.com/2021/06/22/podcasts/transcript-ezra-klein-interviews-sarah-schulman.html>.

understand that direct address to specific individuals would never happen—it would be too embarrassing for them. The sentiment seemed to be that departments would rather wait until folks retired—even if retirement was decades away and a suggestion rather than a requirement¹¹⁸—then call out (or call in!) individuals. Tenured faculty would rather protect themselves and each other from cultural embarrassment, while students, postdoctoral researchers, and junior faculty could be subject to career ending humiliation with no hope of redress. Social sanctioning easily and regularly trickled down through the ranks but it rarely, if ever, moved up or even horizontally.

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As mentioned previously, specialization, whether in scientific fields or other academic disciplines, requires the guarding and policing of the borders of that field. As interdisciplinary artist Beatriz da Costa writes, “the shift toward the technical will make the penetration and understanding of literature even harder for the outsider, and is thereby fulfilling its desired function. Outsiders are to be kept *out* of this discussion.”¹¹⁹ James Gleick, writing in the 1980s about chaos theory, said, “few laymen realized how tightly compartmentalized the scientific community had become, a battleship with bulkheads sealed against leaks.”¹²⁰ Steven Epstein, author of an extensive study of the AIDS epidemic, wrote, “the consequence is that ‘a form of knowledge that is the most open in principle has become the most closed in practice.’ Scientists themselves are often anxious to police the boundaries of their professional domain and keep out

118. As opposed to some systems where retirement at a certain age is mandatory, guaranteeing that emeritus faculty cannot continue to take up precious lab space, resources, and grant funding.

119. Da Costa, "Reaching the Limit," 372.

120. James Gleick, "The Butterfly Effect," *Chaos: Making a New Science* (1987), 31.

unqualified interlopers or traffickers in ‘pseudoscience.’”¹²¹ I could go on, but the point is simply that Science is not immune to the sanctioning and policing of itself and its practitioners. The use of the scientific method or aspirational objectivity does not eliminate internal or external social structures. Science is subject to the same in-group loyalty as any group of humans.

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Border crossing is more accessible to some than to others. I once had a meeting with someone whose title was “student support” in the Faculty of Graduate and Postdoctoral Studies (GPS) about my need for additional expertise and guidance in my field. I explained that I was having trouble determining a path forward and that while my supervisor was supportive of my work, he didn’t have the type of expertise I needed. He wasn’t a neuroscientist by training and so couldn’t offer clear and constructive feedback aligned with the expectations of the field. I was feeling stuck and a bit abandoned and was hoping for some guidance or ideas on how I might go about acquiring the field-specific support I needed. The GPS staff-member listened to my concerns and then asked what was funding my work. When I answered ‘a CIHR grant,’ they replied that in that case, he *is* an expert in the field, otherwise he wouldn’t have received the grant. I explained that the grant had been achieved with the help of a collaborator and when asked why I didn’t make use of the collaborator, I tactfully explained that the collaborator was largely inaccessible due to a supervisor-trainee conflict that had left him scared to talk to students, including myself. Nothing to be done about that, so the GPS staff simply said that academic freedom allows my supervisor to pursue anything he is interested in. When I expressed concern that this freedom was costing me progress through my own degree program, they

121. Epstein, *Impure Science: Aids, Activism, and the Politics of Knowledge*, 7-8.

proceeded to tell me that I did not do my due diligence researching the lab before joining it and perhaps I should have gone elsewhere for my degree. I did not tell them that this was the only lab that said “yes.”

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When it comes to the education and training of scientists through the Academy, a large portion of training is an education in the price of admission. Specialization is one of those costs of admission, participation in the defence of disciplinary bounds another, the taking up of Science’s values as outlined by Daston and others still another. The ascetic life of a well-disciplined monk amongst the pea plants is held up as a beautiful example of Science at its best, time and time again. These costs are “accounted for” in conversations around “work/life balance”—a straw man dialogue centering the privilege of weekend canoe trips rather than a more uncomfortable discussion of the very real sacrifices expected of practitioners who wish to move up through the pyramidal hierarchy. Sacrifices like moving at each career stage, sometimes multiple times and potentially around the world, making less than minimum wage during graduate school and just over as a postdoc, giving up on or waiting longer to pursue family plans unless someone else can support that family, and so on.¹²² As Isabelle Stengers describes it:

They are supposed to grin and bear it: the great adventure of human curiosity presented to them as children is replaced by the theme of a vocation that demands body-and-soul commitment. And this is what we accuse today’s young people of no longer accepting: compliance with the sacrifices that service to science demands.¹²³

122. The one time I met with an ombudsperson to discuss my options for parental leave during my PhD, I was told that I should have waited to start a family when I said I couldn’t afford to take an unpaid leave.

123. Stengers, *Another Science Is Possible: A Manifesto for Slow Science*, 25.

I hope that this is something that can change—that if it is true that the next generation is not interested in accepting science on these terms than the terms will have to change—but I worry that the pyramidal shape of the hierarchy will mean there is always someone else who will accept the terms exactly as they are, whether or not they realize that is what they are doing.

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A group of concerned graduate students and I once formed a group to discuss and pursue issues related to equity, diversity, and inclusion within our department. The founding members were a mix of racialized and/or queer women and femmes and the whole thing started as a listening group. We found ourselves regularly sharing and acting as witness to one another's stories of bias and bigotry within the department and we often shocked one another by how horrific our experiences were. Collectively, our stories painted a picture of a department that took advantage of graduate students and trainees in the way most science departments do—relying on cheap or free labour to progress their own research agendas—with the addition of racism, sexism, and homophobia always simmering just below the surface. We eventually formed an official student group where we strove to advance change from within through education and policy in collaboration with the graduate advisors and department head. One of our first events was a workshop led by the University's Equity and Inclusion Office (EIO) that was very well attended; indicating to us the need and desire for this type of programming. The workshop focused on structures of power and privilege and with the title "Speak Up," took a critical and much needed look at why and when folks may or may not speak up about negative experiences they were enduring. The workshop was held on Zoom and included both previously gathered survey responses from individuals and responses to prompts and group activities during the event itself. Afterwards, the facilitators stayed on the call including myself as one of the

organizers to respond to any follow up questions or comments. Faculty expressed shock and surprise at how many negative experiences came up during the workshop and some wondered why they had never heard any of this before. A few students stayed on the call as well, and after one faculty member expressed heartfelt concern for the suffering folks had shared, a student jumped in to insist that they had never had any negative experiences, that they genuinely loved this department and were so grateful to be here, and that they couldn't imagine where these stories were coming from. The student was a heterosexual white cis-man.

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As Donna Haraway writes in *Staying with the Trouble*, Science must police its boundaries and borders to keep out not just other ways of working, other ideas that might distract or worse, disprove, Scientific practices, it must also keep out the people, the individuals, who might promote these other ways of working and these other ideas. Science must hold onto its self-image as apolitical and “objective,” and not a cultural practice or a practice shaped by sociopolitical context, “because that account makes ample room for a motley crew of interlopers to take part in shaping and unshaping what will count as scientific knowledge, for whom, and at what cost.”¹²⁴ Stengers described Science as the “great adventure of human curiosity” presented to children, and I have described all children as scientists already: embracing the idea that children are scientists would mean everyone is or was a scientist and is therefore capable of being a scientist now/again. Literally anyone could be a scientist by this definition, a motley crew indeed, and what would that mean for scientific knowledge claims? What would that mean

124. Haraway, *Modest_Witness@Second_Millennium. Femaleman@_Meets_Oncomousem: Feminism and Technoscience*, 67.

for those who currently maintain Scientific Authority? What would that mean for the institutions—academic, industrial, governmental—who profit from the education and maintenance of those Scientific Authorities?

2.8 The Price

There is a cost to this sanctioning and policing, to compliance with the conditions, to the conditions themselves regardless of compliance. There are individual losses, the folks who are pushed out and no longer able to pursue their dreams and interests and the folks who remain but in a compromised position that prevents them from reaching their full potential. There are collective losses in terms of the contributions of those individuals had they been able to pursue their ambitions, both within their specific field and to the wider communities of science and scholarship. And there are large scale losses that expand to national and international levels; losses that we can't even imagine, they are so fully foreclosed upon.¹²⁵ Sandra Harding writes clearly about the costs and benefits of scientific knowledge production. In "Is Science Multicultural?" she writes:

...the benefits are distributed disproportionately to already-overadvantaged groups in Europe and elsewhere, and the costs disproportionately to everyone else. Whether one looks at sciences intended to improve the military, or agriculture, or manufacturing, or health, or even the environment, the expanded opportunities that they make possible have been distributed predominantly to small minorities of already privileged people primarily (but not entirely) of European descent, and the costs to the already poorest, racial and ethnic minorities and women located at the periphery of local and global economic and political networks.¹²⁶

125. Though this thesis hopes to dream some of those imaginings into existence.

126. Harding, "Is Science Multicultural?: Challenges, Resources, Opportunities, Uncertainties," 317-318.

In some cases, Science is beginning to listen to and take better stock of where the benefits and costs of its practices go. With the ongoing alarm call of climate change backed by the majority of the world's scientists, attention is increasingly being paid to where and how the greatest negative effects are occurring and, importantly, to whom. It seems that the decline of the entire planet as a predictably habitable space for human life is a large enough problem for the scientific community to present a relatively coherent front, despite how hard agreeing on possible solutions might be. And yet even within the planetary problem climate change presents, research and proposed solutions continue to focus on already-over advantaged groups leaving the poorest and historically marginalized populations behind to wrestle with climate change's immediate impacts.

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At the level of the individual, I can think of far too many examples of folks who are or have been pushed out of a field for dubious reasons at best, outright discriminatory or abusive ones at worst. I shouldn't be able to name so many, especially in the sciences where I have relatively little experience and a relatively small network. The vast majority of the folks I can name off the top of my head are part of an already underrepresented group in the sciences; racialized folks, women and femmes, queer folks, crip and mad folks. Many are also in precarious positions; on student visas, from a lower socioeconomic status, with limited resources or local community. In fact, there isn't a single person on my list who is a heterosexual white cis-man. Already overrepresented groups continue to reap the personal benefits of a scientific practice—their participation supported by individuals and the system—while underrepresented groups continue to fight an uphill battle to survive. I've witnessed this occur in multiple forms:

errors or problems being blamed on a minoritized scientist rather than a white man taking responsibility; minoritized scientists being talked over and ignored; the contributions of a minoritized scientist minimized in collaborative work; a minoritized scientist losing first-author status on publication of their own thesis work; ideas contributed by a minoritized scientist being handed to someone else to execute without discussion; white men assigned projects that are guaranteed to work while minoritized scientists struggle through ill-conceived projects with little support; a minoritized student implicitly threatened with a forced return to their home country, and so on. These descriptions might sound general—they are so familiar—but that is only for the sake of anonymity. There is an individual, with goals and aspirations, with family and friends, a life invested in this practice, behind each of these descriptions. An individual who came to science often for the joy of experimentation and collaboration, the thrill of discovery and knowledge production. Each a brilliant light shining through their practices, even as these experiences try to stamp them out, try to pass the cost of scientific knowledge production along to those already on the periphery.

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My sense from my time embedded in a Science lab is that many scientists would either find these critiques to be extreme, deny their veracity entirely, or say yes, but what am I supposed to do about it? Taking one's narrowly focused research and expanding it to include broader impacts is not typically part of scientific training. As an example, how could working on a cure for cancer disproportionately benefit some, while passing the "cost" on to others? Wouldn't a cure for cancer be good for everyone? John Valentine, a medical researcher and member of Science for the People (SftP), an organization of radical scientists most active from 1969-1989, developed a breakdown of the ways in which "government, public, and private

institutions interlock to insure that only profitable ‘cures’ for cancer are likely to be discovered.”¹²⁷ As the editors of a collection of SftP documents write, Valentine’s 1980 article “highlighted lopsided allocation of government funds for cancer research as well as socioeconomic disparities in cancer incidence and prognosis.”¹²⁸ In the article, Valentine outlines the intersection of cancer theories with political and economic conflicts such that research efforts emphasize treatment of cancers rather than prevention. This focus benefits the affluent class, which has lower incidences of cancer than poorer groups, while the affluent class has more opportunity to afford treatment. Those of lower socioeconomic status—often racialized and/or marginalized along other axes—have higher incidences of cancer and would benefit most from a preventative research focus. Valentine writes, “thus, there is a contradiction between ignoring our present political and economic system and endeavouring to prevent cancer.”¹²⁹

Valentine’s example is one where the “denial of the interpenetration of the scientific and the social is itself a political act, giving support to social structures that hide behind scientific objectivity to perpetuate dependency, exploitation, racism, elitism, [and] colonialism.”¹³⁰ Levins and Lewontin, also members of SftP, work to pay attention to the political economies of scientific practice. They aim “to show how science and other aspects of social life interpenetrate and to show why scientists, whether they realize it or not, always choose sides.”¹³¹ Choosing to ignore where the benefits and costs of your work land, and how those impacts interface with

127. Schmalzer, Chard, and Botelho, *Science for the People: Documents from America's Movement of Radical Scientists*, 103.

128. Ibid. 103.

129. Ibid. 105.

130. Levins and Lewontin, *The Dialectical Biologist*, 4.

131. Ibid. 5.

sociopolitical axes, is to choose the side of dependency, exploitation, racism, elitism, and colonialism.

Making a choice otherwise—wanting to develop a cost/benefit analysis of one’s work as it moves outside the lab—is uncomfortable, and some might argue impossible work. To understand how one’s work intersects and overlaps with the sociopolitical would require knowledge of transglobal politics, ethnology and anthropology, history and religion, socio- and psych-ology, economics, and more. How is a concerned scientist to go about this task in addition to their ever-expanding lab work and the sustenance of a career in a field that may not promote or appreciate this additional labour? Furthermore, this work often requires or results in a re-evaluation of one’s values and their alignment (or not) with what is uncovered along the way. A concerned scientist might realize that they are complicit in something that runs directly counter to an important personal value, forcing them to make tough decisions about whether and how to continue. This is hard emotional labour that is absolutely not supported in scientific practices or rewarded in promotion and tenure. The reality of day-to-day life working at the lab bench or running a lab in the contemporary neoliberal academy does not support either the interdisciplinarity required to understand one’s work in a broader context or the emotional labour of fully considering one’s role and values within that broader context. And this is still another cost of disciplinary bounds, of specialization narrowing both the education one receives on the road to scientific knowledge production and the type of work that is rewarded once one has moved beyond a trainee stage.

And then there is the question of, what now? if one does connect their lab work with a larger sociopolitical context. Suppose one uncovers some unsightly effects occurring further down the pipeline of their research, or discovers a likely application of their work that they find

problematic, what are they to do with that information? Quit the research? Become an activist? Irrespective of the potential time and effort required to get to this point, hesitation or uncertainty around one's work is rarely rewarded even as uncertainty is a driving principle behind any scientific inquiry. Isabelle Stengers wrote *Is Another Science Possible? A Manifesto for Slow Science* in opposition to a conception of contemporary Western scientific inquiry as "fast," fuelled as much by the tech industry's favourite phrase, "move fast and break things" as by capitalism's relentless quest for more money faster. Stengers positions Science as a colonial institution driven as much by curiosity as by the military-industrial complex, with speed as a major factor in closing the supposed gap between "innocent" curiosity-driven research and military-industrial applications. She writes, "a mobilized army will not slow down for anything. The only question that matters is, 'can we get through?', and the price that others will pay for their passing through (ravaged fields, devastated villages) will cause no hesitation. Hesitation and scruples become synonymous with treason."¹³² While perhaps accurate, statements of this type are unlikely to make headway with scientific practitioners struggling to carve out a career within a system that actively demands the use of blinders in order to get the work done. Practitioners are trying to survive with a voice continuously chanting "publish or perish," as funding options narrow, and the job market is increasingly saturated with PhDs, leaving little to no space for hesitation or scruples. What can one do about the broader sociopolitical impacts of their work when they are working within a system that asks for "broader impacts" on grant applications and then ranks those proposals based on positive, progress, communication, and "diversity" oriented goals?

132. Stengers, *Another Science Is Possible: A Manifesto for Slow Science*, 42.

Scientists and engineers applying for a grant from the NSF are required to submit a “broader impacts” statement that addresses how their research benefits society. As stated on the NSF’s “Five tips for your Broader Impacts statement” website, NSF supported scientists “are accountable to taxpayers for conducting research, and collectively moving their research beyond the lab to impact the public good, thereby benefiting the economy, society and discovery itself.”¹³³ The two examples the website offers as successful Broader Impacts projects are AI-powered robots that inspire “children of all ages and abilities to fall in love with STEM,” (as opposed to considering the ways in which AI are biased and how those biases might impact the work) and an infographic that describes “how computer science and engineering researchers partnered with industry to develop billion-dollar industries over many decades”¹³⁴ (instead of possibly analysing how these partnerships feed directly into industry profit margins). These are the shining examples the NSF is sharing with the community; this is what the agency wants to receive in a Broader Impacts statement. It becomes quite challenging to imagine impact proposals that make space for slowness, for emotional labour, that celebrate hesitation or uncertainty, and yet this is arguably the place where exploring the work’s position and role in a sociopolitical context could occur. I would not expect either of the NSF’s two examples to inspire an applicant interested in exploring critical takes on their own work.

Simultaneously, granting agencies are increasingly looking for applied work, continuing the trend of reduced funding for “basic” research. During a town hall session at a January 2024

133. “NSF 101: Five Tips for Your Broader Impacts Statement,” NSF - National Science Foundation (blog), February 23, 2023, <https://new.nsf.gov/science-matters/nsf-101-five-tips-your-broader-impacts-statement>.

134. Ibid.

conference of basic biologists, NSF program officers informed attendees that recent executive directives from the government ordered funding agencies to prioritize proposals which addressed a list of applied, economically-valuable areas, including biotechnology and biomedicine. When a conference attendee pointed out during the Q&A that the community understanding had historically been to avoid those areas because they were too applied for the NSF, the program officer flustered that applicants could always propose work with direct applications, they just had to make sure their *question* was basic. This stunned the room into silence as folks considered the possibility of a future where the NSF would fund applied research through a thinly veiled emphasis on “basic research questions.” A reminder here that Hope Jahren’s big “war” money was from an NSF grant and the home page for the NSF website includes this quote from Director Sethuraman Panchanathan: “America’s economic and national security depend on our ability to invest heavily in the technologies of today while making the discoveries that are the foundation for the technologies for tomorrow.”¹³⁵ This is from the US’s federal agency specifically tasked with funding “basic” scientific research.

A reviewer of CIHR project proposals reported that in fall of 2023, zero of the proposals that received grants in their pool of applicants studied anything other than mice. None of the other common study organisms—C. Elegans, Drosophila, zebrafish, Xenopus, etc.—all of which contain tools and techniques that have been in use for decades, received funding. The pool of proposals they reviewed was just a percentage of those submitted and granted in that round of funding, but the focus on a single study organism does not bode well for developing a breadth of

135. “NSF - National Science Foundation,” NSF - National Science Foundation, January 29, 2024, <https://www.nsf.gov/>.

biological knowledge. Perhaps this is a recognition of the challenges of translation from other organisms to human health—it almost never works in a direct way—but it also rarely works with mice.¹³⁶ And if granting agencies steer research towards mice and away from other organisms, we lose the many contributions to our general understanding of biology that *have* been achieved through the study of other organisms, just not necessarily with direct applications to human need.

On the one hand, insisting on a recognition and review of broader impacts is fully aligned with what many scholars have been arguing science needs for decades. So is an insistence that scientific studies be accountable to the communities they claim to serve; the broader public through beneficial applications. Many have criticized discovery and curiosity driven research of ahistorical nostalgia—wishing for a childlike innocence in science that maintains ignorance and a lack of responsibility for said broader impacts—and yet I think there would be a great loss if discovery-based research were to disappear entirely. That curiosity, the joy of contributing even the tiniest bit of previously unknown knowledge, that wonder is what has brought so many to science in the first place and is what allows anyone to be a scientist, regardless of training or credentials. The NSF’s broader impacts statements—both the request and many of the answers—feel like performative lip service. The request for broader impacts does not go deep enough and

136. Stephan P. Rosshart et al., "Laboratory Mice Born to Wild Mice Have Natural Microbiota and Model Human Immune Responses," *Science (American Association for the Advancement of Science)* 365, no. 6452 (2019); Daniel G. Hackam and Donald A. Redelmeier, "Translation of Research Evidence from Animals to Humans," *JAMA : the journal of the American Medical Association* 296, no. 14 (2006); Michael B. Bracken, "Why Animal Studies Are Often Poor Predictors of Human Reactions to Exposure," *Journal of the Royal Society of Medicine* 102, no. 3 (2009); Kendall Powell, "Technology Feature | Replacing the Replacements: Animal Model Alternatives," *Science (American Association for the Advancement of Science)* 362, no. 6411 (2018); Lindsay J. Marshall et al., "Poor Translatability of Biomedical Research Using Animals — a Narrative Review," (London, England: SAGE Publications, 2023).

is not expansive enough to include the actual breadth of science’s impact on society and vice versa. Paired with a growing preference for applied research at basic science funding agencies, these efforts demonstrate a performance of broadening even as the funding itself excludes, limits, and restricts.

If we take, as another example, one “smaller” aspect of a lab-based practice—animal use—and try to think expansively about the potential broader impacts, the ethical questions grow exponentially. In our efforts to develop our ideas around animal use, we might find this statement from Cary Wolfe’s book on animal welfare, *Before the law: humans and other animals in a biopolitical frame*:

And while it is true that the other main law cited by the commission, the Animal Welfare Act (passed in 1966 and amended several times since), provides more extensive protection, mice, birds, and rats are specifically excluded from the act, and... they make up about 95 percent of all animals used in scientific research in the United States.¹³⁷

If we imagine a graduate student working on neuroscience in fruit flies, a common study organism in the field, we might feel exempt from animal use concerns since invertebrates are not animals that we collectively care about. While this number might be staggering—that 95% of the animals used in research are exempt from more extensive protections—we may feel that as an invertebrate researcher, this is not my problem. Yes, those boundaries are getting squishier all the time since cephalopods now receive extended protections in spite of being invertebrates, but

137. Cary Wolfe, *Before the Law: Humans and Other Animals in a Biopolitical Frame* (Chicago: The University of Chicago Press, 2013), 13. The 1970 amendment, which expanded the scope of the Animal Welfare Act to protect all warm-blooded animals and called for the use of anesthetics and tranquilizers for the first time, was then modified by the 2002 amendment, which excluded mice, rats, and birds from the definition of “warm-blooded animals.”

insects, especially ones that are not “charismatic” (flies, mosquitos, cockroaches), are not animals we concern ourselves with. Even more so for labs that study organisms outside the animal kingdom like yeast and e. Coli, or plants and fungi. But there are arguments from critical animal studies scholars that the animal-human divide, regardless of the type of animal, is just one of many problems that limits our imaginations and therefore our ability to invent different questions, methodologies, and ways of thinking and doing. Wolfe later writes,

The main lesson of the biology of consciousness is not that the important questions are reducible to a biological or neurological substrate but rather that, to comprehend the phenomenon, we have to adopt a mode of thinking that does not cleave along the lines of human vs. animal, who vs. what, inside brain vs. outside world, or, for that matter, organic vs. inorganic.¹³⁸

These dichotomies and categories, just like our disciplinary bounds, limit what and how we think, foreclosing possibilities before we can invent them. The taste neuroscientist working in flies might be so focused on the network of connections in the fly tongue and brain that they miss a much larger and perhaps more relevant point about sensation and perception that reaches beyond the receptor and the neuron, just as they miss the larger point about the ways their work upholds Science’s violence against humans and other organisms. This is a zoology department after all, the study of animals is in its name and given the link between violence against animals and violence amongst humans, we cannot engage in this work ethically without considering these connections. We will spend more time with critical animal studies later, but for now I am not suggesting that the student studying taste should abandon their work and take to protest. Instead, I am wondering how we create space for open thinking. How do we develop the ability to hold

138. Ibid. 70.

nuance and complexity as we move forward with the work? How do we create opportunities for exploring and acknowledging the impacts our work has both inside and outside the lab?

2.9 Professionalism, collegiality, and mind your business

When a field of knowledge becomes “professionalized,” it requires specific training and with that training comes the need to prove competency, skills, and expertise. In turn, which skills count towards proof of competency now requires definition and who gets to create that definition matters immensely. The parameters established around this proving ground become a barrier that must be passed for the next generation aspiring to participate in the field, thus a field becomes bounded and those boundaries require policing. Professionalism under capitalism brings with it capitalistic values like keeping public and private separate, clarity over ambiguity, and productivity over care. Professionalism under white supremacy brings with it white supremacist values like timeliness, language preferences, perfectionism, and binary thinking. The two are, of course, deeply entangled, as is patriarchy, but in sum they produce a belief that these “professional standards” are objective and unbiased, that they are an inherent property of participating in a workplace and not something layered on by human values and systems of control and production.

After professionalization of a field, individual practitioners can now be judged professional or not, depending on how well their practices, skills, and even personhood align with the often tacit definitions of “professionalism” in the field. “Professionalism” becomes either a promotional tool with which to praise an individual’s alignment with these standards—standards that might be cultural or practical, explicit or implicit—or a weapon to oust those

deemed “unprofessional.” Rarely do conversations around an individual’s alignment with (un)professionalism pay attention to the specifics of what exactly is (un)professional about a given action; nor do they attempt to account for the creation of the definitions of professionalism in the first place and whether or not those definitions themselves might be biased.

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When I began in the zoology department in 2016—perhaps even before I started, during the interview process—I was informed that the zoology department had a “no assholes” policy. There is, of course, no defined “no assholes’ policy” on the books and I did not inquire into what exactly was meant by this statement. The implication I took away was that there was a departmental culture of congeniality, that folks generally got along, and that “assholery” would not be tolerated. This in and of itself was not really a surprise since something like this idea exists in many workplace cultures; collegiality is often valued over conflict, as if the two cannot co-exist. However, over time it was repeated so often that it became a sort of mantra or tagline for the department. Visiting scientists would praise the department’s “collegiality,”¹³⁹ and the phrase “no assholes” came up more than once during my time as a graduate representative on a faculty hiring committee. As I began to understand some of the problems within the department, I became suspicious that the “no assholes’ policy” was not only a way to gloss over conflict that already existed—gaslighting those experiencing it—but also a means of silencing anyone who

¹³⁹ “Collegiality” in the context of “collegial governance” has a specific meaning in which university governance is achieved with the participation of faculty members through committees, titles, and additional roles related to academic governance and administration. Collegial governance does not necessarily involve congeniality or a lack of conflict, it simply references shared responsibilities. Here, I am primarily using “collegiality” according to the think/feel definition that developed over my 5 years hearing it in the lab and around the department: a sense of positive affect and a congeniality that brushes conflict aside.

might wish to speak up. If one were to come forward with a problem or conflict they were experiencing, what was to prevent them from being labelled “the asshole” and their problem minimized, dismissed, or worse, turned into a weapon against them?

My time on a faculty search committee was eye-opening; I would never see the department quite the same afterwards. Not only did the “no assholes’ policy” come up in casual conversations around the search, but the idea of “cultural fit” was incredibly powerful. Candidates with fantastic research ideas coupled with ample evidence of research and teaching success were undermined by the completely undefined notion of whether or not they were someone you could “go to lunch with” or “grab a beer with.” Ideas around “fit” had the power to create a culture of exclusion as those already in the department strove to fit into the implied, undefined standard—to be a non-asshole—and those applying for entrance were held up to this no-asshole template.

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There’s an additional set of terms, a binary, around relationships to time that helps explain some of the ways in which professionalism plays out in capitalist white supremacy, but sometimes in conflict with ideas of “collegiality.” Under capitalism, definitions of professionalism are based on a monochronic relationship to time, which extends into various aspects of work style. “It centers productivity over people, values time commitments, accomplishes tasks in a linear fashion, and often favours individuals who are white and Western.”¹⁴⁰ Cultures with a polychronic relationship to time prioritize socialization and connection over economic labour, while still completing tasks. Polychronic work styles tend to

140. Aysa Gray, "The Bias of 'Professionalism' Standards," (2019).

be more flexible with space for changes, substitutions, and interruptions, often juggling multiple tasks at the same time. There are many ways in which these relationships to time and work styles conflict with one another, especially when it comes to being on time or promptness, but we can also imagine and perhaps already practice a blending of the two. Conflict with the idea of collegiality occurs when we want congeniality—an emphasis on long term relationships as might occur in a department faculty—without the investment of care, depth, and time required to maintain those relationships. Without a clear definition of what “collegiality” is, how we would like it to manifest in a workplace, and how those expectations do or do not align with our definition of professionalism, the two can conflict with one another. For example, collegiality might require asking after a colleague’s family and learning more than we were prepared to hear about their personal and private life. Or a close working relationship might lead to a conflict over differing work styles, in which case confronting that colleague becomes challenging if we do not have the emotional tools to manage conflict with care. Without a clear understanding of “collegiality,” it can become a means of reproducing oneself, as in, *I’m not an asshole, so a department full of me will be a department without assholes!* It is easier to reproduce oneself—hire more of me, someone I know I can have a beer with—than to hire someone we differ from, whose very presence may be uncomfortable or lead to a conflict in work style.

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In Aysa Gray’s clear-eyed article from 2019, “The Bias of ‘Professionalism’ Standards,” which forms a scaffold for these ruminations, Gray discusses the link between micromanagement and termination. Gray writes, “in the United States, Black workers and other workers of colour are monitored more than white workers, and there is a correlation between levels of monitoring

with employment termination.”¹⁴¹ This is not a new idea—Black, Indigenous, people of colour, immigrants, women, 2SLGBTQIA+ have said they have to work twice as hard to succeed where mediocre white men get by without a problem for decades—but now there is data demonstrating that Black workers receive extra scrutiny from bosses, which can lead to worse performance reviews, lower wages, and eventual job loss.¹⁴² Increased scrutiny and monitoring increases the chance that a mistake would be caught whereas white workers who are not micromanaged could make the same mistake without anyone knowing. More mistakes meant worse performance reviews and worse reviews sometimes led to termination. The data Gray points to is from 2015, and here we are, nearly a decade later, still rehashing the same stories about race and gender-based gaps in labour forces and pay. At one point, academic STEM fields had the largest gender-based wage gap in comparison with industry and government,¹⁴³ and I would argue that the mechanisms for these gaps are still largely the same—micro- and macroaggressions and micromanagement that disproportionately affects minoritized workers.

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At the start of my “personal conflict” in the lab, I met with a friend who had also been through a supervisor conflict during the conclusion of their PhD. I started to explain how I

141. Ibid.

142. Gillian B. White, “Black Workers Really Do Need to Be Twice as Good,” *The Atlantic*, June 27, 2018, <https://www.theatlantic.com/business/archive/2015/10/why-black-workers-really-do-need-to-be-twice-as-good/409276/>.

143. Londa L. Schiebinger, *Has Feminism Changed Science?* (Cambridge, Mass: Harvard University Press, 1999), 36. Schiebinger is citing semi-annual NSF women and minorities reports from the 90s, but these reports are still released, the most recent of which can be accessed here: Elizabeth Grieco and Steven Deitz, “Diversity and STEM: Women, Minorities, and Persons With Disabilities 2023 | NSF - National Science Foundation,” n.d., <https://nces.nsf.gov/pubs/nsf23315/>.

perceived many members of the lab to be unhappy and that their feelings were being railroaded by an ongoing narrative that everyone was doing great, myself included. At some point along with way, they jumped in with an animated yelp of “mind your business!” This was a friend who was trying to be supportive and so this exclamation was not directed at me, telling me to mind my own business, but it stopped me in my tracks. I realized at that moment that this was part of the problem. I was supposed to mind my business, put blinders on, put my head down, and get the work done. I was not supposed to care about my peers, their mental health, their personal lives or even my supervisor’s mental health and personal life. I realized in that conversation that my “personal” conflict began out of concern for and solidarity with peers who were in a much more tenuous (or so I thought at the time) position than myself. I wanted to help them by improving our lab dynamic and in the process, help myself. I absolutely could not mind my own business while my peers, my friends, were told that their work had always been unsatisfactory one day and then the next listen to the same person brag that everyone was doing great. “Mind your business” was another tool, another form of white supremacist capitalist professionalism expressing itself in someone I had turned to for support.

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Aysa Gray writes of micromanagement and termination, “while trying to appear inclusive, this style of management presumes that black and minority workers are less competent and cannot be trusted with completing tasks.”¹⁴⁴ Trust and competency, two pillars of “professionalism” and “collegiality.” An entire book, *Presumed Incompetent: The Intersections*

144. Gray, "The Bias of 'Professionalism' Standards."

of Race and Class for Women in Academia,¹⁴⁵ is full of stories of women deemed incompetent or untrustworthy. Another book, *Mediocre: The Dangerous Legacy of White Male America*,¹⁴⁶ is full of stories of white men failing upwards. And here we are, still working twice as hard for half as much, struggling to appear trustworthy and competent according to definitions that were created without us and against us.

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While I departed from the lab on paper at the end of January 2021 with an official change of supervisor, my desperation to finish experiments, to finish my research, led me to continue to work in the lab under a set of guidelines defined by my previous supervisor. This should have been a good deal for him—his research would continue through my body and hands while he would remain distant from me personally, only communicating through the new supervisor—and yet it was a spectacular failure. The guidelines required that I file weekly reports in which I described what I accomplished in the lab during the previous week and then outlined my plans for experiments in the upcoming week. In the moment this seemed fine to me; whatever it took to get the work done. But after weeks of writing and submitting reports—which no one else had ever been required to do in the history of the lab—while still managing the devastating emotional fall-out with my now-ex-supervisor, I missed a report submission. I turned in the report the following week as soon as I realized my error. I would later learn from a Freedom of Information (FOI) request that not only was this mistake cited in a list of complaints against me that had me

145. Gabriella Gutierrez y Muhs et al., *Presumed Incompetent: The Intersections of Race and Class for Women in Academia*, 1 ed. (Boulder, CO: University Press of Colorado, 2012).

146. Ijeoma Oluo, *Mediocre: The Dangerous Legacy of White Male America*, First;1; ed. (New York: Seal Press, 2020).

removed from the lab’s animal use protocol (AUP)—the rules and regulations around animal use for research that allowed me to conduct my experiments—but the complaint went on to state that my reports were insufficient, even though he had never asked for anything more or different.¹⁴⁷ Without an AUP, no work can be done on animals in a laboratory and my experiments would have to halt immediately, regardless of what state they were in and what animals were in use at the time. Remember, my experiments included chronic, sometimes months long manipulations; halting without sufficient warning in the middle of a set of experiments would have wasted the lives of any animals I was engaged with. And this complaint was sent to the head of UBC’s Animal Care Committee (ACC), the university organization tasked with overseeing ethical animal use. This list of complaints was my ex-supervisor’s most successful endeavour to remove me from the lab. Other tactics had failed to varying degrees but this one—which he had been pursuing for months in different forms—finally worked. I was removed from his AUP within a week.

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Professionalism can define a cultural environment, but it can also define the rules of method and modes of apprehension in a “professionalized” field through training and proof of expertise as mentioned earlier. As STS scholars Susan Star and James Griesemer outline, “professional biologists sought international credibility by distinguishing themselves from amateurs, establishing advanced degrees as credentials, establishing specialized journals for the dissemination of results and by increasingly eschewing the public’s eclectic interests in

147. FOI March 29, 2021

science.”¹⁴⁸ Professionalization for biology and many other fields has expressed itself in these ways and more, and one might argue this professionalization is necessary for “progress,” but it is not without consequence. As Steven Epstein notes,

one consequence of this arrangement for the expert claims-maker is that maintaining legitimacy (both one’s own and that of science in general) becomes of paramount importance: when legitimacy is threatened, the credibility of one’s claims is in jeopardy, and with it, the availability of resources and the maintenance of professional autonomy.¹⁴⁹

Once a field is professionalized, those within must become gate-keepers, participating in the definition of the boundary and the policing of who is allowed to pass through, how, and why. It is possible to participate in a professionalized field without becoming a gate-keeper, but only if one is willing to take on the risk of reducing one’s own legitimacy and credibility. To defy one’s role as gate-keeper puts one’s own professionalism at risk and if that is the choice we make, we must do it with open eyes, understanding what is at stake for ourselves and our position within the field. Defying the gate-keeper role can manifest in different ways; by holding the door open for others, by pushing the bounds of what is considered legitimate or credible in the field, or by refusing the boundaries altogether, both for individuals who desire access and for areas and methodologies of study. As Tajja Isen writes about law school, “professionalism, isolation, rationality, a complacency toward leaving the world as it is—are so central to legal education

148. Susan Leigh Star and James R. Griesemer, "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39," *Social studies of science* 19, no. 3 (1989), 393.

149. Epstein, *Impure Science: Aids, Activism, and the Politics of Knowledge*, 16.

that they often get codified in its curriculum.”¹⁵⁰ This observation applies to education in many professionalized fields, including the sciences, and as a result requires active resistance. Once codified, these values are no longer available for discussion and become invisibilized. If one wishes to counter the negative impacts of these value systems, one must become aware of their existence before active resistance can begin. Discussions around what professionalism means, how it is defined and by whom, both culturally and practically, in each and every field, must be had if there is to be any hope for countering the biases that “professionalism”—cultural or practical—brings with it.

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These are the commitments to professionalism, collegiality, and minding your business to which I remain disloyal. Refusing to mind my business and instead being concerned with my peers, rallying us together to support one another through a hard time, searching for tools in solidarity is what ultimately brought things to a head in my own “personal” conflict. In spite of how things played out, this is not something that I would change, and it is certainly not something I will do less of in the future. I have learned what is at stake the hard way, but that lesson has not changed my conviction that we need community and solidarity. This is my version of collegiality—not one that holds up collegiality as the opposite of conflict, or a surface level interaction without the messiness of humans, or that hides behind a proclamation of “no assholes”—but one that builds relations for and with one another, that can hold conflict and tension and difference while still deeply caring for and respecting one another. And forget

150. Tajja Isen, *Some of My Best Friends: Essays on Lip Service* (New York: Doubleday Canada, 2022), 136, ~~strikethrough mine as this quote could apply to any professionalized field.~~

“professionalism.” Relationality—caring for one another as people, respecting one another’s interests, skills, experiences, and knowledge—can replace all of “professionalism” in my mind. Sometimes this means conflict, sometimes this means someone has to speak up and be “the asshole,” sometimes this means hearing hard truths, sometimes this means discomfort, sometimes this means pushing each other in unexpected ways, sometimes this means tough discussions and decisions about how to move forward.

2.10 Invisibilize

Academic institutions wield incredible power in the form of education, collectively deciding what is taught, how it is taught, by whom, and to whom. Exclusion—conscious or unconscious—can and does occur at every level, whether it is through what disciplines exist in the academic landscape, what methodologies or pedagogies are allowed in the classroom, laboratory, or studio, or who is allowed to teach and who is deemed worthy of receiving education. Many of these thresholds—who/what is/isn’t allowed—have their origins in the founding of the Academy, by and for the landed aristocracy, and while changes have certainly occurred in how academic institutions function, countering some of its most insidious aspects is an ongoing battle. As I write this, protests against teaching critical race theory or even acknowledging the existence of 2SLGBTQIA+ people in primary education proliferate across North America, while US Senate antisemitism hearings have successfully ousted Claudine Gay, Harvard University’s first and only Black woman president, after only a few months at the

helm.¹⁵¹ Far-right groups on campuses rally under a banner of “free speech” to defend their right to hate speech,¹⁵² while simultaneously restricting the free speech of pro-Palestinian faculty and students by accusing them of antisemitism, sometimes successfully removing vocal anti-Zionists from campuses.¹⁵³

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While I, thankfully, have not had to experience explicit hate speech directed at me or my peers during this PhD, I have had a lot of experience with liberals virtue signalling their support of marginalized groups while saying and doing things that reflect an utter lack of self-reflection or deep understanding of what it is they claim to support. A few examples for you. During a discussion of accessibility in the classroom, a tenured professor claimed that providing subtitles or a transcript during lectures made students lazy since they no longer had to listen and/or could copy and paste notes out of the transcript. A committee member commented on a section of a racialized student’s dissertation, “is this English?” rather than provide any kind of specific feedback; this professor was recently working on creating an endowed lecture not in their name but in the name of equity seeking groups. A lab head insisted that trainees learn and actively participate in equity, diversity, and inclusion (EDI) discussions: he informed lab trainees that

151. Sarah Mervosh, “What to Know About Claudine Gay, Harvard’s Embattled President,” *The New York Times*, December 12, 2023, <https://www.nytimes.com/2023/12/11/us/claudine-gay-harvard-president.html>.

152. “Campus Clash: Students Battle Over What Constitutes Free Speech,” *CBC*, April 18, 2017, <https://www.cbc.ca/news/canada/free-speech-versus-hate-speech-1.4058994>.

153. Science is not exempt from these oustings as can be seen from the firing of Michael Eisen as editor-in-chief at *eLife* after an uproar over his vocally pro-Palestinian stance on Twitter.

“Prominent Journal Editor Fired for Endorsing Satirical Article About Israel-Hamas Conflict,” *Science | AAAS*, March 18, 2024, <https://www.science.org/content/article/prominent-journal-editor-fired-endorsing-satirical-article-israel-hamas>.

they would not be able to get a job without some knowledge of these issues because ‘EDI is academic fashion right now.’ I cannot even count the number of times someone has asked me why we can’t just hire for excellence instead of “diversity,” or the number of times someone has commented on how hard it is to be hired these days as a white man. All these examples are professors training the next generation on how to progress along the academic path and where academia’s values lie.

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I understand these acts as an unequal application of the right to free speech (dependent on who is doing the speaking and what they are saying) and as manifestations of backlash against an insistence on being heard by people historically relegated to invisibility. According to white supremacy and Hills’ matrix of domination, marginalized folks are supposed to stay in the margins; quiet and non-existent except when there is a need to oppress, blame, or exploit, in which case they can be seen but only to fulfil a white supremacist need. Asians, stereotypically regarded as the hardworking, boot-strapping, follow-orders minority get to maintain preferred status as long as it benefits white supremacy, as evidenced by the use of the academic success of Asian students as a means to end affirmative action. When Asians take up too much space or become too well aligned with whiteness, they must be reminded of the precarity of their position. As Cathy Park Hong writes in *Minor Feelings*, “Asians lack presence. Asians take up apologetic space. We don’t have enough presence to be considered real minorities. We’re not racial enough to be token.”¹⁵⁴ By stepping forward and demanding attention, care, equality, a seat at the table,

154. Cathy Park Hong, *Minor Feelings: An Asian American Reckoning* (One World, 2021), 7.

power, we are a threat to the unexamined power and privilege of the institution and those who have been able to maintain the status quo from its colonial founding to the present.

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I was never able to define the type of pedestal I initially occupied. Was it a pedestal made of shock that an artist could be good at biology or one constructed from misogyny and racism? A visibly racialized femmes pedestal? Or a specifically Asian-American pedestal built on a racist hierarchy where I was the best kind of minority—the quiet, submissive Asian woman who willingly worked long hours without complaint? I was certainly told that one of the reasons I was so good at science was an anti-authoritarian streak—that my “punk rock”¹⁵⁵ disposition lent itself to asking questions others were unwilling to ask or pushing where others were hesitant—though wouldn’t that run directly counter to the submissive Asian? When I offered feedback on mentoring practices, the response I received was fawning over what a great addition to the lab I was because of the ‘diverse perspectives’ I brought... so maybe a “diverse perspectives” pedestal? I will never be able to disentangle these aspects of how I was perceived and so elevated, but elevated I was, a golden child for nearly five years. With that height I could try all kinds of wildly challenging experiments, acquire expensive reagents and equipment, leave the lab for a summer for an advanced training course, enjoy a flexible schedule—especially after having a child at the start of my fourth year—and so on.¹⁵⁶ From that height, I could also look down on my peers with a clear view of how they struggled; their experiment ideas rejected, their

155. His words, not mine.

156. Though these would also be used against me when the pedestal fell. Either as evidence of my unsatisfactory progress, or as evidence of his support, directly counter to the aggressive undermining I would come to experience.

requests for tools denied, basic support undermined. I couldn't believe a lab colleague was making a paintbrush by hand the day the laser I ordered arrived. With time my position, while obviously beneficial, became increasingly unbearable when paired with the knowledge that *I* was not really seen or heard, only an idealized version of me, and I was distanced from my peers as we were unconsciously pitted against one another. I also knew pedestals were precarious, that they often came with a potentially devastating fall, and so I began a cautious attempt at stepping down.

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It is important here to not depoliticize racism, sexism, homophobia, transphobia, ableism, and so on as only a matter of cruelty or insensitivity, where compassion or charitable feelings would solve the problem. While compassion certainly has a place at the interpersonal level—in how we experience these -isms relationally—we must draw attention to the ways in which these -isms have been codified into structures and then invisibilized, removed from discussion, no longer a problem that needs addressing. The fight for gender equality did not end with the suffragists and we are not colour blind after the election of a Black president. Alison Kafer in *Feminist, Queer, Crip*, writes, when “disability is depoliticized, presented more as nature than culture... these are exercises in ‘personal imagination’ rather than ‘cultural imagination,’ and a limited imagination at that.”¹⁵⁷ Kafer thinks with Jodi Dean, quoting Dean on the need “to take depoliticization seriously, to address the means through which spaces, issues, identities, and events are taken out of political circulation or are blocked from the agenda—or are presumed to

157. Alison Kafer, *Feminist, Queer, Crip* (Indiana University Press, 2013), 5.

have already been solved.”¹⁵⁸ In addition to addressing depoliticization in academia—how is it occurring in scientific practices and academic science specifically?—scientific knowledge production, especially biology, has been used to “naturalize” many of these -isms through determinism, and since the “success” of the human genome project, specifically with genetic determinism. As Ruth Hubbard put it in *The politics of women’s biology*: “biologists have the authority to tell us what is natural and what is human. They sort nature from culture, and what is more political than that?”¹⁵⁹ Biology has long been complicit in the task of naturalizing human made categories of race, sex, sexuality, ability, class, and so on. This naturalization means biology has played a major role in the active depoliticization of these terms, rendering them “natural” and not cultural. Once reified in this way, given a concrete justification, systems, spaces, and structures related to these categories become invisibilized, no longer something we need concern ourselves with. They are simply “nature” after all.

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How does one talk about one’s experiences of racism, sexism, transphobia, and ableism within a racist, sexist, transphobic, ableist institution without reifying those categories, applying them to oneself and others along the way? As Larissa Lai wrote in *Slanting I, Imagining We*, “the difficulty of talking about one’s ‘actual life’ from a raced position remains fraught.”¹⁶⁰ I can’t talk about my experience of Asian stereotypes without pointing to and stating an Asian stereotype. I also can’t discuss trauma inflicted during this PhD without the risk of utilizing that

158. Ibid. 10

159. Ruth Hubbard, *The Politics of Women's Biology* (New Brunswick, [N.J.]: Rutgers University Press, 1990), 209.

160. Larissa Lai, *Slanting I, Imagining We: Asian Canadian Literary Production in the 1980s and 1990s* (Wilfrid Laurier Univ. Press, 2014), 13.

trauma for personal gain—I once had a conflict manager from UBC’s EIO tell me I had the material for a great memoir—or of harming peers who witnessed or experienced similar traumas. But if I don’t talk directly about what happened, I’m accused of concealment, of collusion with the invisibilizing and silencing that the institution relies on. Yes, the art expresses some of the horrors of that time, but the audience would have a better understanding if I was willing to disclose more. What about making a documentary? There are demands for me to tell all, spill the tea, but not as gossip of course and certainly not to get ahead. Increased exposure, but not so much that the audience becomes uncomfortable, and no direct accusations lest you open yourself up to defamation. Walking this tightrope of telling this story without offering myself as Other to be consumed has been exhausting. I’m not sure it is possible to express racist, sexist, or queer trauma without offering oneself up on a platter. As bell hooks opens her 1992 chapter titled “Eating the Other: Desire and Resistance:”

The commodification of Otherness has been so successful because it is offered as a new delight, more intense, more satisfying than normal ways of doing and feeling. Within commodity culture, ethnicity becomes spice, seasoning that can liven up the dull dish that is mainstream white culture. ...The ‘real fun’ is to be had by bringing to the surface all those ‘nasty’ unconscious fantasies and longings about contact with the Other embedded in the secret (not so secret) deep structure of white supremacy.¹⁶¹

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And what happens if or when we force these depoliticized topics back onto the agenda? How do we account for the resultant backlash? As we demand accountability for white supremacy, what tactics are used to evade responsibility? How will power continue to prop itself up and defend itself against would-be usurpers? Christina Sharpe, writing in *Ordinary Notes*

161. hooks, "Eating the Other Desire and Resistance," 21-22.

about recent acts of white violence and how those acts are represented in media coverage, is well-attuned to the grammar of white evasion. In Note 63, dated March 16, 2021, after the Atlanta shootings at three separate spas, the victims of which were almost all Asian and women, Sharpe writes, “the white supremacist is extended the grammar of the human.”¹⁶² In Note 62, she writes:

This grammar of the good is the same one that names J. Marion Sims and Francis Galton ‘fathers’ of gynecology and eugenics, respectively. Sims, who tortured many enslaved women—among them Anarcha, Lucy, and Betsy, to call just three of these women by their names—by performing multiple surgeries on them as he experimented for a way to cure vaginal fistulas... Then there is Francis Galton, the man who named his racist theory of intelligence ‘eugenics’ and after whom buildings were named at University College London. Good men. Fathers.¹⁶³

In Note 60, dated May 10, 2011, the subject of which is the *New York Times* coverage of neo-Nazi leader Jeff Hall’s death when his ten-year-old son shot him, Sharpe writes, “daily and with deliberation, newspapers constitute whiteness as innocence, in ways that hide and forgive their own interests in the preservation and distribution of white supremacy... That grammar of ‘mistakes were made’ is one in which terrible acts are committed and yet no one is assigned responsibility for them.”¹⁶⁴ The evasion of responsibility Sharpe describes, the celebration of these “good men,” the extension of grace to the white supremacist, resonates with academia’s own strategies for conflict resolution. Given academia’s founding in white supremacy, this resonance is unsurprising, including the naming of buildings after eugenicists. The archaic

162. Christina Elizabeth Sharpe, *Ordinary Notes*, First American ed. (New York: Farrar, Straus and Giroux, 2023), 102.

163. *Ibid.* 101.

164. *Ibid.* 99.

protections of tenure enthrone mostly white men with the power to do just about anything they want. These good men, fathers, commit terrible acts within academic positions and largely evade responsibility.

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I recall a conversation with another UBC EIO staff member in which I was outlining some of the problems I had experienced in the lab with my now-ex-supervisor. The staff member responded with support and incredulity, as well as something like, ‘he probably doesn’t even beat his kids or anything.’ This was meant to be a nod to his liberal values, to his ability to love his family and be a “good father,” while simultaneously enacting micro- and macroaggressions in the lab. Placed beside Sharpe’s observations about the grammar of “good men. fathers,” this off-the-cuff statement takes on a different hue.

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In *Complaint!*, Sara Ahmed finds that much of how conflicts are handled is through evasion. There are many tactics utilized to this end including inefficiency; “inefficiency is not just the failure of things to work properly but is also how things are working,”¹⁶⁵ confidentiality; “confidentiality... means that those with more connections have more control over how the complaint is framed... who controls the situation, who controls the narrative,”¹⁶⁶ and mediation; “informal mediation was strongly preferred, because it involves neither fact-finding nor fault-finding.”¹⁶⁷ All of these tactics add up to dissolution of the problem, rather than direct address.

165. Ahmed, *Complaint!*, 91.

166. Ibid. 128.

167. Ibid. 85.

“Resolution” in the vast majority of cases is a disappearance process—whatever it takes to make the conflict go away, whether that is through bureaucratic exhaustion, lack of support and isolation, silencing via confidentiality, or identifying a person as the problem and making that person go away. “Resolution as dissolution.”¹⁶⁸ As much as the Academy would like to think of itself as above these problems, terrible acts can occur inside the Academy without anyone being assigned responsibility for them.

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The inefficiency is mind-boggling. The number of meetings I had with disparate units and individuals across the university in my search for support and recourse was astounding. Multiple divisions and individuals within the EIO, multiple individuals within GPS, the Ombuds Office, the Office of the Vice-President, Research and Innovation (VPRI), the Graduate Student Society (GSS), the Animal Care Committee (ACC), and of course mentors across the Faculty of Science and within the Zoology Department, including regular meetings with the graduate advisors and the head of department. Each of these meetings required some level of recounting aspects of the targeting I was experiencing and its adverse impacts on my work, as well as responding to questions about specific incidents and forms of evidence. Hours and hours spent rehashing and reliving each incident because none of these units would talk to each other, nor would they share my stories with each other within a single unit. Each promised confidentiality, which I did not want or ask for. Confidentiality meant exhausting myself retelling these stories, fielding questions, navigating scepticism, and listening to hand-waving responses of concern without power to act. None of these units or individuals, regardless of titles like “student

168. Ibid. 53.

support,” “conflict management,” or “executive director,” had the ability to positively affect anything I was experiencing. Many suggested meetings with someone else and most of the time I had already met with the suggested person/unit. After months of reliving my experiences over and over again, I was too existentially fatigued to keep repeating myself, especially when I could see no visible change. Many people/units encouraged me to file a formal complaint as one of the only forms of effecting action, while also warning that the investigation process would be harrowing for me and my peers and that everything found in the investigation and/or recommended actions would be hidden behind, you guessed it, confidentiality. I would never know the outcome of my own complaint, no one would ever hear the experiences of my peers and I, and if there was a disciplinary action taken, it would all be kept secret. Given the silencing I had already experienced and the fear of “gossip” that had been instilled in my peers, I could not imagine a worse way to go about seeking recourse.

On the other hand, the person already in a position of power was protected by this confidentiality; no one would ever know if an investigation turned up clear evidence of discrimination, and no one would ever know if disciplinary actions were taken. He would not have to experience shame or embarrassment or even awkward conversations, while I would continue to experience humiliation and scientific career ending consequences due to my inability to finish my experiments or publish anything. Without going public or hiring a lawyer (which I couldn't dream of affording on a student stipend), I could not be heard and taken seriously by anyone with enough power to make a difference in my case. The month and a half in which we engaged in mediation, all of which is protected by confidentiality, only assisted in his efforts to silence and undermine me. Evidence that might support my claims unearthed in pre-mediation—is it breaking confidentiality to say that we never even made it to mediation itself?—will never

see the light of day unless, again, a lawyer deems it necessary and finds legal grounds to have those notes disclosed. I have hundreds of pages of emails from my FOI request that outline the ways in which confidentiality and mediation enabled my supervisor's construction of a narrative about our conflict that suited him and his needs, while simultaneously methodically removing my support systems. Meetings and emails where he was able to override my concerns with his own 'red flags,' that weaponized my previous EDI work against me, depicted me as an anti-authoritarian, unpredictable person whose activist friends might do something terrible. And emails and conversations with colleagues that pathologized me as depressed and unstable, next to concerns for lab and animal safety, implying a link between the two. These concerns were used to both request increased surveillance through UBC's Early Alert system, and ultimately to remove me from the AUP.¹⁶⁹

2.11 Pathologize

“Under Empire, happiness is seen as a duty and unhappiness as a disorder.”¹⁷⁰

~ carla bergman and Nick Montgomery

Polite silence in the face of inefficiency, confidentiality, mediation, bullying, and violence only reproduces the evasion of responsibility, the denial, the invisibilizing, the depoliticizing, and the gaslighting. Another powerful tool to uphold all of these is pathologizing;

169. FOI Dec 3, 2020, March 20, 2021

170. Carla Bergman and Nick Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times* (AK Press, 2017), 56.

framing systemic problems and negative responses to those problems as individual failings or diseases. Pathologizing has a long colonial history, tied up in gender, race, ability, and so on—all the ways bodies and minds are divided, categorized, and placed in a hierarchy—resulting in emotional impoverishment and disenfranchisement at best, institutionalization and carceral or mortal punishment at worst. In *Joyful Militancy*, Nick Montgomery and carla bergman write:

Imperatives to be happy, nice, or kind can sustain violence, forcing out anger and antagonism. Unhappiness is pathologized... These tangled webs of subjection are portrayed as individual failings or pathologies. Unhappiness, outrage, and grief are then perceived as individual disorders, to be dealt with through pharmaceuticals, self-help, therapy, and other atomizing responses.”¹⁷¹

Now we have the simultaneous naturalization of categories and hierarchies so that those constructions can be depoliticized, rendered “natural” and therefore not available for questioning or critique, and the framing of systemic problems as individual failings. Anyone who might wish to critique a “natural” category as a construction or a systemic/structural issue, will now have to contend with the possibility of becoming the problem, of a framing that depicts their critique as a personal misunderstanding, an individual failing to understand a “natural” condition. The questioning individual becomes a disordered individual.

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While there were many small red flags along the way—small in that it was easy for me to justify their presence or better yet, rationalize them away entirely—there were a few distinct points of rupture. While I am tempted to name the entirety of becoming a parent as one point of rupture, I’ll try to be more specific. The transition out of parental leave was a rocky one at best.

171. Ibid. 58.

While I had put the foetus on the childcare wait-list at the age of -34 weeks (about 6 weeks in utero), we were still nowhere near entry into the on-campus program 18 months after our child was born. We heard from the childcare center when Hayden was 7 months old that we *might* get in soon, but on a graduate student stipend—my partner was also a graduate student at the time—we could not even dream of being able to afford the “discounted” student rate. To pay for the possibility of getting into childcare, I asked for a stipend raise so that I wouldn’t have to take on an additional job, but the answer was “no,” so I dutifully signed up for an extra TAship. As my leave was ending, I learned that we would not get into childcare after all and so was faced with both the TAship and the resumption of my lab work with no childcare. I was in a state of panic. In the first month of my return—January—I had a phone call with my supervisor and outlined all the research I had done into various childcare subsidies, student financial assistance, and so on, that had left me empty handed with nothing more than my student stipend. Neither myself nor my partner could go on leave and get a full-time job for extra cash since we were both here on student visas—we would have to return to the US or split our family across the border. He responded to each of my frustrations with questions that only made matters worse: so I wanted the same handouts domestic parents received? was I looking for high quality childcare only? why not ask my parents for money? why not get rid of our dog and move into family housing, isn’t that more affordable? I ended the conversation furious and immediately called my co-supervisor at another university in tears at the impossibility of it all. A few weeks later, we received notice that we had been awarded a CIHR project grant, and the use of my data and ideas in the proposal was used as justification to increase my stipend to cover a couple days of childcare per week.

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Robin McDonald & Julie Hollenbach historicize our contemporary understanding of depression in their introduction to *Re/Imagining Depression*, outlining the transference of “the problem” from larger structural issues to the individual. They write:

the cause of depression was reframed from the individual’s environment to the individual’s reaction to that environment, effectively relocating the origin of the affect within the individual and the personal. ...Perhaps even more acutely, the contemporary era of psychiatric discourses also obfuscates colonial and imperial histories of enslavement and displacement, cultural and literal genocides, and ongoing occupations of land, which, as many Critical Race scholars have pointed out, continue to impact the emotional, psychological, and embodied lives of Black people, Indigenous people, and other people of colour.¹⁷²

Many distinct and specific acts and histories of colonial oppression were purposefully swept under a generalized rug of medical discourse. Pathologizing became another way to depoliticize structural issues; individuals were burdened with negative feelings as a personal problem to be dealt with on their own, rather than a collective problem to be addressed in solidarity with community, society, governments, etc. In addition to depoliticizing the historical origins of depression in acts of oppression, contemporary and ongoing acts of oppression that impact the minds and bodies of marginalized people become contested ground. Without the ability to point to structural oppressions as a source of negative impacts on emotional, psychological, and embodied health, individuals were and are left struggling to identify the root cause of their negative symptoms and experiences.

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172. Julie Hollenbach and Robin Alex McDonald, *Re/Imagining Depression: Creative Approaches to “Feeling Bad”* (Springer, 2021), 3-5.

The next major point of rupture would occur only a few weeks after the increase in stipend for childcare costs. My supervisor sent an email in which he excitedly informed me that he had acquired Richard Mooney, a Duke University neuroscientist known for his work on the song system in zebra finches and whose lab I had visited at the start of my degree to learn optogenetic techniques, as a visiting speaker at UBC. While I obviously knew Mooney from my visit to the lab, I had been advocating for two other visiting scientists instead; Erin Hisey, a postdoc who had completed her PhD with Mooney, and Natasha Mhatre, a newly hired Canada Research Chair in Invertebrate Neurobiology at Western University. I replied to the email reminding him of my past nominees, especially in the context of our mostly white and male division with a mostly white and male speaker series. He responded that I was welcome to nominate those folks when the time came and the email thread ended—I thought nothing more of it. The following week he gave me the cold shoulder, not responding to my emails, avoiding me in the hallways, and not making eye-contact during meetings. This avoidance was especially acute because my co-supervisor from the University of Alberta was visiting that week; I was the only lab member not invited to after-hours beers or dinners with him. Towards the end of the week, I asked a colleague if the mood had been strange this week. They replied with incredulity, ‘don’t you know?! He’s mad at you!’ I had no idea and asked them to elaborate. They went on to explain that at a visiting scientist dinner at the beginning of the week, my supervisor told a postdoc in our lab that I was sowing discord in the department. According to the story, I had sent an email about our division of the department being made up primarily of white men to a gay man in our division and that person was now upset with me for not including queer folks in my consideration of department demographics. Apparently this person was very upset with me and my supervisor was indignant on his behalf. I was flabbergasted. I immediately scrolled through

my emails to see if I had somehow included this additional person in my email—I hadn't—which only left me wondering; did my supervisor forward it to him? How did he see the email? Or was this entire situation a fabrication and no one had seen my email except my supervisor? I had no idea what to do. Do I ask the gay man about it and apologize? Do I ask the postdoc about it to make sure this retelling of the story is accurate? Do I confront my supervisor directly? In what order should I do any or all of these things? After a sleepless night of panic, I ultimately did nothing. I didn't confront anyone, didn't ask anyone for their version of the story, didn't confirm any part of it. I tucked it away inside myself as a hurt I would never get to the bottom of and the following week much of the world shut down as the COVID-19 pandemic took hold of our collective bodies and minds.¹⁷³

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Any ordering of bodies, whether based on gender, race, ability, etc. impacts the application of pathology as an oppressive tool in terms of what affect is allowed, for whom, and the consequences resulting from “incorrect” affective performance. One impact is initial access to resources and attention; Alison Kafer, quoting Rosemarie Garland-Thomson writes, “this hierarchical division of bodies and minds is then used to ‘legitimate an unequal distribution of resources, status, and power within a biased social and architectural environment.’”¹⁷⁴ Kafer continues, describing a political/relational model of disability in contrast to a medical/individual model. In a political/relational model “the problem of disability is located in inaccessible

173. I did eventually ask the postdoc about this story, about a year after it occurred. They confirmed the tale as my colleague had passed it along and remembered the incident as very awkward for them. They apologized that they didn't know what to do or how to respond at the time and so did nothing.

174. Kafer, *Feminist, Queer, Crip*, 7.

buildings, discriminatory attitude, and ideological systems that attribute normalcy and deviance to particular minds and bodies.”¹⁷⁵ Kafer and Garland-Thomson are working here to (re)politicize disability; to counter the ways in which disability has been framed as an individual problem rather than a collective, community problem. The medical/individual model treats disability a problem to be cured with medicine, rendering the disabled “normal.” It presumes that individuals desire “normalcy” and focuses its efforts not in changing the built environment or structural/ideological problems but in “fixing” the individual.¹⁷⁶ The political/relational model aims to understand disability as a community problem that requires changes in structures and ideologies—political changes—placing responsibility squarely on systems in need of fixing rather than individuals. While Kafer and Garland-Thomson refer to the built environment as one powerful locus in which these ideologies manifest, ideologies function in all social environments, especially those fighting over limited resources, status, and power, as is the case in Academic and Scientific institutions. In a neoliberal academy, which has taken on capitalism’s scarcity, competition for resources, and urgency of production, the medical/individual model becomes a powerful tool to both depoliticize disability so that institutions are not required to take responsibility for their structures and systems, and a tool with which an individual might eliminate competitors or those considered inefficient, problematic, or otherwise uncooperative by labelling them disordered.

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175. Ibid. 7.

176. *The End*, directed by Ted Evans (BSLBT, 2011), 24:7. <https://www.bslzone.co.uk/watch/zoom-focus-end>.

The next nine months were a mess; some externally produced as the pandemic unfolded and we were forced to sacrifice all our birds rather than visit the lab regularly to take care of them, some internally produced as we wrestled with the “racial reckoning” of the summer of 2020. In the midst of trying to make progress on the research—primarily through data analysis since I could not go to the lab—transitioning the class I was TAing from in-person to online, juggling childcare between myself and my partner (childcare centres closed less than a month after the CIHR grant was used to start paying for a few days of care per week), who was also trying to finish a thesis, there were added EDI focused lab meetings, anti-racist reading groups, lock-downs, deaths, and health concerns for family, friends, and community. I managed to publish an R package with collaborators, though my contribution was continuously downplayed and sometimes wholly forgotten during meetings, and I moved our family to campus housing when we finally got into the university childcare program when it reopened in the fall. This was largely due to families that pulled their children out of care at the start of the pandemic and were unwilling to send them back when it reopened, but we did not feel like we had the luxury of keeping Hayden home. We started full-time childcare when Hayden was 22 months old, 8 months into the pandemic. As I began to schedule myself in for time in the lab again, I prioritized finishing the degree as soon as possible; everything was just too heavy and I was tired of being broke and anxious all the time. I planned my experiments so that I could finish data collection in a year. When I pitched this plan to my supervisor, he was supportive but also visibly saddened that I wanted to finish within the expected timeframe of 4-5 years. After all, he had confessed to me earlier that year that he had hoped these ideas were his ‘Nobel ideas’ and

that when he said ‘I don’t care what you do...’¹⁷⁷ it had been to cover up this ambition and tamp down his desire to push me harder.

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Another impact is who is listened to and believed when trying to advocate for oneself or get assistance for an illness. The hierarchy of bodies, having been “naturalized” and removed from view, implicitly affects those from marginalized groups seeking care within the medical system. Writer Aisha Sabatini Sloan shares an example in her book, *Borealis*;

I came down with something of a norovirus and vomited myself into the emergency room. The nurse did not believe anything I told her at first and asked me to walk from the doorway to the bed to prove my exhaustion while my wife stood by, astonished by the woman’s callousness.¹⁷⁸

With the problem of illness placed in the body of the individual, it is the individual’s problem to also prove their illness to the system from which they seek care. The status of their body as one in need of care has been placed so low in the hierarchy that those invested in care cannot fully see or hear them. Stories abound of Black and Indigenous women’s health not being taken seriously, their pain not real, their cries for help ignored. The ongoing disparities in maternal mortality and morbidity—with Black mothers in the US and UK two-to-three times more likely to die than white mothers, many of which are considered preventable deaths—remain a stark reminder of the adverse impacts of structural racism and its manifestations in pathology and

¹⁷⁷ Usually stated in response to me bringing up and debating between various options in a meeting, for example different analyses, different publishing options, whether or not to pursue an experiment one way vs. another, etc.
¹⁷⁸ Aisha Sabatini Sloan, *Borealis* (Coffee House Press, 2021), 32.

healthcare.¹⁷⁹ For its part, Canada does not collect racial data, reflecting its “hegemonic ‘colour-blind’ attitudes towards race,”¹⁸⁰ termed “race-evasiveness.” Described as “a broad ideological perspective that captures ideas such as ‘colourblind racism’ and ‘laissez-faire racism,’ [race-evasiveness] denies, minimizes, and ignores how race, as a socially constructed category of difference, structures inequalities.” Race-evasive health stands as another glaring example of the effects of depoliticization.

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There was a final series of ruptures before the email that ushered in the beginning of the end. In a one-on-one meeting I was asked to share some mentoring feedback and I cautiously picked an example from the January phone conversation 11 months prior. During that call I had spiralled into frustration over the “pyramid scheme” of academic scientific knowledge production in the context of the absolute lack of supports for a new parent at the bottom of the hierarchy. My supervisor responded at the time with a description of the structure as one that purposefully reflects industry—is designed this way—with a funnelling effect as individuals become increasingly specialized and professionalized for a CEO or lab leader type role. In no way did this response address my concerns and the explanation of the funnel was not only patronizing and condescending but... a funnel is an upside down pyramid. I explained 11 months later that what I needed in that moment was for him to listen, not for him to explain the system to me, which invalidated my concerns, leaving me feeling helpless, angry, and gaslit. After a

179. Donna L. Hoyert, “Maternal Mortality Rates in the United States, 2021,” March 16, 2023, <https://doi.org/10.15620/cdc:124678>.

180. Elizabeth Dayo, Kayonne Christy, and Ruth Habte, "Health in Colour: Black Women, Racism, and Maternal Health," *Lancet Regional Health - Americas (Online)* 17 (2023).

moment of silence, an apology, and a lot of fawning, he asked if we could schedule a meeting for a future date that would be all about giving him feedback so that he could adjust his mentoring style if necessary. We scheduled a meeting a few weeks out and ended the call with me as uncomfortable as ever but cautiously optimistic that this one bit of feedback had gone okay. Boy was I wrong.

2.12 Negative Affect

These ideologies affect everyone, not only the marginalized, albeit in different ways. Those in power, expected to uphold the status quo, must perform what José Esteban Muñoz terms “normative whiteness,” and while they may have the room to occasionally express negative emotions, they are generally subject to the expectation of a high level of stoicism. Muñoz describes it as “...affective performance of normative whiteness is minimalist to the point of emotional impoverishment.”¹⁸¹ The problem grows exponentially when the body expected to perform normative whiteness is not white, male, cis, or able-bodied, and so on. Those from marginalized groups who have done what was required of them to gain access to power sometimes fight the hardest to deny access to others. Margaret Atwood’s ongoing defence of Steven Galloway’s dismissal from the UBC creative writing department is just one example. Andrea Bennett, a writer who was in the creative writing program at the time of Galloway’s investigation wrote about the experience in an essay in their book, *Like a Boy but Not a Boy*.

181. José Esteban Muñoz, "Feeling Brown: Ethnicity and Affect in Ricardo Bracho's" the Sweetest Hangover (and Other Stds)", *Theatre Journal* 52, no. 1 (2000), 70.

Bennett describes Atwood thus; “she represents the compromises a white woman can make in order to succeed in [Canadian Literature], and to uphold it so as to preserve her success.”¹⁸²

Oftentimes the most impassioned upholders of the status quo are those who fought the hardest to open a door for themselves and gain access to that power. When domination or superiority was required for one’s ascendancy to success, one will do what is necessary to protect that hegemony, including slamming the door shut behind them or worse, enacting oppression on others as a means of maintaining their individual sovereignty.

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Our next one-on-one meeting occurred a week and a half later and immediately prior to an EDI lab meeting. We briefly discussed my research before he asked for a follow up to our previous “feedback” discussion. He wanted to know why I hadn’t told him about my feelings earlier—why I waited 11 months. I tried to explain that when your concerns are met with condescension or defensiveness, your thoughts and feelings are invalidated and so you’re not so inclined to be open with your thoughts and feelings in the future. I also said that I might not be the only person who feels this way as this is a common occurrence for minoritized folks and women and when I asked if he wanted to discuss further, he declined and said let’s talk about it at our already scheduled future feedback meeting. We then transitioned straight into the EDI lab meeting, which ended with an ex-postdoc in the lab and I getting into a heated discussion over speaking up about sexist experiences. She stated that she had experienced sexism at every stage of her career (she had just started a faculty position in the UK) and had never once spoken up. I

182. Andrea Bennett, *Like a Boy but Not a Boy: Navigating Life, Mental Health, and Parenthood Outside the Gender Binary* (Vancouver, BC: Arsenal Pulp Press, 2020), 211.

countered that not speaking up allows the behaviour to continue unchecked—how will anything ever change? She replied that speaking up requires emotional labour, to which I replied that I was full of rage every single day at the misogyny I witnessed and experienced—is that not emotional labour, too? Ultimately, the two of us came to the conclusion that it is all emotional labour for us, never them, and that teaching others about their own -isms is both exhausting and risky, but so is keeping it all in. This exchange between just the two of us occurred on Zoom in front of the whole lab towards the end of the meeting and our supervisor responded to our discussion with again, a long moment of silence. When he did finally speak up, he simply stated that we all had a lot to think about and ended the meeting.

I would later learn that he called her that night and questioned her about whether I was undermining his authority in the lab and if I might be a problem. When she relayed this conversation to me later, she did so with the belief that she had successfully talked him out of this idea, but evidence from his conversations with others and the email that started it all would show that she had not.

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What for the cis white man is emotional impoverishment, becomes emotional disenfranchisement for the Black body, the Indigenous body, the trans or gender-non-conforming body, the crip or mad body. Wahneema Lubiano's essay on *The Colour Purple* thinks through the politics of sentimentality as a corrective to an imposed stoicism. She writes, "given the dearth of attention... to the emotional well-being of marginalized others, such whole-hearted engagement with emotion is a way of asserting a previously denied right to feel... Emotional disenfranchisement has been part, an overlooked part, of the total costs borne by objects of

marginalization.”¹⁸³ Cathy Park Hong writes in *Minor Feelings*, “minor feelings occur when American optimism is enforced upon you, which contradicts your own racialized reality, thereby creating a static of cognitive dissonance.”¹⁸⁴ This cognitive dissonance—a kind of gaslighting—disconnects emotions from experience, invalidating those emotions and causing one to question their source, which then forecloses the opportunity to develop an emotional understanding of oneself. Deprived of the privilege to feel one’s feelings, objects of marginalization are denied a “right to feel.”

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The rest of the week became an uncomfortable repeat of the cold shoulder from earlier in the year; my emails were ignored, meetings I was a part of were inexplicably cancelled. I got the distinct feeling that something was happening behind my back, but I wrote it off as stress-induced paranoia and tried to convince myself that he was just busy. A few days later I received a cryptic email with the graduate advisors and head of department CCed stating that he believed there were problems in our supervisory relationship and that I should seek council from the head or grad advisors. Simultaneous to my receiving this email, my colleagues in the lab were receiving requests for unscheduled, spur-of-the-moment, intense, one-on-one meetings with my supervisor in which he would ask them about their experience of toxic lab culture—everyone except me that is. I had no idea what I should be seeking council about but I met with a graduate advisor as requested and together we attempted to puzzle out why we were having this meeting.

183. Wahneema Lubiano, 1989: 8-9 as quoted in Avery Gordon’s *Ghostly Matters* endnotes: Avery Gordon, *Ghostly Matters: Haunting and the Sociological Imagination* (Minneapolis: University of Minnesota Press & London, MN, 1997), 220.

184 Hong, *Minor Feelings: An Asian American Reckoning*, 56.

When I didn't seem to know why, the grad advisor eventually said that it had been suggested that maybe I 'no longer accept him as my supervisor' and did I have any thoughts on what that might mean or why he might feel that way? We debated briefly if it could be science based—was I moving forward with my research in a way that didn't include him?—but since we had just had what felt to me like a successful scientific meeting in which we planned the conclusion of my experiments in the next year, that didn't seem to be it. Ultimately, the only thing we could come up with was that this was somehow related to authority—that he felt like his authority over me was threatened in some way. The grad advisor asked me what I wanted to do and I said honestly, I just want to finish my research. Could we just ignore this and move on? The next day I received another email requesting another meeting with everyone; grad advisor, supervisor, and co-supervisor, because he was not willing to move on. I would later learn that the email in which my supervisor stated “I believe that she no longer accepts me as a legitimate supervisor,” also went on to say “I am worried that if her efforts to change our department are not satisfactory to her than she may take extreme action.”¹⁸⁵ This email supported this worry by claiming that “she is very upset that UBC is on unceded territory and I now believe that she is upset specifically that the lab is on unceded territory,” and “she is also upset that my authority as a professor comes from my privileged background.”¹⁸⁶ This email thread between my supervisor, the grad advisors, and the head of department would end with a request that UBC's Early Alert system be notified “given the serious nature of these concerns.”¹⁸⁷

185. FOI December 3, 2020

186. FOI December 3, 2020

187. FOI December 3, 2020

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Gaslighting, a tool that combines both invisibilizing and pathologizing, shuts down conflict, understanding, and evidence through emotional disenfranchisement. The cognitive dissonance produced leads targets to question the validity of their feelings and perceptions, ultimately questioning the validity of the experience itself. By undermining or minimizing an experience before it can be fully understood—before it can become evidence—gaslighting accomplishes a foreclosure of the marginalized experience. When occurring repeatedly or in the presence of witnesses who either participate in the gaslighting or turn a blind eye to it, a target may begin to question their own sanity or their understanding of “reality.” One wonders, ‘how could my experience of an incident be so radically different from everyone else’s? It must be me that is off, me who is misunderstanding the situation or condition.’ Once neutralized in this way, a problem, conflict, or confrontation is avoided and a potentially negative interaction eliminated before it can bear the fruit of evidence. Hong again has an apt description, “minor feelings: the racialized range of emotions that are negative, dysphoric, and therefore untelegenic, built from the sediments of everyday racial experience and the irritant of having one’s perception of reality constantly questioned or dismissed.”¹⁸⁸

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Simultaneous to the email conversation expressing concern over my mental health and the safety of the lab, and as meetings were being organized that included the grad advisors, head of department, and perhaps a representative from the EIO, my supervisor sent me the following email:

188. Hong, *Minor Feelings: An Asian American Reckoning*, 55.

Hi Melissa,

If you would like to chat on the phone before the meeting, I'm happy to do that. This meeting with [M] and [D] is just a way for us to find a path forward. I'm not mad in case you are worried about that. Please do let me know if it would be helpful to have a more informal discussion in advance.

Best Regards,

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The drive to “help” or “fix” the abject individual must be seen for what it is; a Trojan horse. A “gift” promising to “remov[e] their passivity and cleans[e] them of the ‘core of despair’ crystallized in their bodies,”¹⁹⁰ with a dagger of pathology hidden inside if one does not yield. Once a body has been pathologized, labelled as problematic in some way, a future of institutionalization begins to materialize. Trust is revoked and the possibility of danger tinges every comment or action as anything said or done can become a weapon. Esmé Weijun Wang writes of her experiences with psychiatric institutionalization in *The Collected Schizophrenias*: “we cannot be trusted about anything, including our own experiences.”¹⁹¹ Regardless of whether Wang entered the institution voluntarily or involuntarily, once inside, no amount of insisting that she was okay or ready to leave would result in her freedom. Descriptions of how well she felt would be disregarded while the opinions of nurses and doctors took precedent, overriding her own experience of herself. Thinking with Nellie Bly’s 1887 expose, *Ten Days in a Mad-House*, Wang writes, “as Bly’s anecdotes, and my own, indicate, a primary feature of the experience of staying in a psychiatric hospital is that you will not be believed about anything. A corollary to

¹⁸⁹ Email to author, December 7, 2020

¹⁹⁰ Bergman and Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times*, 70.

¹⁹¹ Esmé Weijun Wang, *The Collected Schizophrenias: Essays* (Minneapolis, Minnesota: Graywolf Press, 2019), 39.

this feature: things will be believed about you that are not at all true.”¹⁹² Once pathologized and/or institutionalized, those in positions of authority control the narrative about what you say and do; they gain control of your experiences of yourself. The story told about you becomes the only story and there is little that you, as the pathologized one, can do to rectify this narrative.

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Things went from bad to worse, from annoying to intolerable, from troubling to terrorizing. In the moment, I just wanted to finish my research and was fighting tooth and nail to make that possible. As I struggled to push forward in spite of the escalating conflict, my supervisor employed what became a months long campaign of gaslighting: he asked me to train a postdoc and undergrad while telling others I was depressed and unsafe;¹⁹³ he questioned my requests for basic supplies while expressing excitement in the possibilities of my results;¹⁹⁴ he informed me that my progress was unsatisfactory while submitting recommendation letters for fellowships and awards.¹⁹⁵ As the months wore on, examples only accumulated. Many are hidden behind the veil of mediation-based confidentiality, and while I cannot share those specific examples, I will say that there are outright lies in those documents that I never had the opportunity to counter. Other examples can be openly shared but are so convoluted, would require so much unpacking and back story, that I have yet to find a way to adequately address them. Many only make sense to those of us who lived it, to whom his actions are transparently disrespectful but opaque to those who do not know his patterns, have not worked in this

192. Ibid. 98.

193. FOI, January 4, 2021

194. Email to the author, January 11, 2021

195. Email to the author, January 6, 2011

subordinate position with him for years. And of course, I would not know these narratives existed if I had not filed a FOI request and reviewed the results a year and a half later. The narrative had already been living its best life, one built on lies, without my participation, for nearly two years by then.

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In addition to the impacts on the individual labelled disordered or diseased, there are larger consequences to pathology as oppressive tool. Being able to express, name, and acknowledge negative affects are an important part of collectivity and community. Many scholars in queer affect theory have developed concepts of negative affect that are powerful; Sara Ahmed's feminist killjoy, Lauren Berlant's cruel optimism, Heather Love's feeling backward, and Cvetkovich's political depression to name a few. Leanne Betasamosake Simpson in an interview with Nick Montgomery and carla bergman said, "we are encouraged to suppress responses that are not deemed palatable or respectable to settler society. But the correct emotional response to violence targeting our families is rage."¹⁹⁶ Cvetkovich and Michalski write that, "to name bad feelings as a way of also producing collectivity and survival remains pertinent,"¹⁹⁷ and Alison Kafer writes "in refusing to acknowledge pain, fatigue, or depression, 'our collective ability to conceive of, and achieve, a world which does not disable is diminished.'"¹⁹⁸ For better or worse, negative affect can bring people together, and the simple reality is that negative affects are part of life as a thinking feeling human. Especially as a

196. Bergman and Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times*, 57-8.

197. Ann Cvetkovich and Karin Michalski, "The Alphabet of Feeling Bad Now," *Re/Imagining Depression: Creative Approaches to "Feeling Bad"* (2021), 14.

198. Kafer, *Feminist, Queer, Crip*, 8.

thinking feeling human living under Empire with senses open to the many injustices wrought under capitalism, colonialism, and patriarchy. As Kafer says, we cannot imagine and therefore move towards a world that does not disable if we cannot name all the parts of disability. Living fully with all the parts of ourselves requires seeing, acknowledging, and talking about negative affects. Jack Halberstam takes it a step further with his preface to Fred Moten and Steven Harney's *The Undercommons*. Halberstam writes:

We cannot be satisfied with the recognition and acknowledgement generated by the very system that denies a) that anything was ever broken and b) that we deserved to be the broken part; so we refuse to ask for recognition and instead we want to take apart, dismantle, tear down the structure that, right now, limits our ability to find each other, to see beyond it and to access the places that we know lie outside its walls.¹⁹⁹

Recognition and acknowledgement alone are not enough; not when that recognition comes from the institution itself, the seats of power themselves. Those seats, the institution, the tools of oppression, must be taken apart, the system itself refused because we do not deserve to be the broken part.

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For a long time this is what I wanted; a public apology as a form of recognition and acknowledgement of his harmful actions and their adverse impacts on my life. Part of me still wants that—some form of atonement for the months and years of humiliation, for the lost mentors, colleagues, and friends, for the foreclosure of a world of opportunities that I was so close to grasping—but I try to feed the part of me that does not need an apology as much as I can. I have been warned that even if I received an apology (and I have been explicitly told I

199. Halberstam, "The Wild Beyond: With and for the Undercommons," 4.

never will), it will not feel as good as I want, it will not heal the wound. Moving forward is something I must do for myself; I can't build a new foundation on acknowledgement from him or the institution. I am not the broken part, even if I felt that way for a very long time, even if I sometimes still do. A foundation built on their recognition is no foundation at all because it is the institution that is broken. Trauma begets trauma: only a deeply hurt person would be able to wall off so many parts of themselves from each other, be able to maintain so much cognitive dissonance, a lifetime of intricately constructed defences to avoid confronting oneself and one's own pain.

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More on refusal to come, but a moment of caution before we continue. There is real danger in the marginalized leaning into negative affect. Without access to power and privilege on some axis, the labels “diseased” and “disordered” loom. Opening up about pain, fatigue, depression, and trauma, risks the wielding of the tool of pathology against the already marginalized body. But there is also the risk of the performance of trauma and suffering as white pedagogy, as Saidiya Hartman put it. Robin Maynard and Leanne Simpson discuss this trap in *Rehearsals for Living*. Thinking with Hartman, they write, “the tentacles of racial capitalism do not get to demand hope or optimism, or celebrate rage and pessimism, or consume our trauma and tragedy, or transform me into ‘uplift’—what Saidiya Hartman calls ‘a translation of Black suffering into white pedagogy.’”²⁰⁰ White supremacy has the power to twist any affect from a Black body into white pedagogy; hope and optimism become a boot-strap story, rage and pessimism evidence for pathology, trauma and tragedy are character building, transformation

200. Maynard and Simpson, *Rehearsals for Living*, 257.

into strength and resilience, a salve for guilt. Tajja Isen writes with clarity about both the consumption of trauma stories from the marginalized and power's response to demands for change in *Some of My Best Friends*. When it comes to demands for change, those in power either overreact to “threats” made by “terrorists,” or they brush off legitimate concerns as they might brush a freshly fallen snowflake from a shoulder. “These two positions represent the rough historical trajectory of political responses to the demand: from overreading it as a credible threat to writing it off as the whingeing of coddled minds.”²⁰¹ Those in power, bent on maintaining the status quo, can only hear one of two binary extremes in the demand: the rabid activist desire to burn everything to the ground or the feeble-minded imbecile that can be assuaged with a pat on the head. The academy is not immune to these responses—Black suffering as white pedagogy, demand as a form of terrorism, and demand as a snowflake to be ignored—including one Ruha Benjamin identifies in the overuse of the word “diversity” in industry and the academy. Benjamin writes in *Race After Technology*; “here racialized fixes often come wrapped in the language of diversity—celebrated as a self-evident good, a recognition of one’s individuality or identity, touted on university websites and employee trainings, a cheery antidote for those suffering from racial queasiness.”²⁰² Suffering from racial queasiness? Have a demand you’d like to make? Well, we’ve got a rebrand you’re going to love: diversity! Look! They look just like you... *we* look just like you... *we* are you. Doesn’t that make you feel good, ya snowflake?

201. Isen, *Some of My Best Friends: Essays on Lip Service*, 150.

202. Ruha Benjamin, *Race after Technology: Abolitionist Tools for the New Jim Code* (Cambridge, UK; Medford, MA: Polity Press, 2019), 148.

Nothing feels better than a pat on the back from a white able-bodied straight cis-man for being something other than a white able-bodied straight cis-man.

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Trauma begets trauma and white innocence protects white men from seeing their own reflection. Cathy Park Hong writes:

Innocence is both a privilege and a cognitive handicap, a sheltered unknowingness that, once protracted into adulthood, hardens into entitlement. Innocence is not just sexual deflection but a deflection of one's position in the socioeconomic hierarchy, based on the confidence that one is 'unmarked' and 'free to be you and me.' The ironic results of this innocence, writes the scholar Charles Mills, is that whites are 'unable to understand the world that they themselves have made.'"²⁰³

Imagine each time you are confronted by your own reflection, whether a distorted funhouse mirror, an optically clear mirror, a selfie pointed phone camera, or the faint reflection of self in a glass window, you have to engage in mental gymnastics to actively avoid sight, to avoid vision, to avoid seeing your self. It sounds exhausting. This incredible line from Aisha Sabatini Sloan rings true to me so often these days in the disaster of global democracies; "is it just me, or have White men just screamed themselves awake into a murder mystery of their own making?"²⁰⁴ You did this to yourself, you know that, right? The amount of untangling, of dedicated, exhausting, time-consuming, deeply reflective work that would be required for a genuine apology would be years of therapy in the making. To break through the white supremacist-based innocence you've been protected by for your entire life to develop a deep understanding of your own traumas and how you project those traumas out onto the world around you? That would be a lot. So, you

203. Hong, *Minor Feelings: An Asian American Reckoning*, 74-5.

204. Sloan, *Borealis*, 45.

know what? I will still hope for that never-going-to-happen apology. But I hope for it for your sake, not mine.

Chapter 3: Demand

After critique, after dissecting some common academic and scientific cultural norms and practices, we turn towards what is next, we demand better, we demand new. We now have a little more understanding of the history, the genealogy, of our ways of thinking and doing, and the ways that history continues to haunt us. With framings that help us see the workings of oppression and domination at both the personal and systemic levels, how capital and capitalism infiltrates the work and commoditizes outputs, how personal and systemic problems are silenced, pathologized, and “institutionalized,” we have identified a host of specific ways our academic scientific knowledge production impacts itself and its practitioners for the worse. Now what? How do we take what we have learned so far and imagine otherwise? How do we build new and other ways of thinking, working, and being that are able to continue to make meaningful contributions to the work of understanding our world without these harmful side effects?

Here, in Chapter 3: Demand, we will begin the work of building anew and demanding other. Those in power are often scared of activists who wish to “burn it all down” not only because of the loss of their power but because they are projecting their own idea of what starting over would mean. Perhaps they imagine a simple role-reversal, where they are the ones being exploited, abused, “made kill-able,” for the sake of our power and benefit. This is, after all, the foundation of their power so it is not surprising that this is how they imagine building anew occurring. What they often misunderstand is that we are aiming for something much more radical. We are imagining a world where no one is “made kill-able,” where no one is exploited for someone else’s benefit. As Jack Halberstam puts it beautifully in “The Wild Beyond,” “our goal... is not to end the troubles but to end the world that created those particular troubles as the

ones that must be opposed.”²⁰⁵ We are not simply trying to stop oppression, we are trying to build an entirely new world that does not run on oppression in the first place. Or perhaps they do understand, and this is exactly what they are afraid of.

In any case, deconstructing things as they are, systems by design (for oppression), was our first step towards reconstructing something new in its place. We actively refuse what came before, what we are struggling to survive now, through many means including sabotage and subversion. We will also look at some dichotomies or binaries to think through how we might complicate them, work in-between them, or eliminate them altogether, for the sake of resistance and hope. And we will work towards building ourselves a foundation of relations, in community with one another, a network or tensegrity that is flexible, shifting, and capable of movement and growth rather than a stable, fixed, static, and determinate foundation.

3.1 Refusal

“The path to the wild beyond is paved with refusal.”²⁰⁶

~ Jack Halberstam

Academia ignoring or disappearing that which it does not wish to address requires active refusal for minoritarian subjects that wish to participate in scholarly knowledge-production. One task of this thesis has been to document some of the ways in which these tactics operate to the

205. Halberstam, "The Wild Beyond: With and for the Undercommons," 5-6.

206. Ibid. 5.

detriment of both its practitioners and knowledge-production itself. “Divide and conquer” has long been a colonial strategy ensuring that “others” cannot fully understand themselves, cannot find one another across discipline divided campuses, cannot gather in mass, cannot engage in collective critique, cannot demand change as a community. Queer theorist José Esteban Muñoz writes in *Cruising Utopia* of the “cleansing” of Times Square of homosexual gatherings and the necessity of documenting the loss of gathering spaces. Muñoz writes:

We crucially need to map our repression, our fragmentation, and our alienation—the ways in which the state does not permit us to say ‘the whole’ of our masses. It is also important to practice a criticism that enables us to cut through the institutional and legislative barriers that outlaw contact relations and obscure glimpses of the whole.²⁰⁷

Documentation, gathering evidence and ephemera, developing queer archives is one way to map oppressions, but how else might we cut through barriers constructed and enforced by the State to find one another and understand who we are as a whole? As Muñoz continues, “the state understands the need to keep us from knowing ourselves, knowing our masses,”²⁰⁸ and this includes the Academy as an institution that operates as a state in miniature, with its own policies, enforcement, and moral economies to sustain. The Academy is also entrusted with higher education and thus teaches the next generation tactics and strategies for maintaining or dismantling hegemony. Acts of documenting and mapping can be understood as a means of refusal: refusing the invisibilizing, the pathologizing, and the normative whiteness veiled as “professionalism” that the academy enacts to make us, its problems, disappear.

207. José Esteban Muñoz, *Cruising Utopia: The Then and There of Queer Futurity*, 1 ed. (New York: New York University Press, 2009), 55.

208. *Ibid.* 64.

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Once I was fully out of the lab and no longer engaged in scientific work, people began to find me. Though the number of folks who knew what happened were very few and none of them knew all the gory details, enough people knew that I had unwillingly left a lab to send others in precarious positions to me. I would receive cold emails from graduate students in difficult positions, experiencing academic abuse or bullying, wrestling with supervisors who mismanaged them and their work, or directly stole work and credit from them. I always met with anyone brave enough to reach out to a stranger. Not all kept in touch or let me know the outcome of their situations, but each shared harrowing stories of walking the knife's edge with psychologically manipulative supervisors, watching peers soar and not understanding why it was only them that was drowning. Each described the pros and cons of the hard decisions in front of them, whether they should stay or go and how to get through in either case. These meetings had an air of the subversive to them—they felt illicit, like we should be meeting in disguise in a back alley—as if it was somehow wrong to witness one another's fear and pain while in the belly of the beast. I'm glad we were able to overcome this, that we met in the bright sunlight of campus coffee shop patios, in full view of any that might pass by. Our presence should be felt, our gatherings should be visible, our ability to find one another in spite of the confidentiality, the silencing, the attempts to make us disappear, should be celebrated. Empowered by the sunshine, we mapped our repressions, compared the ways we had been fragmented, and refused the alienation that was the end goal of the humiliation and shame piled onto us. While we never acted out as a collective, we became a small community that would not be divided or conquered.

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For many minoritarian subjects in the Academy, refusal can be accidental or simply the side-effect of efforts to survive. Sometimes, the presence of a body that the institution does not want to see is all it takes to provoke discomfort, to be a type of refusal. As Cathy Park Hong writes in *Minor Feelings*:

Most white Americans live in segregated environments... As a result, any proximity to minorities... sparks intolerable discomfort. Suddenly Americans feel self-conscious of their white identity and this self-consciousness misleads them into thinking their identity is under *threat*. In feeling wrong, they feel *wronged*. In being asked to be made aware of racial oppression, they feel oppressed.²⁰⁹

Sometimes, being present is enough to provoke retribution. Creating the conditions to live and work comfortably can be an act of refusal when the institution would narrow labour conditions to the bare minimum. UBC Graduate Research Assistants' (GRA) current fight for unionization is an example of an effort to modify labour conditions being refused by the institution, which has created a situation we often refer to as "Schrodinger's graduate student." The institution will call graduate researchers "students" when it benefits them—to exploit GRA labour, refuse a living wage, or work benefits—or "workers" when it benefits them—to make demands on GRA time or require GRAs meet specific standards. Anti-union faculty insist that this is just part of the process—it has always been this way—GRAs are in training and so should pay for that training, not the other way around. This ignores that on-the-job training is standard in just about every industry. Faculty also often argue that demanding more or better harms knowledge production as supervisors would no longer be able to afford student salaries, ending the productive progress of their research programs. GRAs working under anti-union faculty often have to keep their

209. Hong, *Minor Feelings: An Asian American Reckoning*, 88.

opinions on such matters to themselves at the risk of experiencing retribution for taking a pro-union stance.

Sara Ahmed thinks with the term “nonreproductive labour,” as in “you refuse to adjust to what is unjust.”²¹⁰ It is often easiest to play along, tailoring your own perspective and actions to accommodate the unjust situation, which ultimately reproduces the problem. To avoid replication, you must refuse to play along, which is itself a form of labour; nonreproductive labour. Sometimes the unjust takes the form of the denial of something, a refusal by the institution; to provide resources or support, to believe reports, to create disciplinary mechanisms, to enforce policies, or adjust/create new ones, and so on. Refusing the unjust then becomes a double refusal; a refusal of the institution’s refusal. Jack Halberstam writes at length about this type of refusal in “The Wild Beyond.” Halberstam writes, “if we begin anywhere, we begin with the right to refuse what has been refused to you... When we refuse... we create dissonance and more importantly, we allow dissonance to continue... we refuse order as the distinction between noise and music, chatter and knowledge, pain and truth.”²¹¹ Halberstam argues that Fred Moten and Stefano Harney, by way of Frantz Fanon, believe Blackness “is the willingness to be in the space that has been abandoned by colonialism, by rule, by order.”²¹² And the way we get there is through refusal. Halberstam continues, “we must, on behalf of this alignment, refuse that which was first refused to us and in this refusal reshape desire, reorient hope, reimagine possibility and

210. Ahmed, *Complaint!*, 163.

211. Halberstam, "The Wild Beyond: With and for the Undercommons," 5.

212. *Ibid.* 5.

do so separate from the fantasies nestled into rights and respectability.”²¹³ After all, rights and respectability are often unevenly applied; a privilege for a few.

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I couldn't tell you exactly when my own transition from playing along to refusal occurred. These things are often gradual, sneaky, a whispering thought or feeling at the back of your mind that gets shelved in favour of what's right in front of you. But those whispers accumulate, increase in mass, crescendo, or they are brought to the fore when someone explicitly tells you what's going on and you choose to listen. I am reminded of many initially reluctant, now-prominent, race scholars who describe ignorance of the effects of racism in their lives and what it took for them to “wake up.” Professor of sociology and Africana studies Crystal Fleming, in *How to be Less Stupid About Race*, describes it quite bluntly as “I had no fucking idea that we in the United States live in a racist (and sexist and classist) society until I was a full-grown adult.”²¹⁴ And this is no accident. As she later writes, “racial stupidity has become routinized and is the result of intentional actions of European colonists and enslavers who sought to justify their capitalist exploitation of non-Europeans through the myth of white supremacy.”²¹⁵ Science, of course, is not only affected by white supremacy, it helped create and support it through “scientific racism.” Yet sometimes, even when you know the facts on paper, it takes something catastrophic for you to connect those abstract ideas to your personal experiences. Once my eyes and ears were opened, those sneaky whispers suddenly sounded very different: uncomfortable

213. Ibid. 7.

214. Crystal Marie Fleming, *How to Be Less Stupid About Race: On Racism, White Supremacy, and the Racial Divide* (Boston, Massachusetts: Beacon Press, 2018), 6.

215. Ibid. 11.

early experiences looked a lot more like red flags I ignored; moments of surprise or distraction became keys that unlocked hidden meanings; things that felt like an itchy irritation were recognized as my body's alarm bell alerting me to an aggressor. Everything became unsettled as I struggled to put the pieces together, filtering each one through this new lens. And when some critical mass of pieces fit and I pulled the lens into focus, that wad of wispy thoughts and feelings was revealed to be an inner core of rage I didn't realize I was carrying with me all this time.



Figure 7: *Layering a scream.* On the left, a scream painted onto a fabric dyed lab book page with medium for depth. In the middle, the same scream after additional layers of paint and medium have been assembled on top. On the right, a still from the animation: in other words, the same scream plus layers as they are revealed through sanding, photographing, and assembling into video.

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However, as discussed earlier, even the smallest refusals, including the accidental ones, can be interpreted as a threat. Montgomery and bergman, purposefully taking up military language in their thinking about refusing Empire, write, “thought begins from cramped spaces where one is hemmed in by the forces of subjection. It is not an act of individual will but a

scream that interrupts unbearable forces, opening space for more active combat.”²¹⁶ Even without combative language, refusal often results in a flip wherein the target refusing to be bullied becomes the bully. Sarah Schulman writes at length about this flip in *Conflict is not abuse*, and in an interview with Ezra Klein, summarizes how this reversal occurs. She says, “that happens often, that when you refuse to accept an unjust situation and you resist it, you’re then repositioned as the negative force or the threat. The trend is for perpetrators to present themselves as victims. And conversely, people who resist injustice are then blamed because they create discomfort.”²¹⁷ Those who would refuse an injustice become a threat, a bully for refusing to play along, refusing to take a hit, refusing to accept their position in the margins. And while there may be official channels for reporting an injustice, all too often reported complaints come with the mediation-based tactic of not taking sides and not assigning blame. As Ahmed writes in *Complaint!*, “the refusal to take sides by treating bullying as a side of an argument that needs to be heard is to side with the bully.”²¹⁸ Bullying is not two conflicting narratives, not two different perspectives on the same situation or incident; bullying is the abuse and mistreatment, acts and words that intimidate or harass, of someone vulnerable by someone with power. Power and privilege matter in the naming of bullying. The colonial hierarchy of bodies and minds that persist in academia, the pyramidal or funnel shape of scientific knowledge production, the complicated ways in which power and privilege are entangled with these hierarchies, matter greatly in identifying bullying. In the end, the system, the institution, will always protect itself

216. Bergman and Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times*, 63.

217. Times, “Transcript: Ezra Klein Interviews Sarah Schulman,” June 22, 2021.

218. Ahmed, *Complaint!*, 212.

over and above any individual(s) entangled within. The individual that is easiest to remove, regardless of what role they played as perpetrator or target, will be the one that is forced out. Much of the time, that is the minoritarian body or the body with the least access to power and privilege, the precarious body.

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We see this flip of the bully occurring at every level; between individuals, between groups or collectives, between nation states. Schulman explores this at length with examples from each level in *Conflict is not abuse*, but I wonder about Science as an institution making use of this strategy and I certainly have interpersonal examples. At the individual level, there is what I have been calling the “conflict” between myself and my supervisor, though when privilege and power are accounted for, our “conflict” would more accurately be labelled “bullying.” The few times I chose to speak up about what was happening in the moment—through a public Twitter account, at a UBC EIO led forum on anti-Asian racism after the March 2021 shootings at Korean owned salons in Atlanta, and through my private at the time Instagram account—were touted as evidence of me bullying my supervisor and ultimately used to oust me from my supervisor’s AUP.²¹⁹ While I never named him in a public forum and therefore his conjecture that all my comments were about him is projection,²²⁰ his continued reliance upon them throughout our altercation points to a gross misunderstanding of power, privilege, and the role they play in understanding and identifying bullying. While he expressed that “I have at no point in the

219. FOI March 29 and 31, 2021 and April 5, 2021

220. Except for a private Instagram story that was live for 2 hours in which I *did* name him out of frustration after learning that he had reduced my salary without notifying me. This incident occurred two months after I was removed from the AUP and his citation of my social media as evidence of my bullying. FOI June 19, 2021

process felt particularly powerful,”²²¹ the structures of the institution made and make him powerful regardless of his feelings. He was able to: weaponize my EDI work against me without providing any evidence that “if [my] efforts to change our department are not satisfactory to [me] than [I] might take extreme action;”²²² pathologize me even after a colleague replied that I did “not represent any sort of imminent threat” and that I was not “in a crisis;”²²³ continuously imply that I was a safety concern without providing any evidence and while simultaneously asking me to train a postdoc and an undergraduate assistant in lab protocols;²²⁴ remove me from the AUP citing animal morbidity even as my own birds were assessed to be in good condition by the university vet and while I was not only still responsible for animal care but training others in animal care protocols;²²⁵ reduce my salary without telling me;²²⁶ completely bypass a negotiation process over data use, authorship, and IP by drafting his own Memorandum of Understanding (MOU) that didn’t address any of my clearly stated concerns;²²⁷ refuse to accept and respect my thesis committee’s decisions without providing justification;²²⁸ and remove himself as my supervisor without evidence or explanation, immediately erasing me from his lab website, and removing all connections between us on the department’s website.²²⁹ The absolute lack of requirement for evidence at each and every single one of these steps still astounds me to this day.

221. FOI April 18, 2021

222. FOI Dec 3, 2020

223. FOI Dec 3-4, 2020

224. FOI Jan 4, 2021

225. FOI Feb 17, 2021, March 29, 2021, March 31, 2021, April 8, 2021

226. FOI May 7, 2021

227. FOI June 14, 25, 2021, July 26, 27, 2021 and August 1, 2021

228. FOI Jan 17, 2021

229. FOI Jan 27, 2021

How could I not fight against each of these incidents, meeting with institutional units, reading and reviewing relevant university policies, trying to find a way to halt or slow the barrage of actions taken against me? Even the head of the department at the time spent a weekend searching for a policy requiring proof of ongoing wrongdoing or misconduct to remove someone from an AUP and could not locate any evidentiary requirements. Similarly, there was nothing that required him to justify his inability to sign off on my thesis committee's decisions, nothing that required negotiation over data use, authorship, or IP even as VPRI had assured me it would be a negotiation and both VPRI and GPS weighed in on my MOU draft, no requirement of documented justification for the change in supervisors, and nothing that required that he warn me of my salary reduction in advance.²³⁰ The policies were written to protect him, not me. This is what institutional power and privilege looks like; how they are enacted irrespective of how an individual feels about it.

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In the face of this power and privilege, many fold. It is easier to set aside parts of ourselves, compartmentalize the things a hegemonic system does not want to see or hear and tuck them away out of sight. It is easier to break ourselves apart, to fragment the whole of our masses, than to stand up against the institution. As Ahmed writes:

The violence directed against you by somebody is a violence that leaves a trace upon you whether that trace is visible or not. And: there is a system which creates him, supports

230. I found out a month and a half after the reduction occurred while reviewing my bank statements. My FOI revealed that he asked our graduate coordinator to inform me of the change 7 days after it had already gone into effect. The request was embedded within a string of other requests and they, unfortunately, forgot to tell me. FOI, May 7, 2021

him, and gives him a sense that he has a right to do what he does. To challenge him is to challenge a system.²³¹

You may think your refusal or resistance is directed at an individual, but any refusal is against the entire system since the system supports him.²³² And yet many choose to resist despite the system and its power. Many refuse to break themselves into pieces or cannot set aside the part(s) of themselves the institution does not want to see because it is written on their bodies. Ahmed has termed “coercive diversity” for the ways in which the Academy will use a visibly minoritized body when it suits it and cast it aside when it does not. She explains with the story of a complainant: “coercive diversity for how the university wanted to make use of her body and her research as evidence of its diversity while undermining her work as a colleague, as an early career academic, as a human being.”²³³ Not everyone has the privilege of tucking away that which the academy does not wish to see. So, the challenge becomes one of transmuting the academy’s refusal of you into a resource. Maggie Nelson, writing anecdotally of an incident with a stalker in *The Argonauts*, think/feels with those she gathers around herself as chosen ancestors. She writes, “the many-gendered mothers of the heart say: *Just because you have enemies does*

231. Sara Ahmed, "Selfcare as Warfare," *Feminist killjoys* 25 (2014).

232. I was advised to meet with a human rights lawyer to discuss pursuing a complaint with the British Columbia Human Rights Tribunal. In a pro-bono consultation, I was informed that if I were to file a complaint, while it might be against an individual, because he is employed at UBC and this would be an employment-based complaint, UBC would also be a respondent and so I would be up against UBC’s lawyers. His lawyers would be UBC’s lawyers. Again, institutional power protecting itself and its own—him in this case—against me. I also learned of yet another Shrodinger’s GRA situation: would I be a student making a claim about discrimination in education, or a worker making a claim about discrimination in the workplace? Different laws would apply in each instance.

233. Ahmed, *Complaint!*, 157.

not mean you have to be paranoid... There is nothing you can throw at me that I cannot metabolize, no thing impervious to my alchemy.”²³⁴ How to alchemize the paranoia, the fear of the enemy into something else? Muñoz thinking with Shoshona Felman’s theory of radical negativity, a version of the double negation or double refusal discussed above, quotes Felman, “radical negativity (or saying ‘no’) belongs neither to negation, nor to opposition nor to correction (‘normalization’), nor to contradiction (of positive and negative, normal and abnormal, ‘serious’ and ‘unserious,’ ‘clarity’ and ‘obscurity’).”²³⁵ He continues, “radical negativity, like the negation of negation, offers us a mode of understanding negativity that is starkly different from the version of the negative proposed by the queer anti-relationist. Here the negative becomes the resource for a certain mode of queer utopianism.”²³⁶ Radical negativity becomes a tool with which one might metabolize fear, refusal, and harm into a resource to be utilized for Halberstam’s reshaping of desire, reorientation of hope, and reimagining of possibility that itself refuses colonial recursions.

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I’d like to take a moment to rewrite the previous anecdote in a slightly different way. The initial version above was written as a series of claims linked to evidence, the expected form that an academic argument takes, but what gets to count as evidence and therefore who gets to make a claim matter enormously. Having filed a FOI request at the recommendation of a human rights advisor from UBC’s EIO, I have documents that are able to produce a certain type of evidence

234. Nelson, *The Argonauts*, 122-123.

235. Muñoz, *Cruising Utopia: The Then and There of Queer Futurity*, 13.

236. *Ibid.* 13.

and therefore substantiate a particular type of claim. One that the institution could, in theory, hear if it were filed as an official complaint. However, there is another story within this anecdote that the institution and individuals within it refuse to hear or acknowledge. It is the story of saying one thing and doing another, a story of long-term gaslighting that easily fooled colleagues who only listened at a surface level, who did not want to open their eyes, initially leaving my peers and I unheard, unbelieving, and fighting an uphill battle alone. The best I could do throughout was maintain the conviction that I *did not* do anything wrong, despite everything that was happening around me, despite what he was allowed to do and say, despite how the institution supported his unsubstantiated claims. All I could do was remind myself that sure, I had made mistakes in my time, but nothing that warranted the level of action taken against me.

Here are some things that I cannot or will not back up with formal documentation outside of the FOI or my own emails. Many of these originate in stories and conversations shared orally or in text form but that I will not quote or cite in order to protect the writers of those texts, the speakers of those stories. They are some of the additional bits of evidence and ephemera that might emerge during an investigation, were a complaint to be filed. The first evidence in the FOI of a shift in his perception of me occurs with a full paragraph about how deeply invested in EDI topics I was and his willingness to support those efforts, next to a fear that I might “elevate [my] efforts to a level that [he] cannot predict.”²³⁷ Simultaneous to our conflict—which he himself claims in that first email has something to do with EDI—I was awarded a Faculty of Science Service Award specifically for my EDI work, two days before I was asked to defend myself against a claim of “unsatisfactory progress” in a committee meeting. There is also an email

237. FOI Dec 3, 2020

completely out of the blue to a faculty colleague with whom I have no working relationship that simultaneously informs them of our problems—just two days after he has informed me of our problems—and offers to discuss more about it with them.²³⁸ This faculty colleague was also the chair of the ACC at the time, the very same person that would be called upon four months later to remove me from my supervisor’s AUP. After the first week of our conflict, after meeting with every lab member one-on-one to discuss potential personnel conflicts,²³⁹ he emailed the lab, “in light of recent events...,”—without stating what “events” he was referring to—“I have been working on a draft of the guidelines for trainee-supervisor relationships in the lab.”²⁴⁰ He will open our first and last meeting we both attended about the conflict by stating that he supports many options in terms of how I might finish my research, three out of four of which included maintaining some version of our supervisor-trainee relationship, insisting that his priority was what was best for me,²⁴¹ but he removed three out of the four options from the list within less

238. FOI Dec 5, 2020

239. And during which every lab member expressed to me a fear that he was going to fire them. Reports from peers indicate that he was blaming the women of the lab for creating a toxic atmosphere, informing them that he would lose grants and no longer be able to pay students if the graduate advisors decided there was a problem in the lab, effectively ending his research program. I had a distinct sense at the time that I was being framed as the ringleader—would become a scapegoat—because I had tried to speak up about problems in the department in the past. I stated this concern both to an advocate in the EIO and to our head of department at the time.

240. Email to the author, December 11, 2020. Attendees reported that every potential problem was framed as the trainee's fault or as additional work for the trainee with no mechanism for holding the supervisor accountable if they did not uphold their end of the stated expectations. Trainees were also told during the meeting that if they had a ‘hard problem’ with the document, they could find another supervisor. When one trainee tried to push back at a few moments, they were later told by a postdoc that our supervisor implied that I had put them up to the task of speaking out and that they were acting as my agent in the subversion of his authority during the meeting. I had not even opened, much less read, the supervisor-trainee document at the time.

241. FOI Dec 9, 2020

than a month. A few weeks later, the majority of which is holiday break, he decided to propose an unsatisfactory progress report in my upcoming committee meeting, which is the first step of several in the process to formally remove a student from the lab, department, and graduate program.²⁴² When the committee disagrees and states that the work is satisfactory, my departmental supporters are hopeful that this will be a positive reality check for him, but instead he immediately pursues finding a new supervisor for me.²⁴³ In preparing to propose unsatisfactory progress, he stated “given that you would need to be complete with data collection by July 1 if you wish to write up and defend your dissertation by the end of 2021, then I believe that completing the chapters you and [co-supervisor] discussed would serve this purpose,”²⁴⁴ even as he claimed in a funding progress report in November that he was “not convinced” that I would be able to defend by December 2021.²⁴⁵ He would continue to insist upon June 30th as my last day in the lab through regular questions about my expected completion time line and then request the end of my key card access before June 30th.²⁴⁶ In discussing what to do with a co-op student I had just hired who would start in the lab in a couple weeks, he replied that he is

242. FOI Dec 30, 2020

243. FOI Dec 30, 2020, Jan 8, 2021, Jan 17, 2021. Simultaneously, I receive a call from our mediator that it is unlikely that we will move forward with mediation. In trying to understand how and why, the grad advisor informs me that my supervisor has requested that I cease work in the lab until we have reestablished trust, linking an objective outcome—me no longer in the lab—to a subjective measure entirely dependent on his feelings—whether or not he trusts me. When asked if I would be open to a new supervisor, I respond that a new supervisor would not solve the problem if he does not trust me with protocols, but it appears to be the only path forward, so we take it. As expected, he will continue to express concerns with his responsibilities for lab and animal safety until he successfully ousts me from the AUP.

244. Email to the author, Jan 7, 2021

245. FOI Nov 12, 2020

246. FOI June 18, 2020

“certainly excited to see what you two will find,”²⁴⁷ but later cited my use of a large number of animals as problematic, even as he approved every single animal experiment according to reports submitted by me each week at his request.²⁴⁸ Requests for cheap and basic lab supplies that would typically be cleared without question now required extensive justification and a discussion in front of the whole lab. One purchase I requested, a cheap set of wires for electrophysiology that could be purchased on Amazon, was passed along to a lab mate who didn’t do neuroscience, was on vacation in the States, and so was unable to complete the order in a timely manner rather than allowing me to complete the order myself.²⁴⁹ He announced my change of supervisors the day after the paperwork was signed to my lab colleagues in a two sentence email stating that “nothing else has changed,” as if changing supervisors is a routine occurrence.²⁵⁰ When he decided to pursue my removal from the AUP, he cited the lack of information in my weekly reports as an ongoing concern, however, not once had he ever stated this problem to me, or requested more or other information.²⁵¹ He also cited increased morbidity amongst the birds, which was absolutely true, but as stated earlier, none of my birds were the ill ones and he easily could have looked at lab records to see which birds I was using and if any of mine were sick. He either did not take the time to see if my birds were the sick ones, or did not care, using the illness of other animals to imply that I was not taking care of my own birds or that my experiments were negatively impacting their health.²⁵² He also used my presence on our lab use calendar, a

247. Email to the author, Dec 18, 2020

248 FOI March 31, 2021

249. Email to the author, Jan 11, 2021

250. FOI Jan 28, 2021

251. FOI March 29, 2021, March 31, 2021

252. FOI March 29, 2021, March 31, 2021,

symptom of working during the COVID-19 pandemic, to imply that I may have been conducting experiments without approval, even as he knew that half of my in-lab days were spent processing tissues for microscopy, not working with live animals.²⁵³ He uses my breakdown, as reported to him by other attendees, during an anti-Asian racism event after the Atlanta shootings in 2021 as one piece of justification for my removal from the AUP, additionally citing a tweet from me that had nothing to do with him—again, his conjecture is only projection.²⁵⁴ He cited salary supplements for childcare, a family friendly office, and the freedom from producing results²⁵⁵ as evidence of his support for me in opposition to my view of him as a bully, as if both cannot be true at the same time.²⁵⁶ He goes on to make use of the Faculty Association for support, composing a request to the head of department for clarification regarding his 1) fulfilling his responsibilities to his lab, 2) “ongoing commitments to financially support” me, 3) requests for assistance deemed as escalations that “chastised [him] for requesting help,” and 4) my “ongoing complaints on twitter and in a recent public forum.”²⁵⁷ He will use my tweets to suggest we “delay or cease working on a negotiated IP/publication agreement,”²⁵⁸ and then my ill-timed—admittedly stupid and angry—call out in a private Instagram story to halt that process,²⁵⁹ file a bullying report against me that he withdraws the next day,²⁶⁰ and request the revoking of my key

253. FOI March 31, 2021, April 5, 2021

254. FOI April 5, 2021

255. Even as he asked me regularly during leave if I had looked at the data.

256. FOI April 18, 2021

257. FOI April 28, 2021

258. FOI June 14, 2021

259. FOI June 19, 2021. My account was private at the time so how he acquired a screenshot of the story is still an unsolved mystery.

260. FOI June 19, 2021

card access earlier than our originally agreed upon June 30th deadline.²⁶¹ When we do finally resume work on the MOU in which we “negotiate” how to manage our shared data, authorship, and IP he completely ignores my carefully outlined concerns, many of which I took up from VPRI’s example and with the encouragement of GPS and our head of department.²⁶² Instead, he writes a one paragraph statement and then states, “I do not anticipate any additional changes.”²⁶³ The emeritus professor who was tasked with acting as mediator during the MOU process does not push for acknowledgement of my requests, only states in a private email to my supervisor that his version “does not address several of her other concerns. Where she goes with those remains to be seen but this may not be the end of things.”²⁶⁴ None of the other faculty CCed in this process say anything.

3.2 Sabotage and Subversion

For those who choose to stay within the academy, how might we use radical negativity and refusal for not only survival but for thriving? In “ $1 \text{ (Life)} \div 0 \text{ (Blackness)} = \infty - \infty$ or ∞ / ∞ ,” philosopher Denise Ferreira da Silva insists that critique is not enough because it still exists within the hegemonic framework, within a discourse bounded by colonialism. For her, critique and contradiction run the risk of reproducing “the violence housed in knowledge and in the scene

261. FOI June 18, 2021

262. Though they will later state that “her note to you does betray some confusion on her part about standards and rules.” FOI, July 27, 2021

263. FOI July 26, 2021

264. FOI August 1, 2021

of value,”²⁶⁵ as it continues its arguments within the limited framing of a system defined by whiteness. Composing an equation of Blackness “as a nullification of the whole signifying order that sustains value in both its economic and ethical scenes,”²⁶⁶ Ferreira da Silva works to develop a philosophical logic that is entirely outside of colonial forms and origins. “The crux of this exercise is to provide an account of opposition that figures nullification instead of contradiction. This is crucial for distinguishing a radical engagement from a critical one—because the latter cannot but assume the Kantian forms when it seeks to expose their conditions of possibility.”²⁶⁷ Ferreira da Silva’s work is “a radical praxis of refusal to contain blackness in the dialectical form,”²⁶⁸ a powerful methodology for philosophizing within the academy but outside of canonical philosophical arguments and values. She concludes the paper with this powerful descriptive summary: “A guide to thinking, a method for study and unbounded sociality—blackness as *matter* signals &, another world: namely, that which exists without time and out of space, in the plenum.”²⁶⁹ Ferreira da Silva provides an example of the subversive intellectual as described by Moten and Harney in *The Undercommons*; thinking and studying within the institution but working to remain outside of its value system(s). Tajja Isen, thinking with *The Undercommons* in *Some of my Best Friends*, writes, “to be ‘in but not of’ the place, to use their phrasing, to be present within it but an outlaw from its value system. To steal what you need in

265. Ferreira da Silva, “1 (Life) ÷ 0 (Blackness) = ∞ – ∞ or ∞/∞: On Matter Beyond the Equation of Value. *E-Flux*, 79 (February),” 9.

266. *Ibid.* 9.

267. *Ibid.* 9.

268. *Ibid.* 9.

269. *Ibid.* 10. Emphasis hers.

order to build a kind of freedom.”²⁷⁰ Ferreira da Silva’s philosophy is one that refuses to be in dialog with the canon, with Kant, with the logic and values of the discipline; it is undisciplined and could be marked as unprofessional, uncollegial, irrational, disloyal. And yet Ferreira da Silva persists and creates entirely new forms, develops new methodologies with foundations in the Black radical tradition of Fanon, Robinson, Spillers, Hartman, and Moten. Hers is an example of the kind of radical creation Robin Maynard and Leanne Simpson discuss in *Rehearsals for Living*: “it is never enough to just critique the system and name our oppression. We also have to create the alternative, on the ground and in real time.”²⁷¹ Ferreira da Silva knows critique is not enough—she is able to work towards setting critique and argument aside—instead focusing on building something entirely different, with a radical foundation, from the ground up.

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How might I take my experiences of working in a neuroscience laboratory and “figure nullification instead of contradiction” as a means of radical engagement with the material reality (materiality?) of that work? What could this mean, what form might it take, when applied to laboratory produced data, when applied to the practices of scientific knowledge production? I have outlined a few common critiques of science and academia, but what would it look like to follow Ferreira da Silva’s example and go one step further, leaving canonical arguments and values behind? And might this go so far as to include leaving now-canonical STS arguments behind as well? What does my version of stealing what I need, being present but as an outlaw, “in order to build a kind of freedom” look and feel like?

270. Isen, *Some of My Best Friends: Essays on Lip Service*, 136.

271. Maynard and Simpson, *Rehearsals for Living*, 36.



Figure 8. *Neon pour.* A neon pour painting over fabric dyed lab book confetti and previous layers of objects, paint, and medium.

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Choosing to remain within or to work from outside, to resign or to stay, is not always a clear delineation and sometimes the choice is made for us. As Ahmed notes in *Complaint!*, “there is no point in resigning in silence if you are resigning to protest silence,”²⁷² yet sometimes we do it anyways. Complaints, resistance, refusal, have a way of following you. Jasbir Puar, writes in *Terrorist Assemblages* that. “contradictions and discrepancies... are not to be reconciled or synthesized but held together in tension. They are less a sign of wavering intellectual commitment than symptoms of the political impossibility to be on one side or the other.”²⁷³ Oftentimes the messy middle is where we must be to do the work of ending the old world and building anew. As Brian Larkin writes of Nigerian pirate media, “once in place, infrastructures generate possibilities for their own corruption and parasitism,”²⁷⁴ but parasitism and corruption require some level of engagement with the system; access to a host or an infrastructure/institution. One cannot be a parasite without maintaining relations with a host. Jarrett Martineau and Eric Ritskes put it well in *Fugitive Indigeneity*: “this means the task of decolonial artists, scholars and activists is not simply to offer amendments or edits to the current world, but to display the mutual sacrifice and relationality needed to sabotage colonial systems of thought and power for the purpose of liberatory alternatives.”²⁷⁵ For Martineau and Ritskes,

272. Ahmed, *Complaint!*, 97.

273. Jasbir K. Puar, *Terrorist Assemblages: Homonationalism in Queer Times*, Second;1; ed. (Durham: Duke University Press, 2017), 209.

274. Brian Larkin, "7 Degraded Images, Distorted Sounds: Nigerian Video and the Infrastructure of Piracy," in *Signal and Noise: Media, Infrastructure, and Urban Culture in Nigeria* (Duke University Press, 2008), 289.

275. Jarrett Martineau and Eric Ritskes, "Fugitive Indigeneity: Reclaiming the Terrain of Decolonial Struggle through Indigenous Art," *Decolonization: Indigeneity, Education & Society* 3, no. 1 (2014), II.

sacrifice and relationality are necessary components for the sabotage of systems. In some cases resignation might be required, in others, stealing, parasitizing, and corrupting might be required. Working outside of the system of values might require working in-between, finding cracks and opening them wider, forcing the creation of space where there was none before.

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For me, finding myself in a crack has meant that this tactic of working in the in-between, inhabiting the in-between, has been my primary methodology and space for moving forward or through: stealing from the various disciplines what I can, parasitizing that which is useful to me, discarding or refusing that which is not. I have arguably corrupted certain elements—statistics, analysis, results, methodologies—in an effort to cobble together this Frankenstein’s monster of a thesis. Think/feeling my way through with cultural theorists, artists, writers, and scientists at my side, working “for the insertion of voices and practices into the academic every day that work to trouble disciplinary relays of knowledge/power, allowing for more creative, sensually attuned modes of inhabiting the university as a vibrant location of pedagogical mattering.”²⁷⁶ My hope is to not only muddle my way through—unlearning harmful frameworks, picking up and setting down new lenses, tearing down and rebuilding my relationship with my own work and work practices—but to also offer examples that hold contradictions in tension, that nullify the most egregious harms, that refuse to reproduce patriarchal colonial white supremacist practices, and that celebrate the everyday birth and thriving of new worlds, new systems, new ways of being.

With this limited critique of the past coming to a close—my past in a neuroscience laboratory, my almost-past in a PhD program—I look forward now to a few key themes that

276. Loveless, *How to Make Art at the End of the World: A Manifesto for Research-Creation*, 3.

underlie the work that is to come. A consideration of the origins of the theory/practice divide and a turn towards “praxis” as something that does not draw a line between the two but instead acknowledges the always already entanglement of practice and theory. A look at a handful of other concepts that are often framed as binaries, but that perhaps cannot be so clearly divided like subject vs. object, internal vs. external. We will continue to ruminate on refusal and resistance as grounded in hope and the role of aesthetics and the arts in maintaining this resistant hope throughout the remainder of this thesis. And we will continue to build on this idea of relationality—a thinking/feeling “we”—and the possibility of reclaiming scientific and academic practices through and with relationality and reflexivity as our foundation.

3.3 Theory and Practice

One of many entanglements encountered in the effort to understand scientific objectivity is its relationship to theory and practice, a perhaps false dichotomy that is often used to “police what gets to count as a valid object and method, within which disciplinary framework, where, when, and how,”²⁷⁷ and for whom. For bell hooks, academic theory separated from lived experience was historically used to elevate one voice at the expense of others, rather than understanding theory and practice as an “ultimately reciprocal process wherein one enables the other.”²⁷⁸ hooks states that “when our lived experience of theorizing is fundamentally linked to

277. Ibid. 70.

278. hooks, *Teaching to Transgress: Education as the Practice of Freedom*, 61.

processes of self-recovery, of collective liberation, no gap exists between theory and practice.”²⁷⁹

Angela Davis, following hooks’ line of thought, recently wrote that “the productive tension of holding onto a radical, real, and deep vision while engaging in the messy daily practice is the feminist praxis: the work of everyday people to try, to build, to make.”²⁸⁰ Leanne Simpson expands her definition of theory to include Indigenous worldviews inclusive of families, communities, and generations:

’Theory’ is generated and regenerated continually through embodied practice and within each family, community, and generation of people. Theory isn’t just an intellectual pursuit. It is woven within kinetics, spiritual presence, and emotion. It is contextual and relational. It is intimate and personal with individuals themselves holding the responsibilities for finding and generating meaning within their own lives.²⁸¹

What exactly is theory? It is used in so many different ways depending on context, sometimes to distinguish “theorists” from “practitioners,” as if these are two unrelated ways of working and being. Looking at Merriam-Webster’s definitions, its use ranges as far as an accepted “general principle” that explains phenomena or an ideal, to a conjecture or assumption, to an abstract thought or principle. If we think carefully about each of these and the relations between them, the use of the term “theory” can get quite convoluted and confusing. Is it a scientifically accepted principle or is it speculation? The way science is often presented—as something backed by empirically produced evidence and data acquired through “objective” methodologies—a scientific principle seems at odds with mere conjecture or speculation. Does it explain real world

279. Ibid. 61.

280. Angela Y Davis et al., *Abolition. Feminism. Now*, vol. 2 (Haymarket Books, 2022).

281. Leanne Betasamosake Simpson, *As We Have Always Done: Indigenous Freedom through Radical Resistance* (U of Minnesota Press, 2017), 151.

phenomena or is it an abstraction? “Objectively” produced and universally applicable Science often argues that its results are not abstract at all but quite concrete and relevant on the ground. In the other fields of inquiry this thesis intersects with—philosophy, cultural theory, art—“theory” is more often used in the sense of general or abstract principles or thoughts or the analysis of relations. Academics in the arts and humanities often create theory by deconstructing ideologies in an effort to develop meaning or understanding with respect to human cultural and social phenomena. Both types of theory, the scientific or humanistic, become contested when we consider the origins of our contemporary use of “theory” as Euro-centric, masculinist, and colonial. Thus, many feminist and postcolonial theorists work to complicate definitions of theory and methodologies of theoretical production by acknowledging the role of practice in knowledge production and/or de-centering “theory” and emphasizing “practice” or “praxis.”

But how do these ideas interface with scientific theory and practice and what are the implications of that interaction? One starting point could be the data itself. In *Data Feminism*, D’Ignazio and Klein state that “the process of converting life experience into data always necessarily entails a reduction of that experience,”²⁸² and while they may be referring to sociological or anthropological data, we have already touched on reductionism and some of its implications in the life sciences. The biosciences are often tasked with converting organismal experiences—floral, faunal, fungal—into quantifiable data points; what is being lost and remains unacknowledged in that reductive process? Steven Epstein provides a clear example of what can happen when bioscientific practitioners are forced to acknowledge, listen to, and work with and

282. Catherine D’Ignazio and Lauren F. Klein, *Data Feminism* (Cambridge: MIT Libraries Experimental Collections Fund, 2020), 11.

for the communities they claim to serve. As he describes it, “in the alternative conception that develops out of activist critiques, reliable knowledge is produced through close attention to the concrete social, moral, and political context: better sciences come about *because of* the focus on individual patients and their needs, desires, and expectations.”²⁸³ Earlier Epstein writes, “AIDS activists’ efforts belie the commonplace notion that only the insulation of science from ‘external’ pressures guarantees the production of secure and trustworthy knowledge.”²⁸⁴ By abandoning the search for universal solutions based on objective criteria and instead listening to the individual needs of patients who are the experts of their own experience, scientists and doctors working during the AIDS epidemic were able to shift their emphasis to “the *local* and *contextual* character of usable scientific knowledge.”²⁸⁵ Epstein’s case study is a glimpse of what is possible when the biosciences move past simplistic definitions of objectivity aligned with scientific experts on one side and patients with subjective experience on the other. Divisions of theory from practice, objective scientists from subjective patients, the universal from the local only “divide, separate, exclude, keep at a distance... silence, censor, and devalue,”²⁸⁶ ignoring “individual[ly] generated meaning [as] an authentic and grounded power.”²⁸⁷ The biosciences could learn something from the “radical Black feminist methodology of scaffolding the intimate and the personal within the global.”²⁸⁸ This could result in not only better scientific practices, but

283. Epstein, *Impure Science: Aids, Activism, and the Politics of Knowledge*, 342, emphasis his.

284. Ibid. 337.

285. Ibid. 342, emphasis his.

286. hooks, *Teaching to Transgress: Education as the Practice of Freedom*, 65.

287. Simpson, *As We Have Always Done: Indigenous Freedom through Radical Resistance*, 157.

288. Maynard and Simpson, *Rehearsals for Living*, 33.

also increased maintenance, care, and repair for its practitioners and greater benefits for those Science claims to serve.

“Theory” can have multiple meanings within science, as it often does in other fields. One sense—theoretical physics vs. experimental physics for example—juxtaposes the abstract and the material. Theory in this context is usually formless, working in a world of equations and ideas that might instrumentalize experiments—the physical—to confirm or refute a particular theoretical principle. It is often reflective of a mind/body dualism which tries to separate one from the other, minimizing entanglement between the two. There is also the “theory” that requires the accumulation of many findings, confirmed hypotheses, refuted null hypotheses and so on to arrive at a conclusion that is generally agreed upon by the majority of the scientific community; the theory of evolution for example, or germ theory. Both of these meanings rely on evidence, an accumulation of “facts,” experimental and theoretical “proof,” in order to make a claim to authority. Relying on the ideologies of objectivity and universality, to repeat the bell hooks quote from above, scientific practices “divide, separate, exclude, keep at a distance,” in the development of an authoritative voice. And as she states, “because this theory continues to be used to silence, censor, and devalue various feminist theoretical voices, we cannot simply ignore it.”²⁸⁹ The professionalized sciences are housed in labs, academies, and research institutes beyond the reach of the public and those who might wish to participate in or observe scientific knowledge-production. The theoretical and experimental sciences both adhere to social orders: “between inventors and implementors, between centers of innovation and peripheries of consumption, between those who make progress and those who follow,” a set of “neocolonial

289. hooks, *Teaching to Transgress: Education as the Practice of Freedom*, 65.

geographies of center and periphery' [that] builds on older geographies of modernity and modernization, developing and developed, extracting and extracted."²⁹⁰ While much of the day-to-day realities of scientific knowledge production might be thoroughly engaged in “praxis”—a blending of theory and practice—the entirety of that praxis is guarded, only to be accessed by those deemed worthy of a position amongst the scientific ranks, even as there may be some examples, like Epstein’s study of the AIDS crisis, of the scientific community listening to those outside of its walls. While cultural theorists may discuss divisions of theory and practice as perpetuating elitism, when the practice of science is bounded by professionalized institutions and its theory held behind journal pay walls, neither the theory nor the practice of science is within reach for those that might wish to engage.

Within the scientific community, there is also a division between theory and practice in the hierarchy of the academic scientific knowledge-production system. “Primary investigators,” the faculty leaders of labs, are often the managers of ideas, the “brain” that decides what questions to pursue, and when, how, and who will pursue them.²⁹¹ From there, control over the ideas trickles down to research assistants (RAs), postdoctoral fellows, PhD students, MSc students, and undergraduates, each level having less input and control over the ideas and each level tasked with more of the execution—the practice—than the previous. This hierarchy is typically pyramidal in shape, with a single PI at the top and increasing numbers of researchers as

290. Lilly C. Irani and M. Six Silberman, "Stories We Tell About Labor: Turkopticon and the Trouble with "Design"," in *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (San Jose, California, USA: Association for Computing Machinery, 2016).

291. There is, of course, a hierarchy depending on where faculty are in the tenure process, with early career researchers spending more time at the lab bench than their colleagues who have achieved tenure and therefore spend more time in the office.

we progress down the hierarchy, with the cheap (or free) labour of students reflected in a high number of student researchers relative to postdoctoral fellows or RAs. Student labour executes most of the day-to-day tasks in the lab, reflecting a division of labour from ideas and theory from practice, with those at the top having more access to ideas and theory and those at the bottom saddled with more of the labour and practice. As one progresses upwards through the ranks, one gains access to more theoretical control and less material labour, so even as theory and practice might be intermingled in the scientific community overall, there are still hierarchies—the hierarchy within a single lab being one example—in which theory remains at the top and practice at the bottom, “a sort of cultural division of labour” as José Esteban Muñoz might say. The labour structure of scientific knowledge-production separates theory from practice, elevating one—associated with the mind, abstraction, and freedom²⁹²—over the other—associated with the body, materiality, and labour.

292. For example the “academic freedom” that protects a faculty position.



Figure 9. *Glove*. A lab book layer created by filling a nitrile glove used in the laboratory with paint and adhering it to a lab book page. The next page of the book, dyed with fabric dye, was then layered on top of the glove with more paint and medium applied.

In this thesis, I hope to work entirely outside of the academic science system, to refuse its structure top to bottom and avoid reproducing any part of either the theory/practice divide or the siloing of knowledge-creation within an ivory tower. While this text is largely academic, though the anecdotes and inclusion of other forms aims to undermine the canonical scholarly approach, the dissertation as a whole includes other forms of knowledge production like video and physical sculptural objects, and other forms of dissemination like exhibitions. If nothing else, every aspect of this thesis is a praxis, an entanglement of theory and practice such that even as I write and create and think, I struggle to distinguish between the two, to determine where one might apply vs. another. The text is a practice as much as the art is a theory and vice versa. The text in the next chapter around the creation of the artwork and its relationship to theory or theorizing were developed simultaneous to the act of creating the works—one did not come before the other. I did not intuitively create an artwork and then find or develop theories to support it, nor did I conceptualize the piece in advance and then simply execute. The act of creation—materializing intellectual embodied moves—is and was completely entangled with the act of “theorizing.” In this thesis, art-making is a form of think/feeling; I am think/feeling through art-making. To quote Muñoz, I am “attempting to imagine a convergence between artistic production and critical praxis... a utopian act in relation to the alienation that often separates theory from practice.”²⁹³ And this “utopian act” occurs at the intersections of scientific practice, cultural theory, and embodied art-making, each affecting the other in a way that is impossible for me to fully disentangle.

293. Muñoz, *Cruising Utopia: The Then and There of Queer Futurity*, 101.

3.4 Subject and Object

“Lowell has decided to be tried as an animal. The nonhuman kind. ...I’m unclear on the definition of person the courts have been using. Something that sieves out dolphins but lets corporations slide on through.”²⁹⁴

~ Karen Joy Fowler

Who gets to be a “subject”—a citizen subject, a sentient subject, an authorial subject—who is allowed to be a “who” instead of a “what,” is also at stake in this thesis. Subjecthood in the modern Western world is reserved for the privileged; the cis-het white able-bodied human man with high socioeconomic status. Black, Indigenous, immigrant, trans, queer, poor, disabled, women, femmes, and the non-human are relegated to objecthood, subjected to the male gaze and its possession, violence, fear, and trauma. The subject/object divide can be linked to the Cartesian system discussed previously; the division of parts from wholes and the reductionist hierarchy where atomistic elements determine the behaviour of higher order systems in a simple summative manoeuvre. Lewontin and Levins close *The Dialectical Biologist* with a set of “dialectical principles” to summarize their arguments about the Cartesian system and its negative effects on scientific knowledge-production. One of their primary arguments is that parts and wholes are interpenetrated; you cannot study them in isolation from one another. They write, “the interpenetration of parts and wholes is a consequence of the interchangeability of subject and object, of cause and effect.”²⁹⁵ “Subject” and “object” are human constructions that while

294. Karen Joy Fowler, *We Are All Completely Beside Ourselves*. (London: Serpent's Tail, 2014), 305.

295. Levins and Lewontin, *The Dialectical Biologist*, 274.

beneficial for communication at times, do not reflect how bodies and relations function. All the ways in which we conceptualize an object vs. a subject, and the impact of that conceptualization on other ideas like cause and effect, must be recognized as human abstractions, not an order or principle inherent to physical phenomena. For Levins and Lewontin, the category or assignation of subject or object is dependent on the context; what is the question being asked? At what level of organization is the location of the question? The role of subject or object can shift and change depending on the question and protocol, sometimes even within the same experiment if there is a shift in methodology or analysis.

In *Before the Law*, Cary Wolfe thinks with Vinciane Despret's "The Body We Care For" about this complication of subject and object. In the paper, Despret analyses several examples in which those studying a zoological phenomena misinterpreted their observations due to an inability to understand their objects of study as subjects capable of influencing their observers. When practitioners open themselves up to the possibility of being moved, new opportunities and relations are created that enable a different type of understanding. Despret writes:

If we follow carefully how some of these scientists create access to the creatures they study, the way they are moved by their subjects of interest, the way they give them a chance to be interesting and to articulate other things, we notice that the signs that define subject and object, what talks and what is talked about, subjectivity and objectivity, are redistributed in a new manner.²⁹⁶

Wolfe summarizes Despret's findings, stating that Despret theorizes "a complex loop of interactions between institutional, biological, affective, and other factors that literally brings

296. Vinciane Despret, "The Body We Care For: Figures of Anthro-Zoo-Genesis," *Body & society* 10, no. 2-3 (2004), 128.

forth a new reality in and through the bodies and practices in interaction—a recursive loop, in other words, between the ‘who’ and the ‘what.’”²⁹⁷ As scientific practice ignores institutional and affective influence on their objects of study in the name of objectivity or neutrality, discrepancies from expected results occur and rationalizations or analytical tools are used to explain away or eliminate those discrepancies. Instead, practitioners could learn to recognize and acknowledge the “complex loop of interactions” and consciously account for them in their studies or better yet, follow those leads in new directions. Methodologies might be developed to study the loop itself, to develop a more nuanced understanding of the role of the subject, the “who,” and the object, the “what,” and the interplay between them.²⁹⁸

Speculative fiction author Ursula K. LeGuin has written many stories granting subjecthood to animals in the laboratory. In *Buffalo Gals*, Le Guin writes of these stories:

So the real presence of an animal in a laboratory—that is, an animal perceived by the experimenting scientist not as an object, nor as a subject in the sense of the word ‘subject of the experiment’ (as in Nazi experiments in pain on human ‘subjects’), but as a subject in the philosophical/grammatical sense of a sentient existence of the same order as the scientist’s existence—so such presence and perception in a laboratory where experiments are performed upon animals would profoundly change the nature, and probably the results, of the experiments.²⁹⁹

297. Wolfe, *Before the Law: Humans and Other Animals in a Biopolitical Frame*, 68.

298. We might even argue that Despret’s analysis in “The Body We Care For” is able to “read against the grain,” understanding the experiments she studies in an entirely new light that runs counter to their original intention. This recalls Larissa Lai’s understanding of Guyatri Spivak: “However, because history tends to be produced by hegemonic subjects—policemen, soldiers, bureaucrats, journalists, academics—the only way the subaltern can access her own history is through what Spivak calls ‘reading against the grain,’ that is, reading official documents for the truths that might emerge in their gaps, counter to their intended purpose and thus counter to their overt framing.” Lai, *Slanting I, Imagining We: Asian Canadian Literary Production in the 1980s and 1990s*, 14.

299. Ursula K. Le Guin, *Buffalo Gals and Other Animal Presences*, ed. Margaret Chodos-Irvine (Santa Barbara: Capra Press, 1987), 157.

Le Guin is arguing that elevating non-human animals used in the laboratory to an existence as privileged as the scientist's would not only change how experiments are designed and executed, but would likely change the results. As I will argue in a later chapter of this thesis, Science's inability to recognize the "humanity" of its experimental "objects"—to treat them as beings capable of their own versions of affect, intelligence, and morality—greatly reduces what Science can learn about those organisms and about itself. Non-human animals are reduced to objects in the lab, a thing to be manipulated and ultimately sacrificed with relative disregard for their subjecthood. They are "made killable" to use Donna Haraway's characterization, through distancing and purposeful anti-relations.



Figure 10. *Lavender and Sage*. For each terminal experiment documented in the lab books, a ritual was performed involving burned lavender and/or sage, locally harvested on UBC's Vancouver campus and while traveling in British Columbia.

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For marginalized human bodies, the privilege of subjecthood is often denied or revoked, complicating the position of the marginalized scientist hoping to occupy the seat of “objective” practitioner with distanced relations from the object(s) of study. The critical distance required by academia and Scientific knowledge-production might be difficult to maintain if the structures and systems around the practitioner would close that distance by positioning the marginalized practitioner as closer to the objects of study than the humans executing the study. Avery Gordon, thinking with Charles Mills’ analysis of Du Bois’s double consciousness writes:

Double consciousness is a sociological imagination, in the most profound sense in which Mills deployed the term. It is an imagination bound to a dialectics of shadows and acts, approaching our gravest social problems from the ‘second sight’ of ‘being’ the problem itself and thereby confounding, in that very moment, the boundary between subject and object.³⁰⁰

First conceptualized in 1903 in *The Souls of Black Folks*, Du Bois’s double consciousness speaks to the experience of Black people in America, forced to juggle the discrepancy between a sense of self and how that self is perceived under white supremacy’s oppressive power. In it Du Bois writes:

It is a peculiar sensation, this double-consciousness, this sense of always looking at one’s self through the eyes of others, of measuring one’s soul by the tape of a world that looks on in amused contempt and pity. One ever feels his two-ness,—an American, a Negro; two souls, two thoughts, two unreconciled strivings...³⁰¹

300. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 211.

301. W. E. B. Du Bois et al., *The Souls of Black Folk*, 100th Anniversary ed., Taylor, Francis (London, [England]; New York, New York: Routledge, 2016), 2.

Scientific knowledge-production, with its origins in Euro-centric Christian thought, is the measuring stick, one of the tools quite literally used to divide humanity into races, developing a hierarchy that could justify racial oppression and produce double-consciousness in marginalized bodies. Science not only played a powerful role in justifications of slavery and racism, it has executed experiments on the bodies of those it deemed “killable;” Black, Indigenous, disabled, and queer bodies to name a few.³⁰² How does one hold this truth in one hand and participate in scientific knowledge-production with the other, especially if those hands belong to a marginalized body? The boundary between subject and object is crossed, both in the make-up of the bodies and where they stand in the experimental apparatus, and in trying to work from the position of being the “problem itself.” How does one differentiate between an internal self and the external positions, relations, and perceptions against which one is measured? How does one reconcile an internal “two-ness” with the external projection of a single story onto one’s body? And how does all of this fit into the apparatus of the Scientific experiment?

One set of proposed answers to these questions is the “specific” intellectual as opposed to the “universal” one, an intellectual that is aware of their position, is situated, and works from this

302. See Tuskegee experiments: “40 Years of Human Experimentation in America: The Tuskegee Study,” Office for Science and Society, n.d., <https://www.mcgill.ca/oss/article/history/40-years-human-experimentation-america-tuskegee-study>; malnutrition on Indigenous children: “The Dark History of Canada’s Food Guide: How Experiments on Indigenous Children Shaped Nutrition Policy | CBC Radio,” CBC, April 19, 2021, <https://www.cbc.ca/radio/unreserved/how-food-in-canada-is-tied-to-land-language-community-and-colonization-1.5989764/the-dark-history-of-canada-s-food-guide-how-experiments-on-indigenous-children-shaped-nutrition-policy-1.5989785>; Nazi experiments: Paul Weindling et al., “The Victims of Unethical Human Experiments and Coerced Research under National Socialism,” *Endeavour (New series)* 40, no. 1 (2016), and so on.

self-aware position rather than from an “objective” one. As Beatriz da Costa writes in *Tactical Biopolitics*:

Unlike the ‘universal’ intellectual, whose duty was to serve as ‘the consciousness/conscience of us all’ and whose primary task was to fulfil this mission through the written word, distanced and removed from the people who were identified as the supposed beneficiaries of such discourses, the ‘specific’ intellectual emerged out of a group of people that was originally not given the status of intellectuals at all.³⁰³

Forget distance and a universal view, a view from nowhere, let’s get particular, partial, provisional even. Natalie Loveless, thinking with the Hans Holbein painting *The Ambassadors* and its use of anamorphosis,³⁰⁴ writes, “*comprehension in the one precludes comprehension in the other*. There is no point from which all can be seen. There is only partiality. In Haraway’s terms: no *God trick*, only *situatedness*.”³⁰⁵ Loveless may be thinking with painting rather than scientific knowledge-production, but the point is relevant; no one person, no matter how educated or practiced in ‘objective’ protocols or equipped with ‘objective’ tools, can claim a universal “view from nowhere,” nor can an institution composed of only one type of person enacting one type of work. Any view—composed of light input to the sensory system or culturally produced by a specific position in relation to the sociopolitical environment—is partial, is dependent on a location in time and space, is emergent from a provisional body and

303. Da Costa, "Reaching the Limit," 366.

304. Anamorphosis is a purposeful distortion placed in an artwork that requires the viewer occupy a specific position or use a special device like a lens or mirror, for the image to resolve and become recognizable. In *The Ambassadors*, an anamorphic skull is positioned such that the viewer can only see the skull from an acute angle, at which point they lose the ability to see the primary image of the painting.

305. Loveless, *How to Make Art at the End of the World: A Manifesto for Research-Creation*, 85.

mind. Nell Irving Painter, lauded historian of race, writes of her transition to art-making in her memoir *Old in Art School*. Thinking back on this time of change when she found herself wrestling with the role of art in her archival practices and history in her artistic ones, she writes, “I was already less interested in generalities and representativeness. I was already going deeper into particularities, even where conventional historical sources failed.”³⁰⁶ Art-making became a way for Painter to study particularities, made space for different ways of thinking and doing with the historical archives she spent most of her career studying through a practice founded in close reading and writing. Developing methods that acknowledge the specificity of working in a distinct time and place, from within a specific body, while letting go of subject/object, internal/external, mind/body divides might be one way to practice scientific knowledge-production from within a marginalized body.

3.5 Resistance and Hope

As Painter grew into her art practice and developed her own methodologies for integrating her work in the archives with art-making, art opened up new ways of thinking, new forms of production, new materially based means of ruminating on and representing her thoughts and ideas. After years of struggle with the biases of academic art education and the Art World,³⁰⁷

306. Nell Painter, *Old in Art School* (Berkeley, CA: Counterpoint, 2018), 307.

307. This is borrowing Painter’s use of capital “Art World,” similar to my capitalization of “Academia” and Haraway’s capital “Science” to refer specifically to the modern Western Euro-centric “Art World,” which continues to dominate decisions around what is or isn’t considered art and who is or isn’t allowed access to artwork and art-making. Biases of an academic art education and the Art World touched upon in *Old in Art School* include racism,

Painter eventually formed a practice that fully merged her work as an academic historian with her drawing and painting, finding not only new ideas and new ways to express and share those ideas, but also a new audience that was receptive to the work that emerged from this practice. Even as Painter's formal art education sidelined her for being too concerned with Blackness, Painter resisted and persisted. As John Berger writes in *Hold Everything Dear*, "we live in a world... whose events do not confirm our Being, a world that has to be resisted. It is in this situation that the aesthetic moment offers hope."³⁰⁸ Painter's example of resistance and persistence offer hope; that while the struggle within the academy is real, there is hope in resistance, hope in emergence, hope in finding a way through despite those that would deny our way of working, our way of being. Art can communicate and refuse, resist in ways other forms cannot. Art can not only imagine, but through the act of material creation art can manifest other worlds, other futures, other pasts and presents. McDonald & Hollenbach write in their introduction to *Re/Imagining Depression* of the "unique abilities of visual and performance art to communicate gestures, expressions, and refusals which language cannot speak."³⁰⁹ Natalie Loveless writes, "'how might the world be organized differently?' is a question that matters urgently, and it is a question that art asks in generative and complex ways."³¹⁰ This thesis captures the development of an art practice as methodology, as a way of analysing and processing data, without distance or sacrifice of elements that do not fit scientific expectations.

sexism, ageism, and ableism, just to name a few. The Art World is no more immune to the prejudices of the culture in which it exists and from which it originated than any other field of inquiry under capitalist white supremacy.

308. John Berger, *Hold Everything Dear: Dispatches on Survival and Resistance* (New York; London: Verso, 2007), 59.

309. Hollenbach and McDonald, *Re/Imagining Depression: Creative Approaches to "Feeling Bad,"* 8.

310. Loveless, *How to Make Art at the End of the World: A Manifesto for Research-Creation*, 16.

This thesis shows—by doing, by creating, by manifesting—another way of working and being, a refusal and a hope for a more expansive scientific practice.

Science and art are often placed at odds with one another despite the famous “Renaissance men” Michelangelo and da Vinci who practiced art and science simultaneously. As modern Western scientific practices formed, scientists began to define themselves in opposition to artists and a wealth of associations with one versus the other began to take shape. Lorraine Daston in *The Moral Economy of Science* describes the origin of one such contrast; individualism and fame seeking artist as opposed to the ascetic, self-effacing scientist. Daston writes:

Scientists paid homage to the ideal of aperspectival objectivity by contrasting the individualism of the artist with the self-effacing cooperation of scientists, who no longer came in the singular... there was a certain nobility in the abandonment of the personal, a sacrifice of the self for the collective... the self-control and detachment required of scientists by aperspectival objectivity was strenuous: scientists must not only wait to be recognized for their efforts; they must give up recognition altogether.³¹¹

Regardless of whether aperspectival objectivity is achievable or desirable, the story it tells about science and scientists is and was powerful, continuing to impact how practitioners think and talk about themselves and their work. It allows Science to tell itself and the public that Science functions thanks to scientists’ ability to abandon the personal and the self—one must set those aside to achieve objectivity—without acknowledging the underlying politics driving much scientific work, as we have already discussed at length. On the other hand, while many artists are driven by individual goals, activist artists have always already pushed the bounds of what counts

311. Ibid. 16.

as art and who it is for through collective actions and community building, upending the science/artist contrast as the self-sacrificing scientist versus the individualist artist.



Figure 11. *Mama*. A layer painted onto a lab book page, responding both to the date in the lab book indicating the day George Floyd was murdered by police and to my own child's first word.

There are many other art/science contrasts we could list, for example, artist Beatriz da Costa and collaborators wrote that the term “research” and all the things associated with the actions of research are reserved for scientists. Thinking through their project, *PigeonBlog*, which collaborated with pigeons to gather data on air quality conditions for the general public, they wrote, “‘researcher’ seemed to imply ‘scientist’ in many people’s minds, rather than ‘creative,’ ‘social’ or ‘artistic’ researcher.”³¹² This association often means both that scientists are denied creativity, sociality, and activism while artists are denied access to labs, technology, and materials they might require for research- or science-based work. Increasingly, artists can serve as “interdisciplinary experts” and in Canada, practitioners can propose research-creation projects for SSHRC funding in an effort to make space for research-based art practices, or for “Research and Creation” grants from the Canada Council for the Arts (CCA) for creative research.³¹³ However, one of the most common and prevalent art/science dichotomies is the designation of art as subjective and science as objective. As we continue to explore this dichotomy throughout this thesis, we will return to the ways in which science is not always objective and art is not always subjective, the ways in which this story largely serves as a prop for scientific authority over and above other forms of knowledge production, other ways of thinking, being, and doing. This thesis works to break apart these art/science contrasts, to find ways to work through and

312. Beatriz Da Costa, Cina Hazegh, and Kevin Ponto, "Interspecies Coproduction in the Pursuit of Resistant Action," *Retrieved March 29* (2017).

313. There is a concern among artists that research-creation instrumentalizes art for profitability in the neoliberal academy, especially in support of PhD programs in studio art where an MFA was previously considered the terminal degree for artists.

with differences between fields without reinforcing disciplinary bounds, hierarchies, and authorities.

My way forward and through has been to free myself, my data, and my methodologies from the disciplinary and historical restrictions placed on scientific and artistic work in the academy. Every step of the way has been driven by resistance and persistence, a refusal to accept the world as it is and instead to pursue a different way in collaboration with all the writers, artists, activists, scholars, and thinkers referenced throughout these pages. Ruha Benjamin concludes *Race After Technology* with recommendations for resistance and imagination as methodologies towards emancipatory ends and I have returned to her often throughout this process to remind myself of where joy lies and how to pursue it. Benjamin writes, “an emancipatory approach to technology entails an appreciation for the aesthetic dimensions of resisting the New Jim Code and a commitment to coupling our critique with creative alternatives that bring to life liberating and joyful ways of living in and organizing our world.”³¹⁴ Similarly, Isabelle Stengers speaks of the need for creative alternatives in *Another Science is Possible*, stating, “our pragmatic and empirical concern would then require cultivating, together with those we trust, an informed art of disloyalty, the art of discreetly dismantling academic habits, of confusing the gaze of the inquisitors, of regenerating ways of honouring whatever it is that makes us think and feel and imagine.”³¹⁵ I hope that the work presented here does all of these things; cultivates an art of disloyalty, an art of dismantling, an art of confusing inquisitors, and of

314. Benjamin, *Race after Technology: Abolitionist Tools for the New Jim Code*, 197.

315. Stengers, *Another Science Is Possible: A Manifesto for Slow Science*, 131-132.

honouring my own thinking and feeling imagination side-by-side with everyone I think and work with.

One last note on this imagining, this daydreaming, of another way of working and being, this resistant hope. I think part of why many turn to art as the means to imagine as opposed to other fields is precisely its generative and generous capacity. Setting aside Art World biases for a moment, art practices can be anything and can take just about any shape or form. The field feels limitless even though there are always those who would try to define and enclose it. When enacted outside of capitalist profit and commercialism, it can be an open space for exploring process over product, material joy without materialism, for performing with a deeply embedded body, for practicing rituals that allow for reinvention, heterogeneity, reflection. This provisional space is what is required to imagine outside of that which one has been conscripted to, to explore borders, shadows, edges, and cracks. With the addition of self-reflexivity on the place of this provisional space within the sociopolitical frame,³¹⁶ the potential for change grows. I think of José Esteban Muñoz and Saidiya Hartman's writing on refusal and the aesthetic. Muñoz writes, "a queer aesthetic can potentially function like a great refusal because art manifests itself in such a way that the political imagination can spark new ways of perceiving and acting on a reality that is itself potentially changeable."³¹⁷ Thinking with Ernst Bloch, Muñoz continues, "[Bloch] values daydreaming and sees it doing the work of imagining another life, another time, another

316. I read this as the "informed" component that Stengers refers to in the previous quote when she writes of "an informed art of disloyalty." We must be aware of what exactly it is we are being disloyal to, to what end, and for whom. Disloyalty for its own sake is not enough. After the dismantling we will not know how to build anew and we risk reproduction if we are not clear about what we are resisting and why.

317. Muñoz, *Cruising Utopia: The Then and There of Queer Futurity*, 135.

place—a version of heaven on earth that is not simply denial or distraction but a communicative and collective mode of transport.”³¹⁸ Art can provide the provisional space necessary for daydreaming, for igniting the spark, for gathering community and transporting. In *Ordinary Notes*, Christina Sharpe creates a glossary of Blackness in community with other Black writers, thinkers, activists, and artists. The entry on refusal, written by Saidiya Hartman, reads:

Refusal is the shorthand for what can’t be named within the conceptual field of the enclosure. It expresses our unwillingness to be conscripted to man’s project or world. *It is easier to index than to describe*. All of the gestures bent on eluding the imposed terms of order and value—the me and the mine, the propertied earth. The vision of us in the clearing best conveys it.³¹⁹

Daydreaming, the provisional, cannot be enclosed, bought, sold, propertied, or ordered. It can be an act of refusal in and of itself. Would that I could daydream the vision of us while in transit with Muñoz and Hartman.

3.6 Relations

To be in transit, to be between, to be in transition implies movement, change, and relations; movement away from or towards someone or something, perhaps with someone or something. Refusal is a movement away; hope is a movement towards—you cannot have one without the other. In “The Wild Beyond,” Jack Halberstam thinks with Max from *Where the Wild Things Are*, writing, “because he shuttles between the Oedipal land where his mother rules

318. Ibid. 144.

319. Emphasis mine. Sharpe, *Ordinary Notes*, 254.

and the ruined world of the wild, he knows the parameters of the real—he sees what is included and what is left out and he is now able to set sail for another place.”³²⁰ Max’s transit via boat and (day)dream, his ability to see the boundaries of both worlds as he crosses them, is what allows him to “set sail for another place.” He perceives the necessity of a change in relations, a positional shift, and with that knowledge can begin to build anew. As Halberstam writes, “the undercommons do not come to pay their debts, to repair what has been broken, to fix what has come undone.”³²¹ It is not the responsibility of those who have been broken to repair the system. Just as the undercommons is uninterested in fixing the inequities of the neoliberal Academy, Max does not set out to repair the ruined world or pay his debt to his mother: he refuses both and moves towards what is next. As Audre Lorde’s famed essay title states, “the master’s tools will never dismantle the master’s house.”³²² A severing is required and a new collectivity, a new community, a new world, must be built.

Throughout this thesis process, I have wrestled with the question of who this is for. Who makes up the audience I wish to address with this thesis, who am I writing this manuscript for and why? Yes, “in partial fulfilment,” but I cannot spend hours, days, months, years working on something that is only for the institution, for jumping through an arbitrary hoop established by a Euro-centric Western tradition. So, who am I speaking to? Especially when I think about the personal reflections, the anecdotes, the trauma, refusal, and healing—what am I disclosing, to whom, and to what end? As Audra Simpson writes in *On Ethnographic Refusal*, “can I do this

320. Halberstam, “The Wild Beyond: With and for the Undercommons,” 5.

321. Ibid. 4.

322. Lorde, *Sister Outsider: Essays and Speeches*, 110.

and still come home; what am I revealing here and why? Where will this get us? Who benefits from this and why?"³²³ There are real risks in sharing anything within the institutions and systems of power. Yes, speak truth to power, but there can be genocidal consequences to such actions depending on the relations and the bodies involved. Care and attention must be paid before moving forward with disclosure. By writing and creating this thesis, what harms do I risk for myself and my community? Can I return to my family, my community, with integrity knowing I have not used their stories, our stories, for my own gain or satisfaction? That sharing these stories benefits us in some way, not just the institution to which this will be submitted? These concerns sit in tension with the weight of the many who have been silenced and remain in silence for fear of consequence. I think often of this Sara Ahmed quote from *Complaint!*: "the loses that abuse constitutes for the generation of students unable to study and whose voices were lost because of how costly it became to remain."³²⁴ These loses go unaccounted for, cannot be acknowledged or reconciled. For those who leave an institution because of abuse, we cannot know what they may have contributed; for those who remain in silence, we cannot know what they endure. For those who formally complain, their complaints are hidden, secreted away in confidential files, leaving them to carry their complaints alone. Those who do not complain must also carry their burden alone. Having wrestled with this position myself, how can I use my voice, position, and time to point towards some of what was lost, what is still lost? How can I tell the stories of those no longer present without harming those who remain?

323. Audra Simpson, "On Ethnographic Refusal: Indigeneity, 'Voice' and Colonial Citizenship," *Junctures: the journal for thematic dialogue*, no. 9 (2007), 78.

324. Ahmed, *Complaint!*, 273.

I hope to move forward, in the work captured in this thesis and beyond, thinking and feeling and writing with a “we.” A “we” that is not only made up of all the scholars, writers, activists, and artists whose work I have drawn on and cited in this thesis, but also a “we” composed of my friends and family, my community, peers, and colleagues who were pushed out and those that remain, the non-human animals with whom I have always already been entangled. A “we” that may sometimes be composed of those who could be grouped by a defining feature, a label, a category, but also a “we” that includes those with shared ways of thinking, feeling, and being, a “we” that refuses and a “we” full of hope. To think with Muñoz; “this ‘we’ does not speak to a merely identitarian logic but instead to a logic of futurity. The ‘we’ speaks to a ‘we’ that is ‘not yet conscious,’ the future society that is being invoked and addressed at the same moment.”³²⁵ The transit and transition that I hope for is not just for myself. As Muñoz says, “individual transports are insufficient. We need to engage in a collective temporal distortion.”³²⁶ Growing from critique, from institution(s) that would not have us as we are, in our fullness, “we” are a collectivity with the potential for more, for other: “from shared critical dissatisfaction we arrive at collective potentiality.”³²⁷

325. Muñoz, *Cruising Utopia: The Then and There of Queer Futurity*, 20.

326. *Ibid.* 185.

327. *Ibid.* 189.

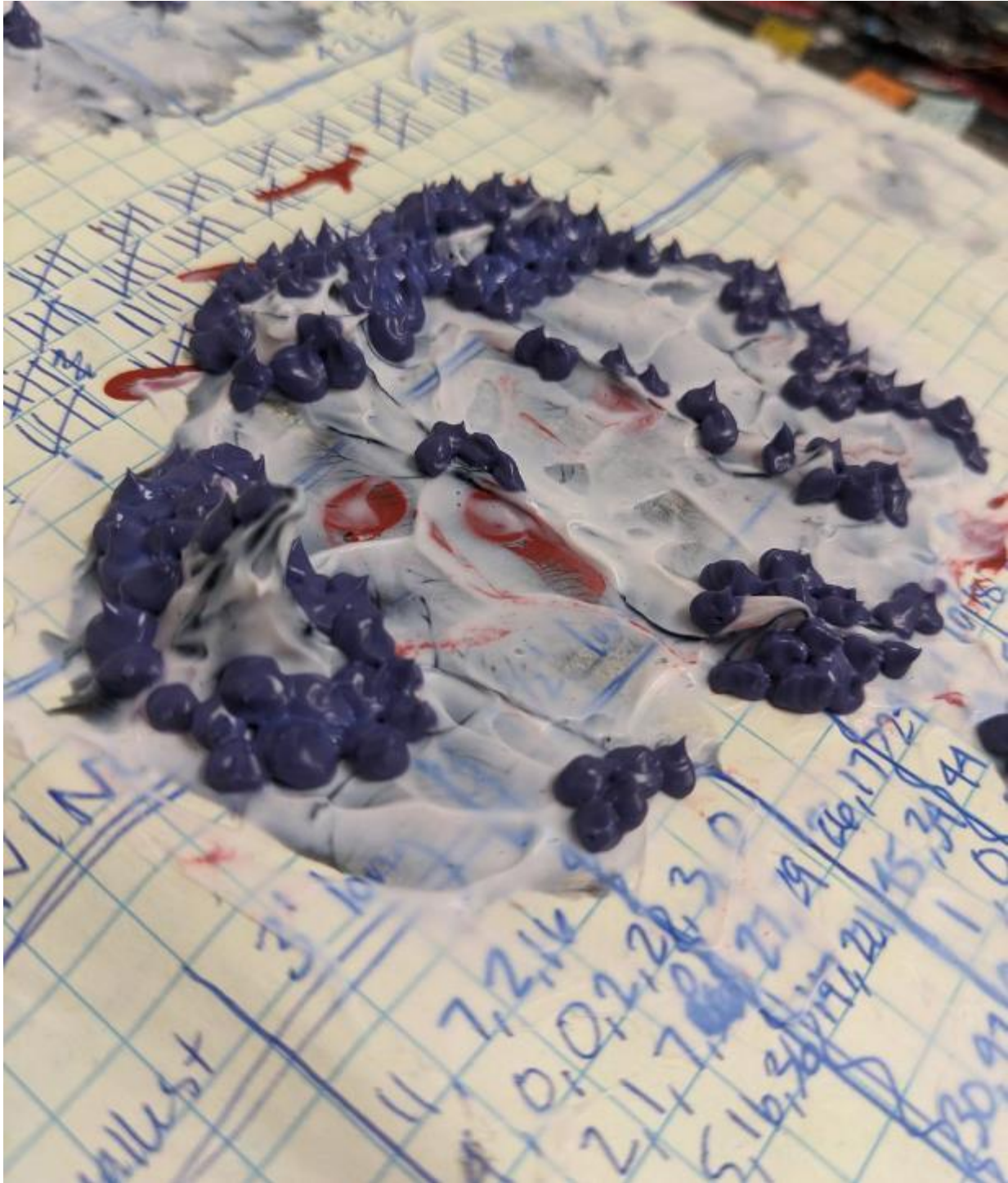


Figure 12. *Punch*. A punch layered into the lab book by a colleague and elaborated upon with additional paint and medium.

This collectivity, this “we,” is in direct opposition to the alienation of neoliberal academic scientific knowledge-production. We have already thought about disciplinary bounds, specialization, and a theory/practice divide as alienating tools, invented borders and blindered depths in the name of progress that would separate us from one another, separate fields of thinking and ways of being from cross-pollination. In the conclusion to *The Dialectical Biologist*, Levins and Lewontin write in response to the Cartesian-world-view that has driven much of scientific practice to date;

We characterize the world described by these principles as the alienated world, the world in which parts are separated from wholes and reified as things in themselves, causes separated from effects, subjects separated from objects. It is a physical world that mirrors the structure of the alienated social world in which it was conceived.³²⁸

They describe the knowledge gained through scientific methods as a type of projection—a flat, two-dimensional at best, representation of an inordinately more complex, multidimensional world—an emaciated understanding that reflects “alienated science.” Their proposal of a dialectical view hopes to move beyond the simplicity of parts and wholes, of contrasts and categories; it proposes the “interpenetration of opposites” as “often critical to the behaviour of the system.”³²⁹ In a word: relations. Objects/subjects of study exist in relation to one another and in relation to the observer; these relations matter and must be paid attention to. They write, “these are the properties of things that we call dialectical: that one thing cannot exist without the

328. Levins and Lewontin, *The Dialectical Biologist*, 269-70.

329. *Ibid.* 287.

other, that one acquires its properties from its relation to the other, that the properties of both evolve as a consequence of their interpenetration.”³³⁰

Science is a practice of relations; setting one thing in relation to another—whether in the lab or in the field—and observing what happens. Experiments are controlled relations: “the affairs of scientists always proceed by putting things into relation, creating very particular relationships with other beings, so these beings have to answer a well-defined question”³³¹ writes Stengers in *Another Science is Possible*. Science also exists in a sociopolitical world of relations, in which practitioners are expected to be able to communicate their results and draft proposals for new work in terms that matter to collectives, communities, granting agencies, and taxpayers. Any proposal or grant application is a weaving of new relations, a process of relation-making, whether or not the scientists drafting it would put it that way. I read Stengers’ proposal for “slow science” as essentially one of new relations-making. Stengers proposes scientific “connoisseurs,” citizens with an interest and passion for science and its findings but who are not scientists themselves and so could contribute to discussions of questions, methodologies, and results to help situate scientific work within the communities they serve. Rather than validating results with other scientists from the same field who have been trained to think, feel, and assess in the same way, validation would come from these “connoisseurs.” Stengers writes, “‘valorisation’ of a possibility born inside a research environment requires a radical redistribution of expertise through the creation of demanding new relations that will give voice to the often messy web of

330. Ibid. 3.

331. Stengers, *Another Science Is Possible: A Manifesto for Slow Science*, 65.

hard questions that matter in any given situation.”³³² Rather than building borders through jargon, specialization, technical publications, and pay walls, Science could open itself up to different ways of thinking, feeling, and being, and benefit as a result. I will conclude this section with Stengers’ rather beautiful description of what scientific practices *could* be:

The experimental achievement is a case, a very specific case, of relation-making between passionate human beings and what might verify the relevance of their questions. Such achievements may be seen as the creation of bridges between heterogeneous beings gifted with radically divergent ways of behaving, bridges that open up new possibilities of action and passion on both sides.³³³

Relations, bridges, transit, collectivity; if Science could open itself up to different modes of praxis, of subjectivity, of the specific and situated, the dynamic and heterogeneous, if it could refuse the way things have always been done in favour of a hope for something else, another science really might be possible.

332. Ibid. 102.

333. Ibid. 146-147.

Chapter 4: Describe

Resistance and hope, the demand for other, the work of building a radically different foundation with which to move, shift, propose, and express alternative ways forward, remembering that “the images we allow ourselves to see, whether in the mind’s eye or in the world, are a small subset of the teeming matrix of possibilities.”³³⁴ This re-imagined thesis is first and foremost an attempt to manifest a few of the possibilities in this teeming matrix. After dissection and demand, after refusal and sabotage, with resistance and hope, how might we create implosions, wormholes, and palimpsests, purposefully working in the interstices in order to “lay bare the fiction of any possibility of a coherent ground on which a knowledge project can be built?”³³⁵ Inter- and trans-disciplinarity requires this—working between and through boundaries, opening up gaps and poking around in the in-between—to create moments and opportunities for imagining/building/maintaining alternative pasts and futures. The *Transmute* animations exist in this liminal space, deconstructing, reconstructing, and transforming themselves as an offering of an alternative data analysis and dissemination method. *Transmute* takes scientific knowledge production and implodes it, picks it apart and remakes it, subverting any sense of a coherent neuroscientific ground as a means of manifesting one of an infinite number of paths forward. Though its genealogy reaches back to the neuroscience laboratory where data was created and developed in accordance with expected disciplinary methodologies, the art-making process abandons the canonical frame, stepping entirely outside the norms of

334. P Schwenger, "Codex Seraphinianus, Hallucinatory Encyclopedia," *Retrieved December 1* (2001).

335. Lawrence Liang, "Shadow Libraries," *e-flux Journal* 37 (2012).

scientific practice. This is not art instrumentalized for Science communication, nor is it art about visualizing data. While the process of developing the lab book into an animation follows a specific and rigorous protocol that mirrors a typical scientific data analysis pipeline—deconstruction as data tidying, reconstruction as data modelling, sanding as data transformation, animating as data visualization, and presentation as data narrativizing—it does so in a form that is wildly unrecognizable, unpredictable, and uninterpretable to a scientifically trained eye. The results of this framework offer an alternative conclusion, with different accessibility and dissemination, and diverse and conflicting perspectives. This methodology does not claim objectivity. Instead, it begins with an acknowledgement that all data, no matter how rigorous the protocol, is created by and is contingent on bodies in a socio-political framework, collaborating with the materials, methods, apparatuses, subjects, and capital resources available to them in a specific time and place. The work asks, if the complexity and situatedness of scientific knowledge-production are more fully considered and included, what happens to objectivity? To universality? To determinism and statistics? And what if this work were to re-enter the lab in this unrecognizable form? What consequence might the development of these alternative methodologies bring to bear on how bioscience is practiced?

This chapter will walk through each step in the creation of the *Transmute* animations, discussing the possibilities captured and questions proposed at each stage of development. While images of the process will be scattered throughout, the animations themselves will be shown in the following chapter, Chapter 5: Demonstrate.

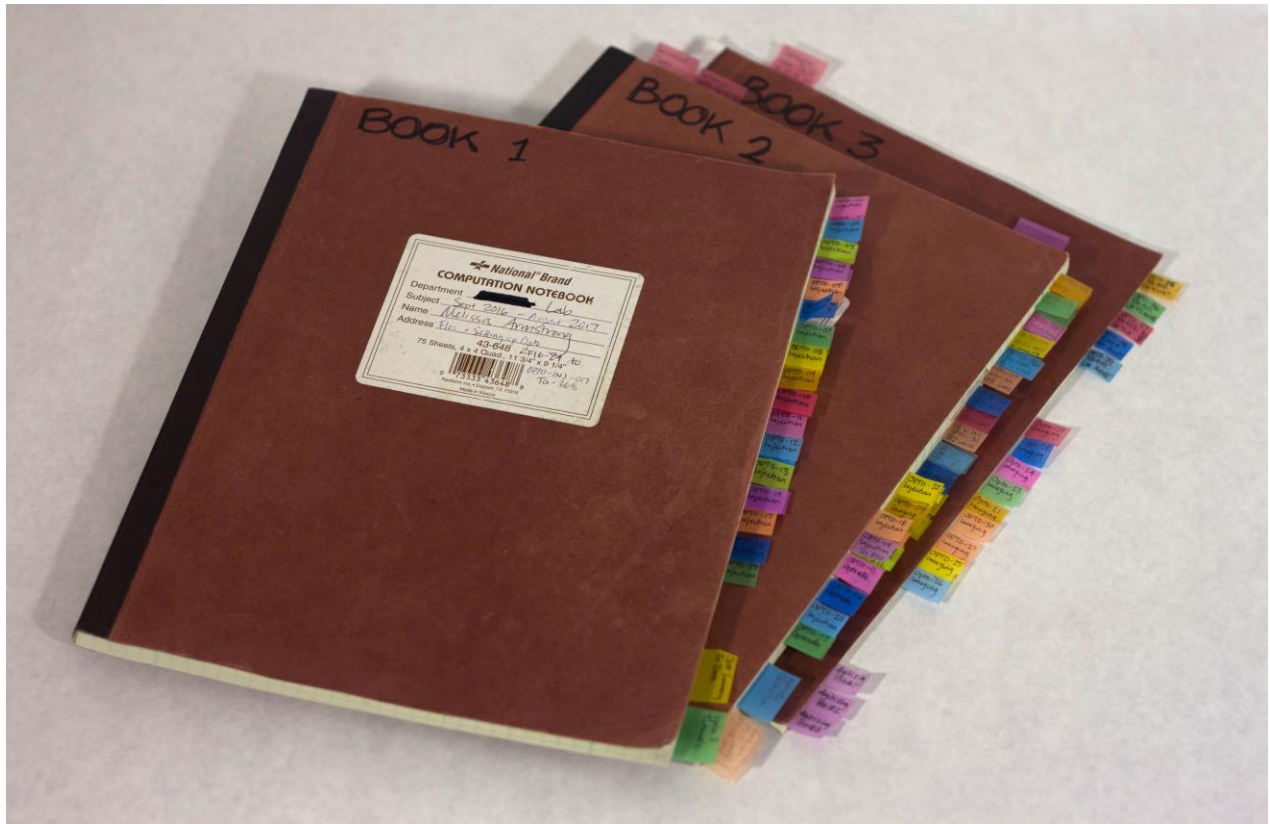


Figure 13. *Unaltered lab books.* A few of my laboratory notebooks prior to (de/re)construction.

4.1 (De)construction

“Undoing Empire also means undoing oneself.”³³⁶

~ carla bergman and Nick Montgomery

Sandra Harding wrote in 1994 that, “the laws of nature ‘discovered’ by modern sciences... are not the only possible such universal laws of nature; there could be many universally valid but culturally distinctive sciences... thus an entirely new set of ‘universal’ but

336. Bergman and Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times*, 25.

socially determined natural science laws are possible.”³³⁷ A colloquialism among scientists goes something like, *the more one learns about the world, the more one realizes how little we know*, and yet even as scientists acknowledge how little we understand about the world, there still exists a systemic inability to expand and seriously consider other sciences and other modes of knowledge production as equally legitimate. How might an individual counter the stuckness of the scientific field and push through to unlearn these universal, neutral, and objective claims and conditions if “one’s social location both enables and limits what one can see and do?”³³⁸ If one can “only count as evidence what occurred within his very limited field of vision?”³³⁹

Here is where this work begins; the work of (de)construction. “Challenging Empire’s radical monopoly over life means interrupting its affective and infrastructural hold, undoing some of our existing attachments and desires, and creating new ones.”³⁴⁰ carla bergman and Nick Montgomery think in community with a diverse group of activists, practitioners, and scholars on how to maintain fluidity and emergence, on embracing the instability of change in the effort to create and maintain new ways of being that undermine capital and Empire. They write:

As Empire was enclosing lands and bodies, it was overseeing the enclosure of thought as well. The Age of Reason was marked by a new kind of knowledge that could subdue and control nature and the human body, enabling capitalist rationalization and work discipline. Time and space would become measurable, stable, and fixed. Bodies were no longer conduits for magical forces but machines to be harnessed for production. Plants, animals, and other non-human creatures were no longer kin but objects to be dissected and consumed.³⁴¹

337. Harding, "Is Science Multicultural?: Challenges, Resources, Opportunities, Uncertainties," 320.

338. Ibid. 322.

339. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 186.

340. Bergman and Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times*, 140.

341. Ibid. 86.

The first step of the *Transmute* pipeline aims to interrupt the “infrastructural hold,” un-enclose thought, and create opportunity for the freeing of time and space from measurable fixity. With time and space freed from the drive of capitalist production, the establishment of new relationships with non-human kin and with the infinite potential of our own bodies becomes possible. This (de)construction hopes to relieve some of the “markers so loaded with mythical prepossession that there is no easy way for the agents buried beneath them to come clean.”³⁴²

In addition to the traditional role of documenting the details of experimental protocols one might associate with the idea of a laboratory notebook, in contemporary scientific practice, lab books have also taken on a judiciary role. Whether digital or physical, laboratory notebooks have become legal documents for substantiating claims of discovery, to settle authorship disputes, as well as disputes over who can lay claim to a novel finding and establish Authority. “Best practices” for laboratory notebooks abound, both for the sake of the science documented within—what to include, when, where, and why—and in its judiciary role—tables of content, introductory pages outlining hypotheses and experimental design, dates, signatures, and so on. Many best practices related to the judiciary role have become significantly more arduous than the scientific one. These often include signatures by witnesses on every single page, how to initial edits or manage version control, recommendations for dealing with blank spaces, and even writing utensil recommendations. Historically a laboratory notebook archived for scientific purposes would be kept until the data produced by the protocols in its pages was published and

342. Hortense J Spillers, "Mama's Baby, Papa's Maybe: An American Grammar Book," in *The Transgender Studies Reader Remix* (Routledge, 1987), 65.

peer reviewed; to confirm the validity of methods and the rigor with which data were produced as well as remind the author of an experimental detail they may have forgotten. Now they are copied and archived for even greater lengths of time for legal reasons, in case there is a dispute over authorship, a novelty claim, or accusations of data fabrication or research malpractice. These legal disputes over intellectual property reveal a scientific community bound up in competition and hierarchy, impacted by capital and ego, fighting for Authority. While laboratory notebooks first existed to document the day-to-day work of practitioners, symbols of progressive knowledge production, they have now taken on a non-symbolic role as judiciary tool with the potential to make or break scientific careers.

4.1.1 Reading Against the Grain

“To tell the story of a burial is to unbury the story.”³⁴³

~ Sara Ahmed

What is hidden, silent, ignored, and buried? What is simply not thought of in the first place because of our limited field of vision? Institutions—academic, scientific, white supremacist, or otherwise—police borders, defining who and what counts in ways that uphold and maintain their own power. Scientific institutions, as with any institution, often insist on “minimizing signs of difference [as] institutional passing”³⁴⁴ and remaining “apolitical” in the

343. Ahmed, *Complaint!*, 276.

344. *Ibid.* 152.

name of “objectivity” as we have already discussed, but other ubiquitous exclusions include affect and the animals, even when animals are the objects of our study.

In scientific studies with and about animals, scientists are often simultaneously excluding the social context of their own positionality as well as that of the animals. Marc Bekoff and Jessica Pierce argue in *Wild Justice* that our non-human kin have moral lives and that this animal morality is ignored at the expense of our understanding of their cognition and behaviour. They write that, “such sanitized and supposedly parsimonious descriptions exclude the social context that is so very important in discussions of animal emotions and animal morality.”³⁴⁵ In Cary Wolfe’s extensive work on animal husbandry for agriculture and science, Wolfe claims:

The cardinal biopolitical sin of contemporary practices such as factory farming, or subjecting ‘purpose-bred’ animals to routinized experimentation in which they are little more than conduits for statistical throughput, is not just the pain and suffering it causes... but rather the deadening and diminishing of ‘animality’ itself in all its vitality, creativity, and multiplicity, which would in turn forestall our own ability to discover the multiplicity in ourselves via animality as a creative force for our own evolution.³⁴⁶

In the tradition of critical animal studies, both books argue that our treatment of non-human animals not only results in an emaciated understanding of animals, but also a limited vision of ourselves.

If a critical misunderstanding of non-human animals limits our understanding of ourselves, how much does purposefully excluding our own emotional states and biases undermine our attempts to understand natural phenomena? “Such silence is the nickname of distortion, of the unknown human factor that a revised public discourse would both undo *and*

345. Bekoff and Pierce, *Wild Justice: The Moral Lives of Animals*, 41.

346. Wolfe, *Before the Law: Humans and Other Animals in a Biopolitical Frame*, 41.

reveal.”³⁴⁷ While Hortense Spillers is thinking here about the ongoing resonant effects of slavery in the lives of Black and white Americans, the idea that silences distort has relevance here. Unearthing the “unknown human factor” and insisting upon a public discourse around the effects of affect on scientific work could do much to “both undo *and* reveal.” This is undoubtedly why those discourses do not occur. José Esteban Muñoz, thinking about the relationship between race, ethnicity, and affect, writes that “race and ethnicity can be understood as ‘affective difference,’ by which I mean the ways in which various historically coherent groups ‘feel’ differently and navigate the material world on a different emotional register.”³⁴⁸ If Science took the diversity of its practitioners seriously, how might it then make space for the variety of ways in which practitioners feel and navigate the world differently? If diverse scientific practitioners were free to move, think, feel, and practice in ways that reflect their personal experiences, what new questions, methods, and results might emerge? If scientists expanded beyond modern Western notions of non-human animal life and treatment, what new questions, methods, and results might emerge? To return to Harding’s questions around a “multicultural” science, what new sets of “universal” scientific laws, and ways of thinking, working, and learning might be produced, valued, and disseminated? Working through possible answers to these questions again requires (de)constructing the infrastructures that prevent a “revised public discourse.” We must un-enclose in order to unbury the purposefully hidden and ignored, to make space for different emotional registers within which to work and play.

347. Spillers, "Mama's Baby, Papa's Maybe: An American Grammar Book," 73, emphasis hers.

348. Muñoz, "Feeling Brown: Ethnicity and Affect in Ricardo Bracho's" the Sweetest Hangover (and Other Stds)," 70.

One such infrastructure is the laboratory notebook; in its roles both as experimental archive and judiciary tool. What is included or excluded from the lab book and how might those inclusions and exclusions uphold normative and hegemonic ideologies around the practice of science? In my experience, the contents of the lab book reflect and reproduce conceptions of objectivity and neutrality inherited from as far back as grade school and early instruction in the scientific method. The contents of the lab book are cold, impersonal, and devoid of reference to the body and its sociopolitical conditions while conducting the work. While rigorous in documenting the protocols enacted—dates, time stamps, subject ID’s, drug dosages, physical actions conducted or observed, etc.—there is no reference to the human enacting those actions. Bathroom breaks, nourishment breaks, conversations or visits from colleagues during a procedure, the emotional or behavioural state of the practitioner and how that may affect the actions documented, moments of thrill or abjection, concerns for progress at the micro level within a specific procedure or the macro level of the overall trajectory of the work are all missing from the lab book but are certainly occurring in parallel with what is included. With a physical lab book as opposed to a digital one, there are hints at some of these “distractions”—slippages—like a coffee, tea, or grease stain from nourishment snuck into the lab during a long procedure, a scribble of frustration, a note of exclamation, a strikethrough when something did not work as expected. Other slippages require significant reading between the lines that only an experienced practitioner might recognize; a longer than expected time stamp may indicate a break for bodily or emotional needs, a mistake resulting from insufficient rest or the stress of producing data in a timely manner, a gap in notetaking when a colleague interrupted a procedure with questions or comments, and so on. But aside from these subtle interruptions, the contents march forward day-by-day, hour-by-hour, only referencing material deemed “scientifically relevant.”

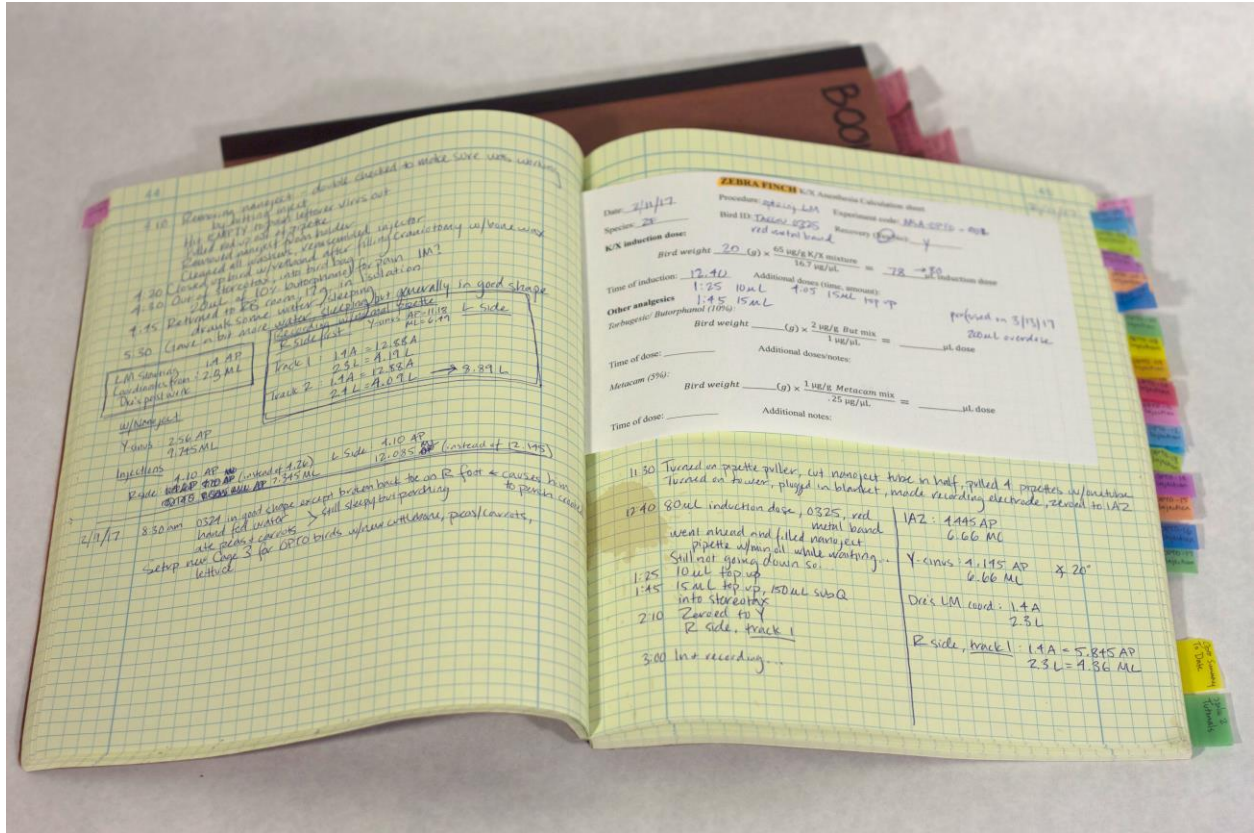


Figure 14: Lab book pages. Coffee stains, exclamations, and notes from visitors are a few of the slippages that can be found within the pages of the unaltered lab book.

The reality of the practice in the laboratory is radically different from the contents included on the page. (De)construction of the books, page-by-page, creates the physical space necessary to begin to imagine another type of lab book and another way of working. One that acknowledges and explicitly includes all the (corpo)realities of the work. Many scientists are initially driven by a love for the work itself, whether that be at the lab bench or in the field, and the moments of curiosity and “discovery” that occur along the way, as well as the “sawdust” initially cast aside but often holding its own secrets waiting to be uncovered. None of that love, joy, frustration, or curiosity is typically found in the lab book even as it is a hand-written book

that goes anywhere the scientist goes. It is wild that it does not include more given its continuous proximity to the practitioner. Let it include all the feelings, bodies, moments; let it be a diary of the journey including all the highs and lows of the process; let it be a place to share all the complicated multiplicities of being a human doing the slow and steady work of knowledge production. This imagined holistic lab book would not only be a more interesting document to engage with, but it would also be a more accurate reflection of scientific knowledge production, and it would reveal more about the workings of the world than a “neutral” one that achieves its neutrality through exclusion. This (de)constructed and then expanded book could make space for all the ways of working and thinking that we carry within ourselves, rather than an emaciated modern Western scientific one.

4.1.2 Knowledge Making, Keeping, and Sharing

In *Staying with the Trouble*, Donna Haraway thinks and writes through “string figures”³⁴⁹ tying seemingly disparate threads together, knotting them as an act of relation making, and thinking through those entanglements as physical, embodied practices. She describes it thus: “these string figures are thinking as well as making practices, pedagogical practices and cosmological performances.”³⁵⁰ Later, referring to the work of Vinciane Despret, Haraway writes, “her kind of thinking enlarges, even invents, the competencies of all the players, including herself, such that the domain of ways of being and knowing dilates, expands, adds both

349. SF, science fiction, speculative futures, speculative feminisms, speculative fabulations.

350. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene*, 14.

ontological and epistemological possibilities, proposes and enacts what was not there before.”³⁵¹

These expansions chip away at a question proposed by Denise Ferreira da Silva; “How to describe the world in such a way as to make it possible to establish that the human mind can know the truth of things in it without the need for divine revelation?”³⁵² “Divine revelation” in this case could be a religious or spiritual revelation, or the modern day scientific equivalent; a scientific epiphany. How can we release ourselves from the modern Western need to justify every piece of knowledge with evidence-based, “objectively” produced, scientific data?

351. Ibid. 126-127.

352. Ferreira da Silva, "1 (Life) ÷ 0 (Blackness) = ∞ - ∞ or ∞ / ∞: On Matter Beyond the Equation of Value. E-Flux, 79 (February)" 4.



Figure 15: *Studio*. An in-progress photograph of (de/re)construction of lab books in the studio. In the top row are pages from three different lab books that have been deconstructed page-by-page and scanned for digital archiving. Sticky notes are added as reminders of events going on around the dates documented on the pages and possible additions to be made. In the bottom row are lab book blocks mid-layering, with objects, images, and media layered in-between the pages.

Turning to other ways of knowing and being that have been silenced or ignored can provide useful examples or insight. In thinking about land-based Indigenous practices, Leanne Simpson states simply, “if you want to learn about something, you need to take your body onto the land and do it. Get a practice.”³⁵³ She writes beautifully about theory growing “from the

353. Simpson, *As We Have Always Done: Indigenous Freedom through Radical Resistance*, 165.

ground up, and its power stems from its living resonance within individuals and collectives.”³⁵⁴

Simpson manages to emphasize epistemologies in a communal context, without subsuming the

individual; she says, “individual generated meaning is an authentic and grounded power.”³⁵⁵

What can science learn by stepping out of the lab and onto the land? Out of celebration of the individual genius and into collectivity? Out of the mind and into the body?

Barry Stephenson, writing about performance and ritual, has a lot to say about ways of knowing that remain firmly grounded in the body; “like reason, ritual is a way of knowing.”³⁵⁶

He writes, “performance theory seeks a better understanding of the relations between embodiment and knowing. Embodiment refers to the way in which intentions, feelings, beliefs, and values are not merely in the head but are bodily experiences.”³⁵⁷ To quote him at length:

To consider ritual as an alternative, secondary medium for expressing what could otherwise be (perhaps more easily) expressed is to miss what is distinctive about ritual: a rite requires doing—if it is not performed, there is no rite. The manner of the performance is important. We can learn through the use of our body; knowledge is corporeal (in contrast to cerebral), active (not simply contemplative), and potentially transformative (not merely speculative).³⁵⁸

What if the sciences took this pedagogy seriously? If knowledge is corporeal and active, what might scientific practitioners learn by acknowledging their own bodies and the feelings, beliefs, and values contained within them? What is scientific practice if not a ritual, albeit one that has purposefully abandoned its own embodiment and the important lessons housed within the body?

354. Ibid. 151.

355. Ibid. 157.

356. Barry Stephenson, *Ritual: A Very Short Introduction* (Oxford University Press, 2015), 94.

357. Ibid. 88.

358. Ibid. 99.

Avery Gordon writes about “sensuous knowledge” in *Ghostly Matters*, an exploration of hauntology and the ways in which the past haunts and shapes the present, determining possible futures through ghostly disturbances. She writes:

Sensuous knowledge is a different kind of materialism, neither idealistic nor alienated, but an active practice or passion for the lived reality of ghostly magical invented matters. Sensuous knowledge is receptive, close, perceptual, embodied, incarnate. It tells and it transports at the same time. Sensuous knowledge is commanding: it can spiral you out of your bounds, it can hollow out, with an x-ray vision, the seemingly innocuous artifacts of the master.”³⁵⁹

If we temporarily set aside some of the more “magical” language, Gordon’s description begins to sound a lot like how some practitioners might describe their personal experience of scientific knowledge production. It is active and passion driven, it requires perception, proximity, and openness, and at its best it can “tell and transport at the same time,” propel you out of your comfort zone, and reveal so much about the world. She goes on to say, “to experience a profane illumination is to experience the sensate quality of a knowledge meaningfully affecting you... Sensuous knowledge always involves knowing and doing... Everything rests on not being afraid of what is happening to you.”³⁶⁰ This “profane illumination” is perhaps another possible answer to Ferreira da Silva’s question above on the human mind’s ability to know without “divine revelation.” If Gordon’s description of “sensuous knowledge”—a knowledge based in the body and described as “magical”—is aligned with the practical experience of scientific knowledge production, perhaps Science is not so different from other forms of knowing even as it strives to maintain separation from such magical ideas. Again, what might scientific knowledge production

359. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 205.

360. *Ibid.* 205.

gain by embracing ghosts and magic and releasing itself from its own stranglehold of ascetic neutrality? What if science could encounter itself “primarily through the senses rather than the intellect, and with an openness to incomprehensibility that allows for a unique appreciation of the obscure and the obtuse”?³⁶¹

The first step of (de)constructing the laboratory notebook is an attempt to think through these questions with an embodied practice that occurs beyond and outside the limitations of the lab in which the books were produced. It proposes methods of undoing: unlearning the normative values of neutrality, objectivity, and universality with which they were produced; breaking open enclosure, removing infrastructural binding; returning what has been buried, silenced, and ignored; creating a site of equal value amongst that which has been historically elevated. “No top-down approach is to be found, no ‘outreach’ from an academic environment down to the ‘ignorant’ public”³⁶² as artistic interventions into the sciences are often framed. (De)construction here is an act of space-making, the creation of a gap, an opening through which the animals, human and non-human alike, with their affect, embodiment, and connection to land and each other can emerge. In working towards and with implosions and inversions that subvert Science’s disciplinary foundations, (de)construction strives to “destabilize the ground from which we build order and in doing so reframe the very epistemic basis of how we know.”³⁶³ After breakdown, the work of integration of other types of data and information, the affective and subjective, the animals and bodies can begin.

361. Hollenbach and McDonald, *Re/Imagining Depression: Creative Approaches to “Feeling Bad,”* 6-7.

362. Da Costa, "Reaching the Limit," 376.

363. Liang, "Shadow Libraries."

4.2 (Re)construction

“Add to an image an appraisal of the image; add to the nonfigurative the metaphoric; add to delineation penetrability; add to understanding doubt.”³⁶⁴

~ Mady Schutzman

After the space-making act of (de)construction—an analogue to data tidying in a stereotypic scientific data analysis pipeline where data is reorganized/rearranged/reoriented/renamed—comes (re)construction or data modelling in which additional factors are added to build a more holistic dataset. In thinking through the laboratory notebook—what is included and excluded—and how we might rebuild the object with palimpsestic tenses in mind, much can be (re)integrated at this stage. From other forms of data and information, to the affective and subjective, to the animals and bodies, (re)construction aims to queer the lab book according to Kara Keeling’s definition in *Queer OS*; “queer offers a way of making perceptible presently uncommon senses in the interest of producing a/new commons and/or of proliferating the senses of a commons already in the making.”³⁶⁵ This proliferation and expansion allows the scientific data archived within the books to resonate more fully with the conditions of its own production, activating Mady Schutzman’s formulation that “engaging resonance as an intervention tends to have a democratizing effect in that the more

364. Schutzman, *Radical Doubt: The Joker System, after Boal*, 100.

365. Kara Keeling, "Queer Os," *Cinema Journal* 53, no. 2 (2014), 153.

privileged, cognitive, and direct approaches have to yield the floor.”³⁶⁶ “Universality” is dethroned as the subjective emotional state of the practitioner is added, “neutral” data is subsumed in layers of embodied action painting, “objectively” produced data provides the base for the performance of rituals acknowledging animal sacrifice. While the particularities and particles of data disappear into the whole, “the motive is not to replace the specialist, but to augment specialization with other models that have legitimate claims to producing and interpreting knowledge,”³⁶⁷ as Beatriz da Costa writes with Claire Pentecost. The (re)constructed lab book queers, resonates, and augments in parallel with modelled data, but exponentially expands what mathematical modelling can do in the hands of scientific statistical analysis with its reductionist and deterministic techniques.

366. Schutzman, *Radical Doubt: The Joker System, after Boal*, 118.

367. Beatriz Da Costa and Kavita Philip, *Tactical Biopolitics: Art, Activism, and Technoscience* (Cambridge, Mass: MIT Press, 2008), 375.

4.2.1 Integrating other types of information/data

There are many types of data that are not included in the experimental documentation typical of laboratory notebooks. Narrowing in on lab-based experimentation rather than a field-based experiment, these might include “abiotic”³⁶⁸ conditions like weather or atmospheric state (which are assumed to be neutralized by climate-controlled spaces), changes in physical spaces or equipment, uncooperative tools or apparatuses, and so on. “Biotic” conditions could include animal behaviour state and undetected illness, animal care or husbandry conditions (which are sometimes beyond the control and therefore knowledge of the experimenter), variations in animal subjects that effect experimental setups, relationships between human investigator and animal subjects, all the complexity around and within the human investigator themselves, and so on. These relations are at the heart of bioscientific work even when they are purposefully set aside, and prioritizing these relations, refusing to forget them, can only benefit scientific knowledge production. What traces and threads can we find, pick up, and follow to (re)integrate those relations and the knowledge they hold? “Following the ghosts is about making a contact that changes you and refashions the social relations in which you are located. It is about putting life back in where only a vague memory or a bare trace was visible to those who bothered to look.”³⁶⁹ Practitioners feel and experience these conditions in daily practice but are trained in an act of “deliberate forgetting” as Charles Mills has described the “active deed” that allows denial to occur. He writes, “what makes such denial possible, of course, is the management of

368. There is an abiotic/biotic binary here that should probably be examined as nothing in biology is this clear cut!

369. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 22.

memory.”³⁷⁰ Testimony and witness become tools in memory management and historical (re)tellings, and what is a lab book if not a tool of testimony and witness? The laboratory notebook is tasked with the job of memory keeper; practitioners document notes, conditions, procedures, dosages and more so that they do not have to remember every detail of an experimental setup—the lab book will remember for them. Yet lab books tend to only contain notes deemed “relevant” to the experiment at hand. Relations, even if felt by the practitioner during an experiment, are considered irrelevant. Sometimes some of the (a)biotic conditions mentioned above can fall outside of this boundary of relevance or are completely unknown to the investigator if another individual, perhaps one in charge of animal care, has failed to share the information because *they* decided it was irrelevant. If the lab book acts as memory keeper or archive, and is therefore a tool of testimony and witness, its contents should reflect this expanded role, especially in the context of lab book as judiciary object discussed earlier. However, if a scientific practitioner were to include a more holistic representation of an experimental day in the lab book, the authority of the book could be called into question based on the presence of “irrelevant” information. As Mills goes on, “if one group, or specific groups, of potential witnesses are discredited in advance as being epistemically suspect, then testimony from them will tend to be dismissed or never solicited to begin with.”³⁷¹ Lab books, written by individuals, can act as judiciary testimony and witness, and yet if they include subjectivities deemed epistemically suspect, they can be discarded in a time of conflict. Similarly, individuals building

370. Mills, *Black Rights/White Wrongs: The Critique of Racial Liberalism*, 16.

371. *Ibid.* 19.

the contents within a lab book can be discredited and therefore disregarded as legitimate witnesses to their own experience/experiments if they can be rendered epistemically suspect.



Figure 17. *Tally*. A lab book layer of tally marks carved into medium. The page below was also full of tally marks, manually counting bird flights across a flight tunnel.

Here, at the step of (re)construction, I strive to remember all that was set aside, mining the lab books for traces and ghosts to pull back into the present, to “repair representational mistakes, but also [to] strive to understand the conditions under which a memory was produced in the first place, toward a counter memory, for the future.”³⁷² (De/Re)constructing laboratory notebooks I originally created during experiments at the lab bench becomes an act that both mirrors and is key to my own journey of unlearning white supremacy’s colonialism in the lab and in the academy. Examining the books page-by-page for ghosts and traces, bringing attention and care to discarded moments and elements, and (re)integrating what I found within myself and within the books builds a new testimonial document. I become witness to my own experience, to the experiences of the animals, and to the experiences of my colleagues in the lab. The books become a physical embodied witness at a time when I was being actively discredited by the head of the lab in order to undermine the telling of my own story, countering an attempt at memory management. This (de/re)constructed block of material loses its judiciary authority in exchange for the witnessing of a much more nuanced and complicated story than the one told by the lab books in their original form.

4.2.2 Integrating the Affective

“Remember: you have to record what you do not want to reproduce.”³⁷³

~ Sara Ahmed

372. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 22.

373. Ahmed, *Complaint!*, 288.

Laboratory notebook as record, archive, testimony, and witness, but how to build a lab book that does not reproduce institutional infrastructures? A start might be acknowledging and including the messy, tangled parts of ourselves—the practitioners—the parts that do not fit neatly into categories, binaries, or definitions, the parts that defy the clean lines that scientific practice tries to delineate around and between objects, ideas, and individuals. Returning to Avery Gordon’s “sensuous knowledge” in *Ghostly Matters*, she thinks with Raymond Williams’ construction of “a structure of feeling” as “a historical materialism characterized constitutively by the tangle of the subjective and the objective, experience and belief, feeling and thought, the immediate and the general, the personal and the social.”³⁷⁴ “Sensuous knowledge” or “a structure of feeling” does not adhere to boundaries or binaries; categories are entangled rather than defined in opposition to one another.

In *Ordinary Notes*, Christina Sharpe writes about an attempt at museums dedicated to Black history and trauma to create movement from guilt to grief. She describes the initial personal guilt, “which may be a position of distance, a position of non-implication, but may also be one of complicity,” and the movement to grief, “a position of relation, one of entanglement.”³⁷⁵ Applied to the academy and its historical insistence on “critical distance,” we recognize its contemporary struggles with “equity”³⁷⁶ as resonant with Sharpe’s description of guilt as distant, not implicated and yet still complicit, all of which mirrors the fear of grief, of

374. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 200.

375. Sharpe, *Ordinary Notes*, 70.

376. As of this writing, affirmative action in the US was struck down by the supreme court and conversations are ongoing about the effect on legacy admissions at top universities.

emotion, of entanglement, of relations. Grief and affect might lead to entanglement or relations and academics, especially scientists, cannot let personal feelings interfere with rigorous study. Affect still carries the stigma of the hysterical woman or the schizophrenic person of colour. Isabelle Stengers and Vinciane Despret wrote as recently as 2015 that “we can’t keep ourselves from thinking that our male colleagues... would simply not have understood how we could incite them to what they would have seen as a somewhat indecent proposition, confounding private experience and intellectual life.”³⁷⁷ The academy is increasingly opening itself to the possibility of scholarship arising from proximity, from the personal, from internal state, but Science continues to cling to the false spectre of objectivity and neutrality, allowing it to continue to discount the personal. Not only does this emotional distance and stoicism deny scientific practitioners their own humanity and ways of being and existing, it has always already affected the questions and methodologies deemed “rigorous” by Science and it forecloses multiverses of knowledge; individual, relational, and societal forms of knowledge and knowledge production.

José Esteban Muñoz writes:

Emotion is thus an extension of consciousness, what I would call a performed manifestation of consciousness. ...emotion being the signification of human reality to the world. Such a theory is deeply relational. It refuses the individualistic bent of Freudian psychoanalysis and attempts to describe emotions as emotions, the active negotiations of people within their social and historical matrix.”³⁷⁸

377. Stengers and Despret, *Women Who Make a Fuss: The Unfaithful Daughters of Virginia Woolf*, 147.

378. Muñoz, "Feeling Brown: Ethnicity and Affect in Ricardo Bracho's" the Sweetest Hangover (and Other Stds)," 71.

Emotions are not just personal, they are negotiated between and within individuals, groups, times, and places. They do not fit into simple categories or binaries of love vs. anger, joy vs. hopelessness; they are deeply and complicatedly entangled, often undefinable and unrepresentable. As Saidiya Hartman stated earlier about refusal, it is easier to index than describe. Emotions influence all that we do, think, and say, and can be manipulated to build or topple individuals, groups, times, and places. The idea of normative whiteness as minimal in affect and the expectation that those who wish to participate in a world built on whiteness must also become affect-less cuts both ways as a privilege and a form of disenfranchisement. Tajja Isen, in *Some of My Best Friends*, writes about media's hunger in the last few years for stories of pain from writers of colour. But resisting sharing stories of pain also means setting parts of yourself aside. She says, "like indulging in unbridled sadness, to be able to cut emotion out of your work wholesale is its own form of privilege,"³⁷⁹ an arguably white privilege that is not always extended to others. Damned if you do and damned if you don't. And should you speak up against it, refuse the whole thing, look for paths of revenge, that will be punished as well. "Revenge is wronging wrongs, a form of double-wronging. You, like me, have been guided/good-girled away from considering revenge as a strategy of justice,"³⁸⁰ write Indigenous scholars and artists Eve Tuck and C Ree. Any form of engagement with emotion and affect, whether denying, acknowledging, or using for an end, is off limits for the colonized and marginalized.

379. Isen, *Some of My Best Friends: Essays on Lip Service*, 106.

380. Eve Tuck and C Ree, "Exemplar Chapter 33: A Glossary of Haunting," *Handbook of Autoethnography*, ed. Stacey Holman Jones, Tony E. Adams, and Carolyn Ellis, 654.

For scientific knowledge production, it is perhaps understandable why the world of emotion and affect would be so intimidating. How can you quantify and thus account for something so complicated, entangled, and undefinable? Modern Western scientific practice was built on naming, categorizing, and describing, so what could possibly be done with something that refuses to be named, categorized, or described? If it can't be described, how can it be quantified and if it can't be quantified, how can it be accounted for in scientific practice, included in statistical models, integrated into results? And yet, how can Science continue without making a good-faith effort to include affect, the state of mind of its practitioners, their biases and feelings that have always already been threaded throughout the work? And what new worlds might open if Science is able to think through and with feeling?

bergman and Montgomery write about one of the reasons white supremacy and colonialism fear affect; it can lead to transformation and a shift in priorities and power:

An increase in the capacity to affect and be affected—joy—means being more in touch with a world that is bleeding, burning, screaming. Transformation might begin with rage, hatred, or sorrow. Refusing to 'get over' some things can cut against the grain of obligatory productivity and optimism structuring capitalist life. Shared power might arise from accepting, refusing, hanging on, or letting go. This is the wiggle room of freedom: not the absence of constraint or a do-what-you-like individualism but an emergent capacity to work on relationships, shift desires, and undo ingrained habits."³⁸¹

In *Joyful Militancy*, bergman and Montgomery define “joy” as an embrace of change, emergence, and undoing rather than happiness or comfort. For them, joy is transformative potential, attenuation to affect, and a refusal of a thinking/feeling dichotomy. By starting with an

381. Bergman and Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times*, 236.

older definition of “aesthetic” as “the increase in our capacity to perceive with our senses,”³⁸² in parallel with the still-in-use Spanish verb “sentipensar,” which can be literally translated as “to feel-think,” Montgomery and bergman align their definition of “joy” with sentipensar. They write, “joy is the sentipensar, the thinking-feeling that arises from becoming capable of more, and often this entails feeling many emotions at once.”³⁸³ Joy, the aesthetic, and affect are tangled together in a form that defies a thinking/feeling binary and by extension a mind/body dichotomy. This tangle can invigorate, embolden, and empower by way of attenuation to relationships, desires, and undoing. In a section on capacity building through relations and community, they write, “trust and responsibility... are not simply the result of rational thinking or even a combination of theory and practice, because they are implicated in affect: they come out of thinking *and feeling* the transformative encounters with our own power and the powers of others.”³⁸⁴ Sentipensar and the aesthetic are necessary preconditions and ways of working for joy as transformative potential and for the development of new and potentially inverted power relations: necessary for revolution.

This joy and the power affect wield are two of the many things to be gained by not just acknowledging affect but working with it as a transformative tool. Karen Bolender writes that “unlikely figurations embolden us to explore territories that spook the rational mind.”³⁸⁵ Science, grounded as it is in the rational and logical mind, may inadvertently be shying away from entire

382. Ibid. 60.

383. Ibid. 61.

384. Ibid. 163, emphasis theirs.

385. Karin Bolender, “R. A. W. Assmilk Soap,” in *The Multispecies Salon*, ed. Eben Kirksey (New York, USA: Duke University Press, 2020), 3.

fields of study that defy logic and therefore seem impenetrable or at least not worth the time and effort required to develop another way. For now, those fields are labelled as “pseudoscience” and any potential contributions dismissed before a discourse is possible. One must tread lightly here, as science has historically been used to support, uphold, and invent harm through fields of study such as race and eugenics that are now labelled “pseudoscience” and yet we must continue to develop ways to learn “how to identify cultural features in scientific assumptions, and how to sort the distorting and knowledge-limiting from the knowledge-enlarging cultural values and interests.”³⁸⁶ The sciences could develop a practice with the aim of engaging in the art of “witnessing with clarity. Using sadness, anger and conflict to awaken, amplify, intensify.”³⁸⁷ Science already exploits practitioner’s love of scientific practice for cheap labour, what if it could instead acknowledge the complete humanity of its practitioners and develop methods to think/feel in the lab and field to reshape scientific practices and develop new questions, methods, and fields of study?

4.2.3 Integrating the Animals and Bodies

One cannot discuss affect without thinking/feeling through the body, the role of the body, and the presence of embodied experiences and practices in the lab. The body is the site of action, the conductor of the experiment, the handler of the subject/object, and the locus of emotion and affect. Even as science, following in capitalism’s footsteps, treats the body as machine—part of

386. Harding, "Is Science Multicultural?: Challenges, Resources, Opportunities, Uncertainties," 329.

387. Maynard and Simpson, *Rehearsals for Living*, 129.

the apparatus of scientific practice—no practitioner could claim that affect does not shape their actions during lab or field work. After all, “the body and senses are noetic channels in their own right.”³⁸⁸ The intellect is the body and the body is intellect. Scientific practitioners follow “hunches,” “instincts,” and “intuition” at many key decision-making moments, yet if asked to logically identify the exact reason they chose one course of action over another, they may not be able to define something that doesn’t sound a lot like pseudoscience. There are many moments in scientific practice, sometimes entire protocols, that rely heavily on “intuition,” sometimes even outright superstition. In attempting to reduce electrical noise on a neurophysiology rig, practitioners tweeted that a ponytail was key to the electrical recording process; not for a scientifically grounded reason but an experience-based one—it worked every other time in the past so they continue to do it. Immunostaining—a famously particular practice that uses antibodies binding to proteins of interest to stain biological tissues for visualizing under the microscope—is often accompanied by unwritten protocols like standing on one foot during a particularly important step or shaking a tissue tray clockwise but not counter-clockwise. These may be flippant examples where more serious ones exist, but the point is that practitioners already use their bodies, actions, and “spidey-senses” in ways that defy universality, neutral objectivity, reason, and logic. Practices can be hyper-local, specific, contestatory, and sometimes unreproducible as a result. Protocols are rituals, bodily actions ceremoniously repeated. They become “way[s] of knowing the world, and the kinds of ways the body is used [are] constitutive of our subjectivity and ideas.”³⁸⁹ Why not embrace this reality and find ways to work with it

388. Stephenson, *Ritual: A Very Short Introduction*, 95.

389. *Ibid.* 88.

instead of against it? Yes, lack of reproducibility is a problem when working with the scientific method, especially in translational or clinical fields, but throwing out everything learned in an unreproducible experiment is not only throwing out potentially useful information, but also irresponsible or unethical given practitioner's time and effort as well as animal lives potentially sacrificed.

There are multiple ways in which we might think/feel with/through the body. One might be explicitly, by stating outright events, moments, and happenings in our lives that are affecting our day-to-day experience and therefore anything we touch and turn our attention towards.

Christina Sharpe writes about the decision to start her book, *In the Wake*, with a series of deaths in her family:

It was an ethical decision to include them because while I was reading and writing and thinking about Black people being murdered and about what we make in the face of all that structural violence, I was in the midst of so much personal loss. I thought that this loss also needed to be on the page explicitly, not just implicitly in the ways that, whether one admits it or not, one is oriented to one's work from the location of the body and all that that may mean."³⁹⁰

Making affect and the body explicit not only informs and provides context for the work that follows, it prioritizes relations and entanglement, making explicit the complicated ways the author is entangled with her subject, her community, her audience, and society more broadly. She becomes both subject and object. This is why this is an ethical decision for Sharpe. It is a form of resistance, but also a manifestation of her relations, including her relations to the white supremacists she studies and those who would do her violence. It makes explicit the ways in

390. Sharpe, *Ordinary Notes*, 114.

which thinking/feeling from her particular body with all its relations changes the work she does on a day-to-day basis.

We might also think/feel through/with the body in a less explicit, more poetic sense. Karen Bolender developed an art/poetry practice that originated from living in close proximity with pregnant donkey, Aliass, making soap from her milk with surprising materials. She describes the soap and the practice as “a figural substance, a material-semiotic parapoetics that seeks to nourish imaginative action, holding forth a cleansing hope in the form of a rarefied solvent for our environments, languages, and psyches. ...[It] emulates the fleeting and infinite body-to-body intimacies that inscribe the unwritten, entangled autobiographies of every beastly being.”³⁹¹ In thinking through a poetic text-based practice, Bolender writes that she, “needed to find a way to let wordless interweavings of bodies in timeplaces somehow *be the text*.”³⁹² For Bolender, bodies—hers and Aliass’—became tangled in a way that defied description, for which language had no words, that could not be represented. In a footnote, she quotes Jesper Hoffmeyer; “the body... is autobiography in the most immediate and authentic sense of that word.”³⁹³ We may not always have the language with which to describe what it means to think/feel through/with the body, but this does not mean we aren’t doing it every day. Situated work is autobiographical in some sense, acknowledging and paying attention to the ways in which our particular bodies affect the work we do. Keeling, in *Queer OS*, asks, “how does the body function as a theme within theory and art, emerging from queer, ethnic, and feminist

391. Bolender, "R. A. W. Assmilk Soap," 16.

392. Ibid. 13.

393. Ibid. 2.

studies and other related disciplines?"³⁹⁴ I would modify the question to ask how the body functions not just as a theme, but as site, as action, as entangled, relational, autobiography in any discipline, including scientific ones.

394. Keeling, "Queer Os," 155.



Figure 18. *Foot*. An image painted onto a lab book layer of an ultrasound from my pregnancy. The page beneath was the same date as the ultrasound—I went into the lab the afternoon after receiving this image of my body.

Neuroscience could be a field that concerns itself with some of these questions, given its task of studying the mind/body interface and sensation/perception through the nervous system. After all, the field of neuroscience defined the mirror neuron, a class of neuron that not only aids in learning via mimicry but triggers firing patterns in the observer that are *the same patterns* that would be fired if the observer was conducting the action themselves. It can be difficult to wrap our minds around how wild this is—a viewer’s brain will exhibit similar neural activity as a doer’s brain, even when the viewer is not doing anything except watching an action. Mirror neurons have been most commonly documented in humans and closely related primates watching another human or primate complete an action, but there is evidence that similar neurons exist for other sensory modalities like hearing or smelling, and mirror neurons have been observed in birds, mice, rhesus monkeys, and so on, suggesting that many organisms have similarly functioning neurons. Giacomo Rizzolatti in the *New York Times* described them thus; “mirror neurons allow us to grasp the minds of others not through conceptual reasoning but through direct simulation. By feeling, not by thinking.”³⁹⁵ Sounds a lot like sentipensar. Not only that, mirror neurons only function in relation to someone else. We learn, we do, we exist as feeling/thinking creatures in relations with one another and so do many non-human organisms around us, including many of our objects of study.

“Human intelligence has at least six facets: linguistic, musical, logical-mathematical, spatial, bodily-kinaesthetic, and personal. Animals too have multiple intelligences, though the

395. Sandra Blakeslee, “Cells That Read Minds,” *The New York Times*, January 10, 2006, <https://www.nytimes.com/2006/01/10/science/cells-that-read-minds.html>.

list will look different for each species.”³⁹⁶ Bekoff and Pierce, arguing for the moral lives of (non-human) animals, insist that every species might have their own types of intelligences and therefore their own means of managing and manifesting “morality.” This seems inarguable today, as the biosciences continue to expand which animals are granted the label “intelligent” and by extension capable of feeling pain or existential injury. This label carries material consequences as animals deemed capable of feeling pain and existential injury are then granted protections through additional permitting for experiments and stricter animal care protocols. There was a time when that threshold only included humans,³⁹⁷ then was expanded to include mammals, then some vertebrates, and most recently some cephalopods. Despite these expansions, which it should be noted are not the same for each category—there is a hierarchy—there continue to be millions of species considered not intelligent enough to require care and consideration in our treatment of them in the lab and in the field. Even as the biosciences blur the boundaries between species through genetic and molecular manipulation, there continues to be a lack of reconciliation with how we conceptualize our relationships with the non-human animals we study and increasingly remix. Cary Wolfe, citing a Nicole Shukin study, puts it well: “the question of the animal that biopolitics has ignored is not just conceptual or analytical but *material*, involving not just ‘the semiotic currency of animal signs’ but also ‘the carnal traffic in animal substances.’”³⁹⁸ With the rise of CRISPR, optogenetics, directed evolution, and other bioscientific manipulations that insert genes, proteins, and enzymes from one organism into

396. Bekoff and Pierce, *Wild Justice: The Moral Lives of Animals*, 50.

397. And even then, not all humans since women, children, people of colour—especially Black and Indigenous people—queer people, and so on were considered acceptable for experimentation.

398. Wolfe, *Before the Law: Humans and Other Animals in a Biopolitical Frame*, 52.

another, the list of “animal substances” and therefore the “currency of animals” has grown exponentially in the few years between Wolfe’s writing, Shukin’s study, and this thesis. There are material, physical, and embodied consequences to Science’s ongoing refusal to reconcile its relationship with the organisms on which its work is dependent and founded. One major consequence that critical animal studies scholars have been pointing to for at least a decade is the relationship between white supremacy and animality. As Wolfe puts it, “you can’t talk about biopolitics without talking about race, and you can’t talk about race without talking about species, simply because both categories—as history well shows—are so notoriously pliable and unstable, constantly bleeding into and out of each other.”³⁹⁹

Billy-Ray Belcourt wrote an essay in 2015, “Animal Bodies, Colonial Subjects: (Re)Locating Animality in Decolonial Thought,” that shook up the field of critical animal studies by reminding academics of the need to keep race as a key analytic—especially Native and Black studies—and to proceed with caution when working closely with settler-colonial institutions. In the preface to a republication of the essay in 2018, he described the essay as “a call to tend to the incommensurabilities and interconnectedness of Black, brown, and animal life,” resulting in part from “the uneven circuits of affective investment that moved through the field and out into the world.”⁴⁰⁰ His essay made clear the material, physical, and embodied stakes in discourse and ideology around animality given its entanglement with race, heteropatriarchy, and ableism. Belcourt writes of the three primary logics of white supremacy: “slaveability/anti-Black racism,

399. Ibid. 43.

400. Billy-Ray Belcourt, “An Indigenous Critique of Critical Animal Studies,” in *Colonialism and Animality* (Routledge, 2020), 19.

genocide, and orientalism, which anchor capitalism, colonialism, and war, respectively” and goes on to add anthropocentrism as a fourth; an anthropocentrism in which “humanity delivers a kind of livability to those inside its ontological confine, and suffering to those banned from it.”⁴⁰¹ He continues:

Anthropocentrism begets a racial hierarchy that rips indigeneity and blackness from the terrain of the human and then consigns us into the position of the killable. That is, Black and Indigenous peoples are dehumanized and repeatedly inscribed with an animal status—which is always a speciesist rendering of animality as injurious. There is a dual function to this: (1) Black and Indigenous peoples are refused sovereignty that humanness motors and thus made to weather the terror of a life lived in the status of non-being; and (2) animality is made into a loose signifier, a fungible concept, that invites violence of all sorts. ...In white supremacist societies then, animality is a Trojan horse.”⁴⁰²

Animality as a means of marking certain humans as killable, and in scientific practice, marking certain species more killable than others. Belcourt’s implication of “the uneven circuits of affective investment” explicitly ties normative white affectlessness to the problem of animality and the ways in which it is used to dehumanize people of colour. Tuck and Ree, after Haraway’s description of making-killable as a way of making some sub-human and therefore destroyable, define it thus; “making-killable turns people and animals into always already objects ready for violence, genocide, and slavery.”⁴⁰³

Permitting, animal care protocols, and “ethical” husbandry do not relieve the biosciences from its complicity in animality driven racism, genocide, orientalism, and anthropocentrism. Ending all animal-use in laboratories would not solve the problem either because it would not

401. Ibid. 21.

402. Ibid. 21.

403. Tuck and Ree, "Exemplar Chapter 33: A Glossary of Haunting," 649.

end the underlying ideology of white supremacy using animality as a tool to make-killable. There must, instead, be a discourse within the sciences around ethical animal use that is both broad and deep. Which animals are we using to answer specific questions and why? How many must we use and where can we reduce the numbers used to reach “statistical significance?” Can we abandon “statistical significance” entirely if animal lives are involved? Why are some species subject to rigorous animal care protocols and others not and what are those decisions based on? Instead of requiring that organisms prove their intelligence to us in a way we can interpret, can we instead start with all organisms being capable of feeling pain? When we do have to sacrifice an animal, how might we do so in a responsible way, with deep appreciation for the material living and dying that has been deemed necessary? There are charismatic species that inspire affect within us when a death must occur, that we treat with reverence and care in those moments; how can we engender that affect with every animal that is sacrificed? Yes, it may be exhausting, but that exhaustion could instead be a welcome reminder of the vulnerability and care with which we practice our sciences. To return to Haraway, how might we embody a “feminist ethic of ‘response-ability’” in the lab? What would working with “an affective ecology in which creativity and curiosity characterize the experimental forms of life of all kinds of practitioners, not only the humans”⁴⁰⁴ look like in scientific practice?

404. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene*, 68.



Figure 19. *Transmute I*. A fully (re)constructed lab book prior to the sanding transformation.

4.2.4 Autobiographical Monstrosities

I am interested here in practice, in embodied action. I cannot simply think my way into a different way of working and being; I think by doing. The work of (de/re)constructing the laboratory notebook is a physical manifestation of the work of (de/re)constructing myself and my own relations to science, labour, my body, the animals, and my processes of feeling/thinking and being. As Stephenson claims in his theorizing on ritual, “it is easier to act oneself into a new way of thinking than think oneself into a new way of acting.”⁴⁰⁵ And also, “feelings and ideas are not

405. Stephenson, *Ritual: A Very Short Introduction*, 95.

simply absorbed through consciousness but formed, given body through enactment.”⁴⁰⁶ Both of these are true for my own efforts to unlearn and dramatically shift my way of working and my relations with myself and those around me; human and non-human alike. (De/Re)construction meant taking my “scholarly” output down to zero, refocusing on rest and repair, input through reading and studying, and lots of time dedicated to simply thinking and feeling. After dismantling—not in a linear trough shaped graph but a winding, circular, looping, iterative path of dismantle, build, dismantle, try again, dismantle, build, not quite it, dismantle, build, still not there, and so on—a new practice was built. One that valued my time and energy, my mental, physical, and spiritual health, that rehumanized myself and the subjects of my studies; the birds. One that refused to grind myself into an exhausted pulp in the effort to produce, refused to see the sacrifice of the animals as a necessary evil, refused to set parts of myself aside to do the work. One that integrated all the different parts of me I could find, that developed rituals to honour the birds and the physical reality of my own body enacting the work. As Mady Schutzman writes in *Radical Doubt*, “moving, shifting one’s position, provides the very knowledge necessary to know one’s place,”⁴⁰⁷ and many shifts and moves were necessary and are still ongoing to build and sustain this new practice. One of complication, of entanglement, of ritual, of the messy autobiographical body, one that addressed my own race, gender, sexuality, and ability head-on, that made space for rest, care, and maintenance, one that could be vulnerable and open, that felt/thought carefully on living and dying, on animism. (Re)construction meant incorporating all the parts of myself that were feared, that needed love, that were full of rage, that

406. Ibid. 101.

407. Schutzman, *Radical Doubt: The Joker System, after Boal*, 106.

yearned for joy. I wanted to “trek into the Chthulucene to entangle with the ongoing, shaky, unheroic, tentacular, dreadful ones, the ones which/who craft material-semiotic netbags of little use in trials of strength but of great use in bringing home and sharing the means of living and dying well.”⁴⁰⁸ The (re)constructed lab books became my way of exploring what living and dying well might look and feel like, and to see what forms of thinking and being might arise through the embodied act of (re)construction.

Haraway’s Chthulucene posits an embracing of not only the tangled and tentacular, but those deemed dreadful, grotesque, and killable. In the introduction to *Staying with the Trouble*, she describes the chthonic ones:

Replete with tentacles, feelers, digits, cords, whiptails, spider legs, and very unruly hair. ...Chthonic ones are monsters in the best sense; they demonstrate and perform the material meaningfulness of earth processes and critters. They also demonstrate and perform consequences. Chthonic ones are not safe... They make and unmake; they are made and unmade.⁴⁰⁹

Tuck and Ree’s “A Glossary of Haunting” has an entire entry for monsters. They describe the monster as “one who has been wronged and seeks justice. ...Monsters interrupt when the injustice is nearly forgotten. Monsters show up when they are denied; yet there is no understanding the monster.”⁴¹⁰ There is much history in pronouncing the marginalized as monster, as killable and sub-human, and just as much resistance in the form of claiming the monster, recognizing the power of the monster and choosing to take up the label as empowerment. Patriarchy, white supremacy, and colonization have all been built on

408. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene*, 43.

409. *Ibid.* 2.

410. Tuck and Ree, "Exemplar Chapter 33: A Glossary of Haunting," 651.

pathologizing bodies as monstrous and dangerous. The construction of “evidence” to support such pathologizing has (re)produced binaries like natural/synthetic, sane/insane, reason/emotion, logic/magic, mind/body, objective/subjective, neutral/autobiographical, universal/local, public/private, intellectual/sensate, and so on over and over again. Any work that aims to take apart these dichotomies and insist on interpenetration of each of these with one another, requires a certain amount of reclaiming the monster. Existing in a colonial academic white supremacist institution and insisting on expressing my wholeness as a mixed race, genderqueer, gestational parent means claiming a certain amount of monstrosity, even as I seek humanization after trauma. Muñoz puts it well in his analysis of Sartre’s description of emotions:

In Sartre’s paradigm the magical realm of emotions is something we regress into when under duress. It does not take much critical scrutiny to unpack this move as betraying a typically misogynist gender logic that positions men as reasonable and better suited to deploying the world of utensils whereas women (and men who are overly feminine) are cast as a weaker order who must regress to a magical relation with the world. Furthermore, the discussion of magic and regression resonates with an understanding of people of colour as primitives who forsake reason only to hide behind jujus.”⁴¹¹

Existing as a person of colour who denies the binary of man and woman and insists on the importance of emotions and affect means being cast as magical, so why not embrace it? Later Muñoz states, “this craziness was a powerful way of being in the world, a mode of being that those in power needed to call crazy because it challenged the very tenets of their existence.”⁴¹²

Jack Halberstam writes about Frantz Fanon’s refusal of the division between the rational and the

411. Muñoz, "Feeling Brown: Ethnicity and Affect in Ricardo Bracho's" the Sweetest Hangover (and Other Stds)," 71.

412. Ibid. 79.

crazy, and Moten characterizes the end of colonialism as not an end of colonialism alone but an end of the entire perspective from which colonialism makes sense. This means that:

In order to bring colonialism to an end, one does not speak truth to power, one has to inhabit the crazy, nonsensical, ranting language of the other, the other who has been rendered a nonentity by colonialism. ...blackness... is the willingness to be in the space that has been abandoned by colonialism, by rule, by order.⁴¹³

The undercommons is an inverted place where those labelled crazy and monstrous can live freely, where the settler-colonial is afraid to step, where the logic and law and order of the settler-state has no potency.

The (de/re)constructed lab book becomes this place. Between each page of the (de)constructed lab book, complaint, relations, memory, emotions, thinking/feeling, affect, the body, the animals, racism, genocide, orientalism, anthropocentrism, animism, ritual, monstrosity are layered in, physically incorporated in an embodied, active practice that parallels my own autobiographical (de/re)construction. The natural, synthetic, sane, insane, reason, emotion, logic, magic, mind, body, objective, subjective, universal, local, public, private, intellectual, sensate, alive, and dead are interleaved, interpenetrated, and all made to exist at once in relation with one another. None are given priority, there is no hierarchy; instead an erosion of boundaries through sedimentation, accumulation. Each part is given equal attention and care, irrespective of positive or negative valence, each part is allowed to be exactly as it is without judgement, definition, or category. This is the (re)constructed laboratory notebook, a block of material physically

413. Halberstam, "The Wild Beyond: With and for the Undercommons," 5.

manifesting a heterotopic inversion and an object of immense care and vulnerability for myself, personally.



Figure 20. *Spiral*. On the left, a few of the final layers made of paint and medium on a fabric dyed lab book page before laying down the cover of the lab book. On the right, a still from the animation as it progresses through the cover page and into the lab book block.

4.3 Transformation

The (de/re)constructed lab books exist in this state of imploded materiality for a short time before a rupture occurs. The impenetrable block is broken open through a slow and steady methodical process of sanding and photographing, eroding and documenting, loss and archive. It is a slow violence, one that reveals and transforms as it obliterates. Sometimes change requires

violence—is violent—sometimes the marginalized long to turn violence received into violence delivered. Revenge as strategy, monstrosity as figure, horror and haunting as counter to disappearance. Here, where data is transformed into something else entirely, lies an opportunity to look directly at the transformative process, to think/feel through what is required. After all, for transformation to occur, what was must give way to what will come, must be lost in order to find. Some transformations are irreversible; no form of version control will return us to what came before. Stable and established patterns of thought, action, and ways of seeing and understanding the world must be reset. The rupture jars us out of our meaningful engagements with the world, transports us into a dream-like, ungrounded state where all our expectations are turned on their head.⁴¹⁴

“Perhaps a complaint is what we plant, a new growth of some kind that marks the site of violence.”⁴¹⁵ Planting markers at unmarked sites; complaint as a disruption of ongoing violence or past unacknowledged violence. A complaint can point to a violent fracture and demand action. And yet as we’ve seen, markers, complaints, demands for unearthing are often met not only with denial and refusal but with accusation. Tajja Isen, writing about institutional responses to complaints and demands, says:

When faced with the demands of radical collectives, the state often invokes the rhetoric of violence and threat that characterize this type of terroristic situation. It’s a popular, bad-faith way to shore up power: make it look like there’s parity between people seeking basic human rights and hostage-takers seeking to bring down the chandelier of democracy.”⁴¹⁶

414. Jelena Markovic, "Transformative Grief," *European journal of philosophy* (2023).

415. Ahmed, *Complaint!*, 298.

416. Isen, *Some of My Best Friends: Essays on Lip Service*, 147.

Complaints and demands attempting to mark sites of violence are met with violence, accused of violence. A complaint or demand for human rights is interpreted as an act of terrorism, the complainer a traitor to the State, its power, and the status quo. Sara Ahmed writes that “to be a complaint activist is to be willing to cause damage.”⁴¹⁷ Pointing to violence and harm requires a willingness to become a site of violence and harm; the damage of the rupture of complaint encompasses and damages the complainer. Resistance can also cause rupture; it creates discomfort for those in power, who would rather reflect their fear back on those seeking justice than sit in the discomfort created by the rift. Hortense Spillers, thinking through America’s treatment of Black people, imagines what is required to break through the abuse and violence of white supremacist driven rage and fear. She writes that it is necessary “to rupture violently the laws of American behaviour that make such *syntax* possible.”⁴¹⁸ How does one break through ingrained, systematized behaviours in such a way that the structure, *the grammar*, that allows violence to continue is itself ruptured? Sometimes violence is necessary. Some things are too deeply inoculated, too steeped in poison, to be faced with reason, order, law; the tools of the system itself. A rupture is needed, a willingness to be marked as violent in order to point to violence, to cause damage.

Isabelle Stengers and Vinciane Despret might say complaint is too gentle of an act—not violent enough. They write that “it is not a question of a complaint, but rather of a re-appropriation of the past, like an after-shock that makes possible active experimentation as well

417. Ahmed, *Complaint!*, 286.

418. Spillers, "Mama's Baby, Papa's Maybe: An American Grammar Book," 79, emphasis hers.

as fabulation.”⁴¹⁹ The after-shock of an implosion in order to make space for activity, for experiment, for dreaming up difference. Denise Ferreira da Silva also writes of emergence post-implosion, of “a political subject emerging in the scene of obliteration through a sentence without a (self-determined) subject.”⁴²⁰ And yet there is also loss in the disappearance, the obliteration, the rupture. Disappearance is a common institutional strategy to maintain control through fear, through haunting, through the ghost of what is missing. There is power in the instability caused by disappearance, and while the obliteration and disappearance of the lab book block instrumentalizes metaphorical disappearance in order to transform and make anew, disappearance is a dangerous tactic when combined with institutional and authoritative power. Avery Gordon quotes Philippe Sollers on the political power of disappearance:

Philippe Sollers puts it well: ‘Who is called on to disappear? A little bit of everyone, and, by extension, those who will dare to ask what became of you. The social fabric is thus held in suspension... Fear, agony, guilt, anxiety, trouble, pervasive malaise: the living become virtually disappeared, potential specters... It is a question of slow poisoning, a delayed psychic bomb. Identity is changed, it becomes hypnotized.’⁴²¹

Gordon writes:

Systemic disappearance of people is a method of control that requires a calculation... Everyone must know just enough to be terrified, but not enough either to have a clear sense of what is going on or to acquire the proof that is usually required by legal tribunals or other governments for sanction.⁴²²

419. Stengers and Despret, *Women Who Make a Fuss: The Unfaithful Daughters of Virginia Woolf*, 52.

420. Ferreira da Silva, "1 (Life) ÷ 0 (Blackness) = ∞ - ∞ or ∞ / ∞: On Matter Beyond the Equation of Value. E-Flux, 79 (February)," 1.

421. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 124.

422. Ibid. 110.

She continues, “disappearance is a state-sponsored procedure for producing ghosts to harrowingly haunt a population into submission.”⁴²³ Vanishing as few as a single individual in a group, when there is enough confusion around the circumstances of the disappearance, can be enough to completely rupture the social fabric of a community. Those who remain, those who are left behind, are terrorized by the possibility of being next, each shutting down a little more of themselves, slowly, psychically disappearing themselves in order to avoid physical disappearance. Gordon writes, “the power of disappearance is the power to be spoken for, to be vanished as the very condition of your existence.”⁴²⁴ It is a terrifying proposition, the threat and sometimes reality of being transformed into a ghost even as you continue to live, trapped in a non-place between presence and absence, watching parts of yourself and those around you disappear, becoming living spectres. There is horror on both sides: the horror of watching your community reel in fear and confusion while you are unable to assuage their concerns, tell them it will all be okay; and the horror of watching someone you love disappear, wondering who will be next, if it might be you, and if there’s anything you can do to avoid the same fate.

There is also, of course, a connection here between loss through disappearance and loss through purposeful burying, hiding, and silencing. Thus, we circle back to the need to unbury, to unearth, to reveal that which has been disappeared. José Esteban Muñoz writes of the entanglement of evidence and ephemera in the effort to unearth queerness: queer stories, queer archives, queer people, queer histories. Due to the purposeful disappearance of queer history, queer archives, queer materiality, finding evidence of queerness requires looking for ghosts and

423. Ibid. 115.

424. Ibid. 131.

traces. He writes, “the key to queering evidence, and by that I mean the ways in which we prove queerness and read queerness, is by suturing it to the concept of ephemera. Think of ephemera as a trace, the remains, the things that are left, hanging in the air like a rumour.”⁴²⁵ If we want to find queerness, evidence for/of it, we must look for traces, we must entangle evidence and ephemera, while also remembering that some stories may be untellable, unrepresentable. Some stories may evidence themselves only through ephemera and not through a “direct” telling. As my list of materials interleaved within the pages of the (de/re)constructed lab book is subsumed into the whole and no longer separable, definable, dividable, I now dig through the block through sanding, unearthing traces of (re)integration. Photographing the sanding documents and archives transience, process, moments. The photographs assembled into film become evidence of ephemera, a present captured and lost again just as quickly. The lab book block must be obliterated to become anew. Death so that the next may live.

Haraway describes living with the dead as a necessary part of response-ability. She writes, “response-ability is about both absence and presence, killing and nurturing, living and dying,”⁴²⁶ and that “without sustained remembrance, we cannot learn to live with the ghosts and so cannot think.”⁴²⁷ With the lab books, the act of obliteration, especially as an ongoing process rather than a one-time act of transcendence, is a method to live with the dead, to “mourn by bringing the dead into active presence.”⁴²⁸ It creates a tension between evidence and ephemera, and recognizes the power of disappearance, “in which the boundaries of rational and irrational,

425. Muñoz, *Cruising Utopia: The Then and There of Queer Futurity*, 65.

426. Haraway, *Staying with the Trouble: Making Kin in the Chthulucene*, 28.

427. Ibid. 39.

428. Ibid. 7-8.

fact and fiction, subjectivity and objectivity, person and system, force and effect, conscious and unconscious, knowing and not knowing are constitutively unstable.”⁴²⁹ It creates damage, implodes, ruptures violently in order to break open, to mark a site of violence, to make a demand and a complaint, to create space for transformation, for instability, for change. Hopefully one that reverberates into the future as a method of fabulation.



Figure 21: *Ace*. On the left, a piece of ace bandage layered onto a lab book page with medium and paint. On the right, a still from the animation, sanding through the ace bandage layer.

In thinking through the laboratory notebook processing as analogous to scientific and mathematical data manipulations for the sake of statistical analysis, transformation acts as a type

429. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 97.

of hinge, a moment where data swings from one configuration to another, sometimes irreversibly, but always towards an analytical end. There are, however, other manipulations occurring with this particular dataset that are transformative and irreversibly so. Optogenetics, a now-common genetic tool in neuroscientific practice whereby a cell is manipulated to uptake and incorporate DNA from another organism—in this case a light-sensitive protein—was the primary focus of the original version of this thesis. My proposal, written and defended in 2017 and executed in the lab until early 2021, was to develop a set of optogenetic tools in the visual system of the zebra finch and hummingbird. One definition of transformation is exactly this process, the genetic modification of a cell. Then there were all the transformations of neural activity into recordings that could be documented and archived, the transformations of flights into movement tracking data, transformations of tissue into images taken under the microscope, and the final transformation of the bird from one that is alive and in flight to one that is dead, dissected, and sectioned for analysis. I say this rather crudely to be clear about what is happening in these experiments; how animals are transformed into data, quite literally. When I speak of transformation as a means of living with the dead, of exercising response-ability, I am speaking metaphorically about the obliteration of the lab book and its contents, but I am also speaking literally of the animals that were sacrificed to create the content in those pages and the waveform, image, and coordinate data archived on servers and hard drives. One of the major struggles of a thesis (re)configured after the fact, is that of learning to live with the killing and nurturing, the living and dying, that the scientific practice necessitated. There are worthwhile questions around the use of animals for sample size or statistical significance, but setting statistics aside, current scientific practice continues to require the deaths of organisms in support of its own progress. I am not here to argue that animal use must stop, but I am interested in first

how we live with what has already been done when ethics were not a primary consideration, and second in how to continue to work scientifically while maintaining a sense of response-ability. We must learn to live with the ghosts, mourn the dead, bring what has been killed into active presence as opposed to disregarding each as an animal identification code in an infinitely expanding list of animal codes. Standard practice in most labs is to not name animals, to only refer to them as numbers and codes, supposedly to avoid becoming attached or biased, but why should attachment, relationality, or affect be the problem? There are other ways to mask animal IDs when necessary, while still treating each individual as exactly that; a unique individual worthy of care and attention. *Transmute* is one of what I hope will be many efforts to develop methodologies around active living with the dead, a practice in centering transformation and acknowledging every type of transformation that has been necessary to reach this point, while continuing to make space for ongoing and future transformations.

It is worth noting that there is also an aspect of performance in this work, though not for an audience. In addition to the many rituals incorporated during the (re)constructive process, interleaved amongst the physical pages, the arduous and lengthy sanding process is another site of ritual, of performance. The action of sanding, photographing, sanding, photographing, repeated thousands upon thousands of times becomes a ritual. There is a set of repeated motions, shapes inscribed by a repeated gesture, a swipe of wet, a full-body dip under a barrier, the sound of a shutter, the smell of the dust, the dew of sticky plastic coating everything, the whirl of dust collection, the on/off of the sanding motor. Stephenson writes of “transformance, ...meant to emphasize the role of performance in the processes of social, psychological, or spiritual

transformation.”⁴³⁰ There is the physical transformation of a block to dust, of the impenetrable to the captured, of the analogue image to digital pixel, but there is also an ongoing psychological transformation, cited within my body and psyche as both the creator of the lab book and the experiments documented in its original pages, and the obliterater of the lab book block. Years of experiments documented in a book, with years of (de/re)construction layered on, and then months of sanding and photographing. The books in their scientific form held 5.5 years of time. The (de/re)construction of the books took another 1.5 years. The sanding and photographing will take another 1.5 years in total. Layers of time, layers of material, layers of life and death. I become my own witness as I simultaneously destroy and create the document, the evidence, the ephemera. There is a satisfaction, perhaps revenge based, to the destruction and violence occurring at this stage. One that is fuelled by both the delightful surprise at what is unearthed—the incredible ability of the work to surprise me in every moment of its unveiling—and the knowledge that the laboratory notebooks will never take up the same physical or psychological time or space again. The judiciary document, the arbiter of academic and scientific conflict, the grantor of Authority, hundreds of pages of legal evidence, gone. They were already made illegible during the (re)construction process, but after sanding, they are obliterated, only to gain a second life post-transformation in a radically altered, largely “illegible” form.

430. Stephenson, *Ritual: A Very Short Introduction*, 94.



Figure 22. *Feathers*. On the left, juvenile Eagle feathers from Winter Harbor, BC and Anna’s Hummingbird feathers from the lab layered on top of paint and a fabric dyed lab book page. On the right, a still as the animation passes through the feathers and the dyed lab book page.

In their original form, the laboratory notebooks existed to be seen, read, understood, and perhaps reproduced. And yet, the scientific content of these particular notebooks would only be truly understood by a small handful of people on the planet. While the laboratory notebook is not written to be outfacing—its notes are intended to be useful first and foremost to the practitioner and secondarily to others in the same laboratory or field—outfacing scientific literature is only marginally more accessible. Papers that would have been written using the experiments documented within the lab books would have been field and subfield and sub-subfield specific, written in technical jargon that only a slightly larger subset of individuals would have been able to read. Of those readers, even fewer would know what was being done at the practical, day-to-

day, lab-bench experiment level. Increasingly, this impenetrability is recognized as a problem and more and more funding institutions require “outreach” to help bridge the expert/lay gap.⁴³¹ This is where art most often enters the scientific community; instrumentalized as “outreach” to make the technical more accessible to the general public. Grant proposals might now include an infographic, funds for hiring a scientific illustrator, a community-based education program, a children’s book, a beautifully produced video or animation explaining the work, and so on. Rarely does a scientific outreach proposal work with an artist or artistic practice or collective entirely on their terms or in their domain. Even in proposing a scientific thesis turned interdisciplinary towards visual art meant countering those who imagined illustrations of my experiments and findings as the outcome of such a thesis. The contents of the lab book in its original, hand-written, experiments only form, were impenetrable to nearly anyone who may have browsed its pages. The (de/re)construction process combined with the sanding transforms the books into something that may be legible to any visually inclined individual willing to spend some time viewing the images. A new and different type of accessibility occurs and a new and different audience can experience the work. The expanded contents of the book blocks includes more and other, and therefore has the potential to reach more and other people.

Embracing these transformations, in all their messiness, violence, and harm, is the closest I have come to joy in this process. They have become a reminder that “not only can things be otherwise; they already are, and it is a matter of tuning, tending, activating, connecting, and

431. The NSF’s “broader impact statements” discussed in a previous chapter is an example of this.

defending these processes of change that are already in the making.”⁴³² Montgomery and Bergman write:

A joyful process of transformation might involve happiness, but it tends to entail a whole range of feelings at once: it might feel overwhelming, painful, dramatic, and world-shaking, or subtle and uncanny. Joy rarely feels comfortable or easy, because it transforms and reorients people and relationships. Rather than the desire to exploit, control, and direct others, it is resonant with emergent and collective capacities to do things, make things, undo painful habits, and nurture enabling ways of being together.⁴³³

This has been my experience of obliteration, of sanding, of slowly and painstakingly eroding away the block of (de/re)constructed laboratory notebooks. Watching all that was poured into them emerge in a radically altered form, with moments that are familiar and border on the recognizable, undone and unravelling, reoriented and pointing towards something that I am not in control of and not fully conscious of, but am rather a collaborator in, is joy. The images are not ones I could have imagined or purposefully made; they are flashes from the periphery, something just out of reach, a trace of what was. While their origins lie in a known place and time—a known past—they point towards what is still yet to come, what is not yet here or known, what lies beyond. Palimpsestic transformation as a world-making process pointed towards the future.

432. Bergman and Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times*, 27.

433. *Ibid.* 29.

4.4 Animation

Out of the ashes, out of the dust, something emerges, comes to life, becomes animate. After obliteration, after disappearance, transformation can occur and make way for that which did not exist before. Another world, another way of seeing—of being—another spatiotemporal realm. Thinking with Walter Benjamin, Avery Gordon writes, “Benjamin’s materialist historiography depends fundamentally on animation, on being able to demonstrate to others the moment in which an open door comes alive and stops us in our tracks, provoking a different kind of encounter and recognition.”⁴³⁴ Tracing a genealogy, digging up the conditions of production, developing an integrated and more comprehensive view of the questions and problems at hand can lead to shock, astonishment, recognition. Perhaps even a blow, sometimes violent, sometimes frightening, sometimes enraging or disgusting, but a jolt nonetheless; a shake out of the mundane, the status quo, the normative. All the more so if this emergence, this moment of animation, can be shared: “ritual performance involves display, it is meant to be observed, the ritual act is shown to someone, even if that someone is an internalized self;... not necessarily a one time, static event, but... an ongoing dynamic affair.”⁴³⁵ When shared and observed, the moment can expand, spread, infuse. Rather than a single moment, it gains the capacity to live, stretch out across time and space, gain momentum, shift others as it shifts, shift the self as it shifts.

434. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 67.

435. Stephenson, *Ritual: A Very Short Introduction*, 91.

4.4.1 Movement

To animate is to give life. Or it is a description for something/someone possessed of or characterized by life; to be full of life. Animate as possessing life, keeping life, holding life, being filled by life. The Latin *anima* translates to something like “breath, soul” and is responsible not only for the idea of giving life or coming alive (becoming?) but also for the origin of the word “animal.” Soul and animal in the same breath, yet we’ve divided ourselves away from that breath and soul as we divide ourselves away from the animal. *Transmute* is an animation; thousands of frames flickered in quick succession to imply lifelike movement and therefore a life of its own. An animal-like movement; breath, soul. Merriam-Webster reminds us that “a characteristic of animals is their ability to move,”⁴³⁶ and so an animation is thus named because it moves like an animal. Movement itself is uninterested in the ways in which we have divided ourselves away from the animal, the “inanimate” that is “inorganic.” At the atomic level, everything on the planet moves, including the planet itself, so how do we remind ourselves of this mind-boggling fact? How do we humble ourselves with the knowledge that we privileged humans—animals—are not the only ones capable of movement? That others can move and be moved including the inanimate and inorganic? Mady Schutzman discusses the trickster, the shape-shifter, the jokester as one means of staying in motion; to move across and through

436. Animals move at a speed we humans can recognize, interpret, and understand as movement, but fungi and plants move, as do “inanimate” rocks and rivers. They simply move at spatiotemporal scales that humans have difficulty perceiving. Never mind the subatomic movements we are taught in grade school that animate everything made of atoms and molecules. “Animate,” in Merriam-Webster Dictionary, n.d., <https://www.merriam-webster.com/dictionary/animate>.

boundaries and borders. Exceptions to any status quo might be one means to activate the trickster, to manifest a shape-shift. Schutzman writes, “exceptions perpetually reinvigorate ossified rules, laws, routines, and policies that obstruct free movement across virtual and real boundaries.”⁴³⁷ In thinking with and through the trickster, “archetypal, mythological, and literary figure,” Schutzman theorizes means of resistance and inversion. Schutzman “turns to the trickster... to determine ‘how to stay in motion when the world puts barriers in your path’. Trickster... ‘slip[s] the trap of culture’ through joint work, or re-articulation.”⁴³⁸ Movement through, over, and past barriers, cultural traps, institutional structures and systems; a freedom that can be boundary-less. Not just an individualized freedom, but a freedom that breaks bounds and creates space and capacity for the movement of others as well.

Movement can also be theorized as an embodied act and therefore capable of harnessing the power(s) of embodiment discussed in earlier chapters. Leanne Betasamosake Simpson writes that “answers to how to rebuild and how to resurge are therefore derived from a web of consensual relationships that is infused with movement (kinetic) through lived experience and embodiment.”⁴³⁹ Moving your body as an invitation to let yourself be moved. In community, in relations, the movement of many bodies can take on ritual. Multiply movement by performance and things begin to exponentially expand and shift, affecting and manifesting change, accumulating power. A single body in movement is one thing, a web of bodies in communal movement another. Montgomery and bergman write that “things are not defined by what they are

437. Schutzman, *Radical Doubt: The Joker System, after Boal*, 97.

438. Ibid. 111.

439. Simpson, *As We Have Always Done: Indigenous Freedom through Radical Resistance*, 162.

but by what they do: how they affect and are affected by the forces of the world. ...capabilities are not fixed for all time but are constantly shifting.”⁴⁴⁰ These ideas of bodies defined by the kinetic, by affect, by the ability to shift, are not based on edges, limitations, boundaries, but instead by action, movement, and change. Nothing is fixed, everything is change, and so delineation cannot be based on limits but instead must be based in change itself. “All that you touch/You change. All that you Change/Changes you. The only lasting truth/is Change. God is change.”⁴⁴¹

The imagery and movement of the *Transmute* animations recall this beautiful description of Nigerian pirate media by Brian Larkin. Larkin writes:

Pirated images have a hallucinogenic quality. Detail is destroyed as realist representation fades into pulsating, pure light. Facial features are smoothed away, colours are broken down into constituent tones, and bodies fade into one another. Reproduction takes its toll, degrading the image by injecting dropouts and bursts of fuzzy noise, breaking down dialogue into muddy, often inaudible sound.⁴⁴²

The collective creation that is pirate media—dispersed and iterative acts of reproduction—generate a local and specific aesthetic even as it destroys that which it was meant to reproduce. Haunting images and sounds are a direct result of the means of production, shadows and traces of the original, taking on a new life and form through pirate play. There is something of Max Fischer’s description of hauntology in the Hausa video Larkin describes; the image of a place worn away through reproduction and distribution into a “non-place.” Fischer writes about generic places resulting from global capitalism in the form of airports, box stores, strip malls. He

440. Bergman and Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times*, 87.

441. Octavia E. Butler, *Parable of the Sower* (New York: Four Walls Eight Windows, 1993).

442. Larkin, "7 Degraded Images, Distorted Sounds: Nigerian Video and the Infrastructure of Piracy," 307.

expands the notion of generic non-places to time as well, writing, “the disappearance of space goes alongside the disappearance of time: there are non-times as well as non-places.”⁴⁴³ And yet Hausa video, for all its scratching away at representation into something abstract, is not generic or homogenous, it is specific and local. Nigerian pirate media runs counter to the non-place, the non-time. Fisher explores the globalization and internet driven collapse of space and time—“events that are spatially distant become available to audiences instantaneously”⁴⁴⁴—and hauntology or haunting becomes a means of resisting the contraction and homogenization of time and space. “[W]hen a place is stained by time, or when a particular place becomes the site for an encounter with broken time”⁴⁴⁵ haunting and resistance of global homogeneity can occur. The degraded images of pirated media parallel European surrealist art practices including the use of collage and “automatic” modes of creating, producing similar disruptions and moments of resistance. Alenka Zupancic describes “montage in a surrealist collage” as “something appears where it should not be, and thus breaks or interrupts the linearity of time, the harmony of the picture.”⁴⁴⁶ These breaks and interruptions, infrastructural and technological breakdowns, are examples of glitch as not accidental but a tell. Gaps and disappearances as an opening, an invitation, a jolt awake, a recognition of the shape-shift and the presence of the trickster. These moments can birth a new or other archive, an artificial memory bank, an opportunity to catalogue traces and relations of/with time, a provisional media in an alternate spacetime. Here, all can become entangled, moved, simultaneously shifted together and apart, fricative, tense, proximal

443. Fisher, "What Is Hauntology?," 19.

444. Ibid.

445. Ibid.

446. Alenka Zupancic, *The Shortest Shadow: Nietzsche's Philosophy of the Two* (Mit Press, 2003), 178.

and distanced, an implosion and explosion together/apart. Breaking apart and bringing together anew, making room for chance, play and emergence.

4.4.2 Time

José Esteban Muñoz theorizes waiting—resonant with Ahmed’s waiting something out, waiting for something to change—as a symptom of being in opposition to or outside of “straight time.” Thinking with queer films, Muñoz writes about waiting—waiting on film, making the audience wait—as being “out of time,” or “what it is like not to have time at one’s disposal.” Muñoz, by way of a paper by Tavia Nyong’o, connects this waiting to Blackness, stating:

There is something black about waiting. And there is something queer, Latino, and transgender about waiting. Furthermore, there is something disabled, Indigenous, Asian, poor, and so forth about waiting. Those who wait are those of us who are out of time in at least two ways. We have been cast out of straight time’s rhythm, and we have made worlds in our temporal and spatial configurations. Certainly this would be the time of postcoloniality, but it is also crip time or, like the old joke we still use, CPT (coloured people time). It seems like the other’s time is always off.⁴⁴⁷

In *Transmute*, time congeals and uncongeals, is compressed and expanded. Scientific knowledge production compresses time, summing up years of painstaking work at the lab bench in a short paper, while the work of critical theory and the humanities expands time, slowing down and deconstructing specific moments and actions to understand their origins and impacts. Artwork often does both simultaneously. It can compress years of work in the studio in a week or month long exhibition *and* it can take a single gesture or thought and expand, iterate upon, and play

447. Muñoz, *Cruising Utopia: The Then and There of Queer Futurity*, 182-3.

with it for years. The artist and/or the artwork can invite others “to stand out of time together, to resist the stultifying temporality and time that is not ours, that is saturated with violence both visceral and emotional, a time that is not queerness.”⁴⁴⁸ With the layering of different time frames—the dates documented in the lab book, the dates of the (de/re)construction of the lab book blocks, the dates of the sanding and filming, the dates of exhibitions or screenings—*Transmute* (un)congeals time, stands in its own time as another mode of resistance. It becomes both a “gesture [that] interrupts the normative flow of time and movement,”⁴⁴⁹ and a potentiality that has “a temporality that is not in the present but, more nearly, on the horizon, which we can understand as futurity. Potentiality is and is not presence... It is something like a trace or potential that exists or lingers after a performance.”⁴⁵⁰

This constant movement, change, coming together only to fall apart, requires immense attention and energy. It is not a site of fixed principles or stasis, “but instead a capacity to be attuned to the situation, to be immersed in it, and to create something emergent out of the existing conditions.”⁴⁵¹ With non-time, broken time, time out of place, things tend to slow or jump or speed in unpredictable ways. This is the time of trauma but also of healing, of becoming otherwise, all of which are not linear but uneven, messy; “the ‘self’ as a site of multiple, emergent, and enmeshed attachments.”⁴⁵² These enmeshed attachments are broken, reformed, shifting, complicated, and broken again in trauma/healing. This protosymbolic space is “a realm

448. Ibid. 187.

449. Ibid. 91.

450. Ibid. 99.

451. Bergman and Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times*, 202.

452. Loveless, *How to Make Art at the End of the World: A Manifesto for Research-Creation*, 94.

not of symbolic binaries, but of partial connection and emergent knowledges.”⁴⁵³ Non-space and non-time can become sites of value in and of themselves; spatiotemporal non-locations full of possibility. There is “freedom from coherence, clarity, collective representation . . . which may or may not explicate history usefully or unequivocally.”⁴⁵⁴ These words, from historian Nell Irving Painter, were written after she developed an artistic practice that merged history and images into an unbounded scholarship of the two in a form she could not have imagined a priori. Painter finds inspiration and fellowship in Saidiya Hartman’s *Lose Your Mother*: “[Hartman] demonstrated the possibilities of juxtaposition of text and image to make larger, broader, deeper meaning than scholarship alone.”⁴⁵⁵ I think Painter might feel similarly about Christina Sharpe’s recent *Ordinary Notes*, where text, image, anecdote, autobiography, theory, and collective writing in community all come together to build knowledge and ethics. In these examples, “knowledge is emergent, not predictable from its constituent parts.”⁴⁵⁶ There is no part adding up to a whole or a whole broken down into a base reproducible unit. This is the realm of the emergent and arguably the realm of messy, uneven, complicated, shifting, contingent, ever evolving, biology.

453. Ibid.

454. Painter, *Old in Art School*, 317.

455. Ibid. 311.

456. Loveless, *How to Make Art at the End of the World: A Manifesto for Research-Creation*, 93.

4.5 The Remains

“Little ghosts, little birds, a common graveyard, a queer nest.”⁴⁵⁷

~ Sara Ahmed

After transformation, after visualization, after embracing change and movement and shift, how do we move forward? How do we live with the spectres of our actions, live with the dead? How do we account for what is gone and what we cannot imagine for the future? In the Euro-centric scientific practice, a final stage of narrativizing—telling a story with the data, summarizing results, sharing conclusions—occurs. Rather than suggesting a single narrative with a clear conclusion as would typically occur in a scientific paper, *Transmute* offers multiplicities and celebrates uncertainty. Where the biosciences would summarize and account for actions, materials, animals, and recommend a way forward, *Transmute* recognizes its inability to quantify, to count all of its traces, all of its moments. The remnants from the *Transmute* process—an urn of dust, a core sample, a void, a concavity—are simply that; remnants that reflect back the processes that occurred, that point to an emptiness, a lack, a presence that acknowledges absence. These remnants haunt and are haunted. They are layered, multitudinous, shifting, and dynamic. They defy quantification; there is no clear end point or “product” and therefore no static conclusions to be drawn.

457. Ahmed, *Complaint!*, 309.

4.5.1 To Haunt and To Be Haunted

This whole text, maybe the entire thesis inclusive of the artworks and the science, is arguably a “hermeneutics of residue.”⁴⁵⁸ It is a story of ghosts that does its best not to ignore “the living, the real, and the material.”⁴⁵⁹ As Avery Gordon writes in *Ghostly Matters*, “the story is about haunting and about the crucial way in which it mediates between institution and person, creating the possibility of making a life, of becoming something else, in the present and for the future.”⁴⁶⁰ *Transmute* is a haunting. It is a mediator between myself and the institution of modern Western scientific practice, the institution of academia, the institution of a PhD dissertation. It has been my means of making a life—of becoming—right now in this moment of reading, writing, layering, sanding, filming, and processing. It refuses to disappear. Even when it is obliterated it comes back in another form. It initiates and holds a complaint that the institution(s) would not hear. “No walls, no doors are solid enough to stop the ghosts from entering. The complaints in the graveyard can come back to haunt institutions. We can come back to haunt institutions. It is a promise.”⁴⁶¹ The power of the ghost is its unwillingness to stop, the traces it leaves, the trauma it points to, unflinchingly. “Haunting lies precisely in its refusal to stop. Alien (to settlers) and generative for (ghosts), this refusal to stop is its own form of resolving. For

458. Muñoz, *Cruising Utopia: The Then and There of Queer Futurity*, 71.

459. *Ibid.* 41.

460. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 142.

461. Ahmed, *Complaint!*, 308.

ghosts, the haunting *is* the resolving, it is not what needs to be resolved.”⁴⁶² *Transmute* is the resolving, it does not need to be resolved. I do not need to be resolved.



Figure 23. *Transmute II remnant book block*.

Even as it haunts, it is also haunted. It is full of tangled traces, it does not allow disaggregation, it points to absence, it is a seething presence, it is its own ghost story.

To write stories concerning exclusions and invisibilities is to write ghost stories. To write ghost stories implies that ghosts are real, that is to say, that they produce material effects. To impute a kind of objectivity to ghosts implies that, from certain standpoints, the

462. Tuck and Ree, "Exemplar Chapter 33: A Glossary of Haunting," 642, emphasis mine.

dialectics of visibility and invisibility involve a constant negotiation between what can be seen and what is in the shadows.⁴⁶³

Transmute is a material object. It is the manifestation of years of scientific pursuit in the laboratory transformed by conflict, terror, and trauma, that reaggregates that which “objectivity” removed in order to explore other means of reconciliation and resolution. The cost of remaining haunted by remaining within the institution has meant the only way out is through. Gordon describes it thus:

Haunting... is precisely what prevents rational detachment, prevents your willful control, prevents the disaggregation of class struggle and your feelings, motivations, blind spots, craziness, and desires. A haunted society is full of ghosts, and the ghost always carries the message... that the gap between personal and social, public and private, objective and subjective is misleading in the first place. That is to say, it is leading you elsewhere, it is making you see things you did not see before, it is making an impact on you; your relation to things that seemed separate or invisible is changing.⁴⁶⁴

So many relations shifted and changed: within myself to various parts of myself, between myself and my work, between myself and my colleagues, myself and my supervisor(s) and committee members, between my supervisor(s) and their colleagues, between myself and academia, between myself and my partner, my child, my family and friends. No part of my life was left unaffected as these boundaries are misleading in the first place. Letting go of rational detachment, wilful control, was and is a struggle, though one that *Transmute* demanded and simultaneously assisted in developing. Writing the dissertation was another study in haunting from both sides—to be haunted and to haunt. I wondered with Tuck & Ree, think/feeling with

463. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 17.

464. *Ibid.* 98.

Anne Carson's *Autobiography of Red*, how to write/perform autobiography as a "mythic monster." Tuck & Ree write that Carson's work:

Advises of both life's irreducibility to language, and language's power to perform a life, that words can have many folds and be duplicitous, that I am free to rename and unname, that there may be a way to self-write which will not haunt me forever, that stories and their various attachments while they are being put together should also feel like they are on the verge of unravelling, that desire even wrong-desire, is a part of it.⁴⁶⁵

I was already unravelled so how to self-write/perform as the monster, as the ghost, without becoming lost in the shadows? I wanted to tell this story in a way that might "transform a shadow of a life into an undiminished life," but I was unsure about my ability or desire to "touch softly in the spirit of a peaceful reconciliation."⁴⁶⁶ Reconciliation for me felt violent and ruinous, so the work needed to align itself more with Tuck & Ree's version of haunting: "works which inflect our surroundings with the horror and irrational of the everyday, which glance sideways at spectres and the sociological traumas that they haunt."⁴⁶⁷ The objects and images that resolve out of *Transmute* strive to work through and with the horrors of the everyday, keeping the sociological trauma always both in focus and in the periphery.

465. Tuck and Ree, "Exemplar Chapter 33: A Glossary of Haunting," 655.

466. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 208.

467. Tuck and Ree, "Exemplar Chapter 33: A Glossary of Haunting," 646.



Figure 24. *Transmute II remnant dust.*

This internal/external (de/re)construction, transformation, and animation that manifested *Transmute* was a form of self-care in the face of trauma, but not the self-care of white supremacy as expressed through wellness culture. While there may have been moments of peace, moments of joy, there was no peaceful reconciliation, no resolution through dissolution, no chronic disaffected stoicism gained through meditation and mindfulness. As Sara Ahmed think/feels with Audre Lorde's cancer journals, "[t]his kind of self-care is not about one's own happiness. It is about finding ways to exist in a world that is diminishing."⁴⁶⁸ There can be a form of resistance in self-care, perhaps best exemplified in the work of artist Tricia Hersey, creator of The Nap Ministry, a ministry that spreads the gospel of the liberatory power of rest, imagination, and DreamSpace.⁴⁶⁹ There is community to be created and found in rest, in self-care, in directing energy and time away from white supremacy and extractive capitalism, and these do not have to follow the paths laid by mainstream concepts of individualized white wellness. As Ahmed writes:

In directing our care towards ourselves we are redirecting care away from its proper objects, we are not caring for those we are supposed to care for; we are not caring for the bodies deemed worth caring about. And that is why in queer, feminist and anti-racist work self-care is about the creation of community, fragile communities, assembled out of the experiences of being shattered.⁴⁷⁰

There is strength and power in this refusal, this insistence on rest and care for bodies deemed killable, but vulnerability is required as well—after all, to release into rest is to repose in a vulnerable position. Adriana Cavarero, in her analysis of terror vs. horror and terrorism vs.

468. Ahmed, "Selfcare as Warfare."

469. "TRICIA HERSEY," TRICIA HERSEY, n.d., <http://www.triciahersey.com/>.

470. Ahmed, "Selfcare as Warfare."

horrorism, writes of “the two poles of the essential alternative inscribed in the condition of vulnerability: wounding and caring... In this relational context, to recognize oneself as vulnerable signifies recuperating ‘our collective responsibility for the physical lives of one another.’”⁴⁷¹ This is one way in which community and collective care enter; to be vulnerable means admitting to the need for another, the care of another in community so that release and rest can occur. Tearing down communities through terrorism and horrorism, divide and conquer, disappearance, is one way to make killable by ensuring that rest and care are impossible. Without community, there is no one to hold space while you rest. Care and rest itself can and has been weaponized—this is part of Hersey’s resistance, the reclamation of care—and instrumentalized to build empty spectacles, monuments to care where care is not only absent but doing its opposite: causing harm. “Spectacle is not repair,”⁴⁷² Christina Sharpe reminds us. A self-care practice, as a form of resistance against exploitative academic Science, must navigate these entangled spaces, dodging the allure of white wellness, finding and building communities that can hold the wound and create the space necessary for vulnerability. For Hersey, rest is world-making work, work that can build a liberated future. Christina Sharpe puts it well; “care is complicated, gendered, misused. It is often mobilized to enact violence, not assuage it, yet I cannot surrender it. I want acts and accounts of care as shared and distributed risk, as mass refusals of the unbearable life, as total rejections of the dead future.”⁴⁷³

471. Adriana Cavarero, *Horrorism: Naming Contemporary Violence*, trans. William McCuaig (New York: Columbia University Press, 2009), 20-21.

472. Sharpe, *Ordinary Notes*, 36.

473. *Ibid.* 333.

Haunting as a form of resistance, as a telling of another story, a lost or silenced story, *and* maintaining an openness to haunting, to being haunted—haunt as methodology—creates space for a multiplicity of stories, of experiences, of ways of being in the world. John Berger once wrote, “the distance is the future the dead projected when alive,”⁴⁷⁴ but we are alive now, in the present, and we can make space for the acknowledgement of the future the dead projected when alive as well as construct the foundations for our own futures. Many Indigenous teachings frame ethics with seven generations—the seven generations that stretch before and after you—acknowledging the strength, power, and contributions of your ancestors while think/feeling towards the generations that will come after you. Why not tell as many stories of the lost past and present as we can to provide ample and multiple foundations for many possible futures? The palimpsest and haunting(s) are two tools or frameworks that make space for multiplicity in the past, present, and future. *Transmute*'s remains are many-layered, simultaneously pointing to the past conditions of their production, their present state, and their multitudinous futures. Images and video are malleable, they can be projected, timed, and framed in an infinite variety of ways while the remnant objects contain the means of that malleability as well as independent relations amongst themselves. Not only are elements of *Transmute* layered, they enfold on themselves—their past material conditions—and they have the ability to enfold their audience. Cary Wolfe writes of the possibilities of Jacques Derrida's “delinearizing,” which resonates with *Transmute*'s multi-form hybridity and its origins in neuroscientific processes. Derrida's position is not one that differentiates between forms of life, but as quoted by Wolfe, insists instead on

474. Berger, *Hold Everything Dear: Dispatches on Survival and Resistance*, 99.

“multiplying its figures, in complicating, thickening, delinearizing, folding, and dividing the line precisely by making it increase and multiply.”⁴⁷⁵ Wolfe writes:

Not one line, then, but many. But not ‘no line’ either, and a further way of ‘delinearizing’ it is to realize that the material processes—some organic, some not—that give rise to different ways of responding to the world for different living beings are radically asynchronous, moving at different speeds, from the glacial pace of evolutionary adaptations and mutations to the fast dynamics of learning and communication that, through neurophysiological plasticity, literally rewire biological wetware.⁴⁷⁶

Some components of *Transmute* flicker past at a rate faster than the eye can perceive, others progress slower and sometimes appear stopped in time. All exist together and resonate with one another, are essential to each other’s existence, to any kind of understanding of a whole. Each time the story is told—in a different form, medium, or spatiotemporal axis—it is different and those tellings pile up on one another, adding depth, breadth, and meaning. Isabelle Stengers and Vinciane Despret describe this type of multiplicity as “to re-suscitate” or alternatively as “versions.” They write, “to know again is to *re-suscitate*, [*re-susciter*] that is, to once again take up a story, our own, but in a different mode, as if each time it added new dimensions to a question that up to then we had not posed, or had posed differently.”⁴⁷⁷ And of versions, they say:

A version always signals the existence of other versions, versions which do not tell the same story, or offer variations; it keeps the memory of what it was up against, and against which it continues to develop. Its interest is not to erase all the others, but to create, to

475. Wolfe, *Before the Law: Humans and Other Animals in a Biopolitical Frame*, 73.

476. *Ibid.* 74.

477. Stengers and Despret, *Women Who Make a Fuss: The Unfaithful Daughters of Virginia Woolf*, 54.

make apparent, relations which the others silenced, or to which they gave another meaning.”⁴⁷⁸

In their writing, Stengers and Despret enact the thing they describe; different modes, new dimensions, additional relations, meanings, terms, definitions, ways of think/feeling. This plurality reflects the entangled realities of minoritized life under white supremacy, it “includes more of the messy multiplicities that we are: trauma, triggers and brilliance.”⁴⁷⁹ We can be all these things at once. I can be all these things at once. *Transmute* is all these things at once.

478. Ibid. 62.

479. Bergman and Montgomery, *Joyful Militancy: Building Thriving Resistance in Toxic Times*, 239-40.



Figure 25. *Transmute III remnant dust.*

4.5.2 Counting and Accountability

Scientific data analysis typically concludes with a narrativization of the data, a summary of the results slipped into an overarching story “the data tells.” This idea that scientists are simply listening to the story the data is telling is one element in the larger story modern Eurocentric Science tells itself about how and why it functions as it does. Scientific practitioners are impartial observers, “discovering” and gathering up “facts” as they find them out in the world and using statistical and mathematical analyses to reveal a truth. The story goes that scientists are initially indifferent to these facts and data, and any biases or errors practitioners might bring to their experiments can be neutralized or eliminated entirely with statistical analyses. With rigorous data collection methodologies and “sound” statistical analyses, human error can be reduced enough that the truth within the data shines through, unhindered by messy human prejudices and politics. While most practitioners will admit to a certain amount of “spin” or storytelling when it comes to publishing—even more so in top tier, general interest journals—thinking through the sociopolitical work this narrativizing does and how it fits into the larger picture of scientific methodology is not common. Very few will think critically about this narrativizing as a construction itself, an act of interpretation that could not only introduce error at this final stage, but is also a powerful tool of knowledge production in and of itself. Narrative is what gives the data meaning and transforms data into knowledge, empirically correct or not.

We have already discussed at length some of the things that get left out of these stories, these narratives around data, scientific practice, and scientific practitioners. Black and Indigenous scholars and activists remind us of the relationship between accountability and accounting established by slavery, genocide, colonialism, and capitalism, where land and bodies

are divided and counted worthy or not, literally measured and labelled with a price or death.

There are many other elements that are left out when the goal is unaffected neutrality. As

Montgomery and bergman list:

The incredible things that people do when nobody is looking, the ways that people support and care for each other quietly and without recognition, the hesitations and stammerings that come through the encounter with other ways of living and fighting, all the acts of resistance and sabotage that remain secret, the slow transformations that take years or decades, and all the ineffable, joyful movements and struggles that can never be fully captured in words or displayed publicly.⁴⁸⁰

There are some moments, some acts, some theories that remain tucked away on purpose, hidden from the surveilling eye, protected from a hegemony that strives to nullify resistance and care.

Every part of *Transmute* is an inventory of sorts, a collection of “cumulative juxtaposition(s) that reveals the story,”⁴⁸¹ even as there are elements of *Transmute* and its processing that will never be seen by another human eye or experienced by another human body. These moments that occurred when nobody was looking, the accumulation of objects and actions, representations of individuals and collectives, joy and struggle, are in *Transmute* even as they are most often purposefully protected from the public eye. Hannah McGregor writes through and with the list, anecdote, and inventory, referencing Muñoz’s queer ephemera and these forms as “traces of a life.” She writes that “inventory [asks] who does the witnessing, and who is witnessed,”⁴⁸² while also drawing attention to the items that do not make the list. Brian Dillon says it well: “the list, if

480. Ibid. 182.

481. Sarah Schulman, *Conflict Is Not Abuse: Overstating Harm, Community Responsibility, and the Duty of Repair* (arsenal pulp press, 2016), 58.

482. Hannah McGregor, *A Sentimental Education* (Wilfrid Laurier Univ. Press, 2022), 121.

it's doing its job, always leaves something to be invented or recalled, something forgotten in the moment of its making."⁴⁸³ Thus the trace, the ephemera, the residue, and remnant.

And the things that do not make it onto the list? Some things might always remain beyond sensation, perception, and understanding. Zero and naught have power of their own, not just in the act of protection, negation, or refusal but in their ability to represent that which is unrepresentable. Some ghosts may leave traces, but their corporeal presence is forever missing, just outside the frame of perception and understanding. "Naught represents that which is beyond the sphere of the intelligible, the infinite outside the finite."⁴⁸⁴ It can also represent the cyclical and circular, the ouroboros. Tuck and Ree write that for the Olmecs, "zero was also fundamentally temporal, simultaneously marking the beginning of a cycle of time, and its end."⁴⁸⁵ The black hole, the vacuum, an emptiness that is also full, an infinity and circularity that goes on even as its particularities shift and change. The black hole as we currently understand it is both full of all it consumes and empty, ever able to consume more. Infinity and the finite are not so binary, the beginning and the end as not opposites but the same or at least entangled and enfolded, the paradox of representing something that is unrepresentable. None of these dichotomies are real or true, only divisions we invent to make the world intelligible to our particular sensory systems, to communicate with one another, to be in relations.

483. Brian Dillon, *Essayism: On Form, Feeling, and Nonfiction* (New York Review of Books, 2018).

484. Schutzman, *Radical Doubt: The Joker System, after Boal*, 114.

485. Tuck and Ree, "Exemplar Chapter 33: A Glossary of Haunting," 657.

Chapter 5: Demonstrate

5.1 Transmute I

(De/Re)constructed book block prior to the sanding and filming transformation process.

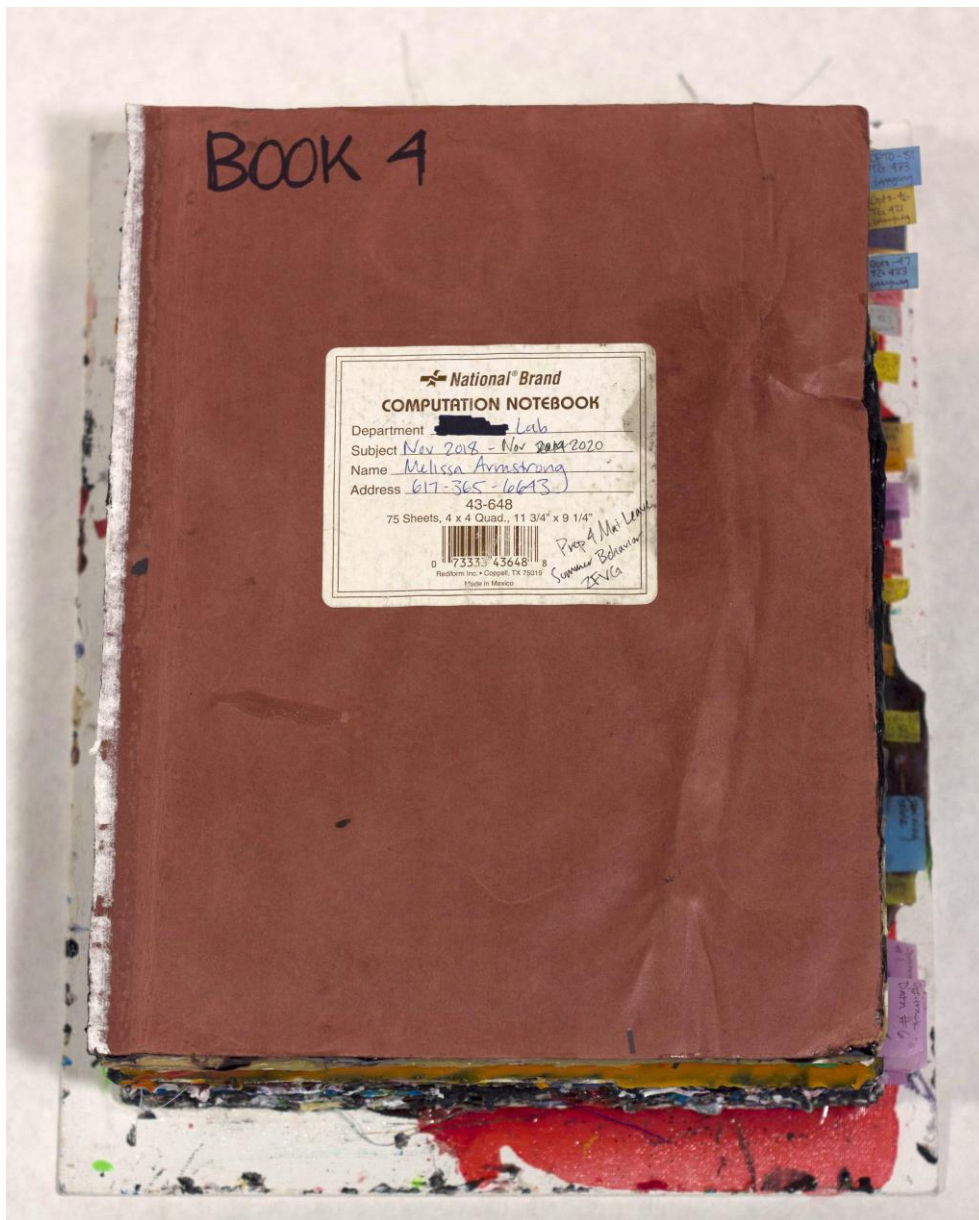


Figure 26. *Transmute I*. Layered lab book block prior to sanding.

Transmute I | 23.5cm x 30cm x 10cm | 2022 – 2024

Materials

canvas wrapped board

laboratory notebooks

zebra finch feathers (*Taeniopygia guttata*)

Anna's hummingbird feathers (*Calypte anna*)

Josh's braided sweetgrass

Morgan's lavender

wood ladder

millet

glitter

acrylic medium

Derek's hair

Hayden's compositions

ashes

bird seed

Mudge Island⁴⁸⁶ sage (*Salvia officinalis*)

chrome flakes

fabric dye

486. Quw'utsun, Snuneymuxw, and Stz'uminus territories.

dust from *Title Unknown*⁴⁸⁷

dust from *Transmute II*⁴⁸⁸

dust from *Transmute III*⁴⁸⁹

metallic thread

ink

paper tape

Vancouver⁴⁹⁰ lavender (*Lavendula officinalis*)

retroreflective movement tracking markers

nesting material

nitrile glove

indexing tabs

oil pastel

watercolour

acrylic paint

mica powder

Mudge Island⁴⁹¹ bleeding heart (*Lamprocapnos spectabilis*), foxglove (*Digitalis purpurea*), and daisy (*Bellis perennis*) dried and pressed inside *The Body Keeps the Score*.

487. Melissa S. Armstrong, "Title Unknown," December 8, 2023, <https://undisciplinedart.com/project/title-unknown/>.

488. Melissa S. Armstrong, "Transmute II," July 12, 2023, <https://undisciplinedart.com/project/transmute-ii/>.

489. Melissa S. Armstrong, "Transmute III," March 22, 2024, <https://undisciplinedart.com/project/transmute-iii/>.

490. Musqueam, Squamish, Stó:lō, and Tseil-Waututh territories.

491. Quw'utsun, Snuneymuxw, and Stz'uminus territories.



Figure 28. *Transmute I*.



Figure 27. *Transmute I*. Layering detail.

5.2 Transmute II

This version of *Transmute II* was screened at [The Morris and Helen Belkin Gallery](#) in Vancouver, BC from May 5 – June 4, 2023 and titled *Transmute ([5.19:11.20] Δ [7.22:2.23])/[5.23:6.23]*. Future exhibitions may take on different forms and screening specific titles.



Figure 29. *Transmute II* as screened at The Morris and Helen Belkin Gallery in 2023.

Transmute ([5.18:11.20] Δ [7.22:2.23])/[5.23:6.23]

Animation | 9:18 | 2022 – 2023

Video 1. *Transmute II*. Available on YouTube here:

<https://www.youtube.com/watch?v=RrAfiY9BwrA>

Transmute II remnants:

Dust | 9cm x 35.5cm x 9cm | 2022 – 2023

Book block | 23.5cm x 30cm x 2cm | 2022 – 2023

Materials

canvas wrapped board

laboratory notebooks

Joelle's shark sticker

zebra finch feathers (*Taeniopygia guttata*)

acrylic medium

ashes

origami crane

bird seed

Mudge Island⁴⁹² sage (*Salvia officinalis*)

chrome flakes

fabric dye

492. Quw'utsun, Snuneymuxw, and Stz'uminus territories.

dust from *Title Unknown*⁴⁹³

metallic thread

ink

bird faeces

paper tape

Vancouver⁴⁹⁴ lavender (*Lavendula officinalis*)

retroreflective movement tracking markers

Hayden's compositions

nesting material

acrylic paint

mica powder

Mudge Island⁴⁹⁵ foxglove (*Digitalis purpurea*) dried and pressed inside *The Body Keeps the Score*.

493. Armstrong, "Title Unknown."

494. Musqueam, Squamish, Stó:lō, and Tseil-Waututh territories.

495. Quw'utsun, Snuneymuxw, and Stz'uminus territories.

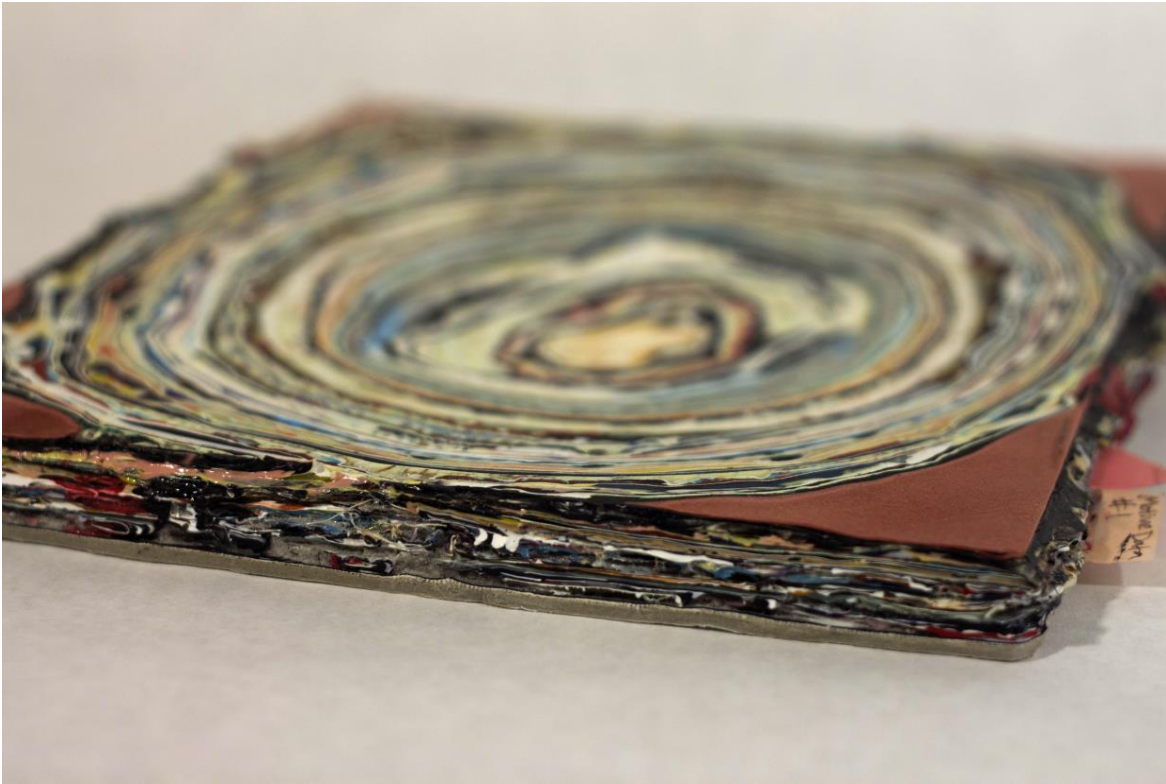


Figure 30. *Transmute II remnant book block detail.*



Figure 31. *Transmute II remnant book block.*



Figure 32. *Transmute II remnant dust.*

5.3 Transmute III

Transmute III

Animation | 8:36 | 2022-2024

Video 2. *Transmute III*. Available on YouTube here:

<https://www.youtube.com/watch?v=h-QpinMC7dA>

Transmute III remnants

Dust | 30cm x 46cm x 12cm | 2022 – 2024

Materials

canvas wrapped board

laboratory notebooks

watercolour

graphite

zebra finch feathers (*Taeniopygia guttata*)

Anna's hummingbird feathers (*Calypte anna*)

150 Mile House⁴⁹⁶ cliff swallow feathers (*Petrochelidon pyrrhonota*)

Dre's diagram

Ace bandage

bird seed

496. Secwepemcúl'ecw territory.

metallic thread

acrylic paint

Vancouver⁴⁹⁷ lavender (*Lavendula officinalis*)

Mudge Island⁴⁹⁸ sage (*Salvia officinalis*)

my hair

aluminum foil

mica powder

oil pastel

Vancouver⁴⁹⁹ Sitka spruce bark (*Picea sitchensis*)

Vancouver⁵⁰⁰ profusion beautyberry (*Callicarpa bodinieri*)

Derek's eye drawing

ashes

sumi ink

reagent labels

indexing tabs

dust from *Title Unknown*⁵⁰¹

dust from *Transmute II*⁵⁰²

fabric dye

497. Musqueam, Squamish, Stó:lō, and Tseil-Waututh territories.

498. Quw'utsun, Snuneymuxw, and Stz'uminus territories.

499. Musqueam, Squamish, Stó:lō, and Tseil-Waututh territories.

500. Musqueam, Squamish, Stó:lō, and Tseil-Waututh territories.

501. Armstrong, "Title Unknown."

502. Armstrong, "Transmute II."

Mudge Island⁵⁰³ bleeding heart (*Lamprocapnos spectabilis*), foxglove (*Digitalis purpurea*), and daisy (*Bellis perennis*) dried and pressed inside *The Body Keeps the Score*

503. Quw'utsun, Snuneymuxw, and Stz'uminus territories.



Figure 33. *Transmute III* remnant dust.



Figure 34. *Transmute III* dust detail.

Chapter 6: Conclusion

“...survival is a radical action; a refusal not to exist until the very end...”⁵⁰⁴

~ Sara Ahmed

I began this PhD a visual neuroscientist interested in questions around how vision shapes action and its integration with movement in a continuous feedback loop. I have also always been an artist, with my primary medium to date being dependent on the visual, which necessarily meant I have been studying vision for much longer than this PhD. As a visual artist interested in sculpture and installation—large scale works that can be moved around or entered into—these studies in vision were always linked to movement. How does perception and therefore understanding change as an audience moves around and through a physical object or space? How do these vision- and movement-based shifts affect meaning-making? What work does observable change across time, either during a single viewing session or across multiple visits, do with the audience and with the work itself? My artwork had an element of discernable change across time, the loss of the object(s), a disappearance often affected by the participation of the audience—human and non-human alike—and/or the entropic effects of time, weather, erosion. The works began as visual objects—objects meant to be seen—but often included other senses like smell and touch and always with a consideration of movement; the movement of light from a flickering candle or the sun in the sky, the movement of the audience around and through, the

504. Ahmed, "Selfcare as Warfare."

movement of the objects themselves in the breeze, in the heat, across time. Movement, shift, change, presence and absence, traces, loss, disappearance, the trickster, joker, shape-shifter.

6.1 The trickster and the hinge

Mady Schutzman writes extensively on the role of the trickster and jokester as existing in gaps, on the side of the marginalized, proliferating in and around the boundaries, making spacetime to support a different kind of flourishing. She writes:

Both are provocateurs and shape-shifters existing in the gaps and gags created by provisional, porous categories. Joker and trickster live to subvert and redraw boundaries. They translate across difference in order to create new cartographies of social space, of community. ...they are always on the side of the underdog, the marginalized, those who have been deprived of their human rights. In proliferating instability and mutability, they do not abandon political rectitude; redistribution of power and resources remains the goal.”⁵⁰⁵

Trickster and joker thrive in the in-between. Their indifference to categories and boundaries insists upon reflexivity as they play and poke at said bounds, making space for and ushering in transformation. Schutzman goes on to theorize working in the in-between as joint-work, an elaboration on articulation that includes both movement and stability; “to articulate is to work at the joints, an in-between place that creates stability and order (by bringing parts together), as well as allowing for movement, for turning or shifting (by creating a separation or interval).”⁵⁰⁶

This articulation itself breaks the dichotomy of stability vs. movement, showing how a joint can

505. Schutzman, *Radical Doubt: The Joker System, after Boal*, 96.

506. *Ibid.* 111.

be both at once, and also speaks to joints as a type of in-between themselves. She writes, “tricksters and jokers ask us to identify with infrastructure, the apparatus that often goes unseen, and with the joints of that infrastructure wherein we can do some artful damage.”⁵⁰⁷ Taking an infrastructure, findings its joints, its soft in-between moments, and pulling them apart to subvert, redraw, make porous, move, or simply draw attention to the invisible apparatus itself. Provoking reflexivity in an inert structure is the power of the medium, the boundary dweller, those in a middle position, tasked with conveying and e/affecting, with supporting flourishing, with transformation.

Transformation has been the hinge around which productive engagements swing throughout the creation of this thesis in its multiple forms, whether that be the science transforming animals into data points, the critical theory transforming my personal experiences and anecdotes into examples of systemic and structural problems and biases, or the artwork transforming “objective” laboratory notebooks into abstract digital films that move through time. Hinges are interpretive, or aid in development of an understanding of what occurred during the transformation. I often recall the hinge as utilized and described by Jordan Abel in *Nishga*, his own PhD thesis submitted as a fully edited and accepted for publication memoir, itself made up of an undisciplined mix of various textual and visual forms. In *Nishga*, Abel theorizes with the hinge as either a symmetrical balancing of two sides in opposition to one another or an asymmetrical hinge which, “on one side... holds my experience and position... and on the other side... holds my dismantling of colonial authority and simultaneous articulation of an Indigenous

507. Ibid. 113.

voice.”⁵⁰⁸ There is a both/and in Abel’s hinge that I find illuminating in thinking through this thesis and the works represented within it. For Abel, the hinge allows him to occupy multiple states, act in multiple forms, move fluidly back and forth through a would-be boundary. He can be more than one thing at the same time, write about and through more than one position or experience, engage in multiple mediums. Abel’s hinge resonates with Schutzman’s joint-work; one can find stability in movement, order in change, a home in fluidity.

6.2 Vision in the body

This PhD began with the visual system: vision in flight, vision in motion, vision as director of action with the locus of that action originating in the brain, mind over matter. But as my studies progressed, I found that this story of the visuomotor system was too emaciated; it lacked nuance, complication, and the messiness of biology. I found that manipulating a single population of cells in the brain—turning them “on” or “off”—was not enough to generate a measurable behavioural change. Vision may be important and able to drive behaviour in some instances, but manipulating one type of vision, one branch in a complicated visual system, or one version of the vision story, was not enough. There are many possible reasons to explain this null result in my studies, not least of which could be the “measurable” part of looking for a behavioural change; perhaps the neural manipulations did work at the level of the neural circuit, but they triggered something like the avian equivalent of a visual hallucination. Or the manipulations worked at the neural population level but were easily overridden by redundancies

⁵⁰⁸ Abel, *Nishga*, 78.

in the visual system that allowed the birds to “ignore” errant signals. Or the simple mechanistic explanation that there was not enough expression of the light-responsive proteins to create a strong enough neural signal to affect downstream pathways. I could fill these conclusions with speculations about why we might see expression of light-responsive proteins under the microscope (figs 1. & 2.), record light-responsive neurons that also respond to wide-field visual motion (fig 3.), and still not measure behavioural changes in flight (fig 6.), but this thesis is not only about visual neuroscience and what we can or cannot conclude based on scientifically produced evidence. This thesis is broader in that it incrementally zooms out to include things occurring in the lab that are not included in experimental results, things occurring in the academic context of graduate school, and things occurring outside of Scientific expectations entirely, all of which I refuse to separate as irrelevant from my scientifically produced results.

When I first started in the lab, I was encouraged to read VS Ramachandran’s book, *Phantoms in the brain*,⁵⁰⁹ a popularization of his neurology work to understand and treat phantom limb pain in amputees with a mirror box. Ramachandran hypothesized that phantom limb pain was caused by a mismatch between the visual system, which told the body that the limb was gone, and the somatosensory system, which insisted that the limb was still present. By putting an amputee’s still present arm in a box with a mirror that made it look like the absent arm had returned, patients would experience the visual sense that both arms were still present. In some cases, restoring “movement”—visual movement of the missing limb and actual movement of the extant limb—to an absent limb would reduce the presence of phantom pains, sometimes

509. V. S. Ramachandran and Sandra Blakeslee, *Phantoms in the Brain: Probing the Mysteries of the Human Mind*, 1st ed. (New York: William Morrow, 1998).

eliminating the pain entirely. While an explanation for why this treatment might work has yet to be confirmed nearly 30 years later, mirror therapy continues to be used to treat a range of situations in which a sensor is incorrectly warning the body that something is wrong, by feeding it signals aimed at turning the warning down or even “resetting” the perceptual system. Neural plasticity allows a region of the brain not typically associated with a particular function to “fill in” when a function fails, called cortical remapping, and it is currently the most likely explanation for why phantom limb pain occurs in the first place, as well as why mirror treatments work for some patients. Cortical remapping is what allows some patients to recover from strokes and other forms of brain damage; training neurons and sensors to respond to different or new stimuli. While Ramachandran’s work and plasticity in general is fascinating and in some ways parallels the contemporary development of embodied cognition, *Phantoms in the brain* became a reminder I would return to often of how little we know about the nervous system, perception, sensation, and cognition. After all, in my comprehensive exam for this PhD, my now-ex-supervisor asked a favourite “gotcha” question: “where is consciousness located in the brain?” The answer is: we have no idea. And without additional deliberation or consideration of what this means for neuroscientific methods of knowledge production, the question becomes a trap rather than an opportunity.

Vision and the senses are never passive, objective, or static; neuroplasticity allows us to be ever-changing, even in adulthood, and also always influenced by previous experience: experiential memories are “hard-wired” into the body. Christina Sharpe writes in *Ordinary Notes*, “visuality is not simply looking. It is a regime of seeing and being, and any so-called

neutral position is a position of power that refuses to recognize itself as such.”⁵¹⁰ Scientific practices are not neutral. Vision is not neutral. The senses are active; our bodies hold memories and those memories and experiences shape what and how we perceive. The pared down “controlled” version of vision we study in the lab is not an exception. At the experimental level, I do not believe that we know enough about active perception, nor do we have the tools yet, to account for or control it in the lab. Additionally, everything that is stripped away in order to make an experiment “work” in the *laboratory* is part of a regime of seeing and being, it is active and *laborious* and therefore *not* neutral. Hypotheses and questions arise from the scientific vision of the practitioner, the apparatuses, and the material resources available in a specific time and place. Our actions in the lab are oriented towards a goal of manifesting an answer to a specific question and are rarely open-ended explorations. Sight is not an objective transmitter of our environment and neither is a lab constructed to study that sight. It might be helpful to recall the presence of hallucination, the possibility inherent in “seeing” that which is not there and what the possibility of hallucination means for neurobiological perception and our understanding of what vision is when it must pass through the wiring of an unruly and dynamic—capable of change—biological nervous system. Peter Schwenger, theorizing with the wildly imaginative *Codex Seraphinianus*, writes that “hallucination suggests a continuum between vision and visualizing, and raises fundamental questions about the ways we distinguish the real from the unreal.”⁵¹¹

Postcolonial theory has things to say about vision that the visual neuroscientist might benefit from think/feeling with. “Visibility is a complex system of permission and prohibition, of

510. Sharpe, *Ordinary Notes*, 123.

511. Schwenger, "Codex Seraphinianus, Hallucinatory Encyclopedia."

presence and absence, punctuated alternately by apparitions and hysterical blindness.”⁵¹² Vision is a regime, it is structured not only by photons in the retina, but by social structures, a priori experiences, learned behaviours, ways of seeing and not-seeing. While Kipnis is speaking here of “visibility,” not of “vision,” there is a link between the two; vision as the eye that sees, visibility as the object that is seen, and the dynamic between them that is structured by relations—how much an object wants to be seen and how much the viewer is willing to see. Layer on as Kipnis does, not just the (un)conscious desire of seer and seen, but also the possibility of apparition or hallucination as well as actual blindness—the blind spot in the human retina is an area with no photo receptors to capture light and therefore start the cascade of reactions that lead to perception—and vision/visibility becomes exponentially complex. The modern Euro-centric Scientific method relies on a kind of false visuality; one that believes that everything can be seen (if only with the help of technology) and that vision itself is objective.⁵¹³ Technologies that aid in visibility prop up this narrative of the neutral apparatus aiding in the extension or amplification of vision; that anything we can observe we can understand and with advanced enough visual technologies we can see and understand everything. This hypervisibility extends externally and internally: externally through increasingly advanced optics aimed at space or at the smallest components of a cell, and internally through surveillance technologies aimed at citizen and non-citizen alike, tracking every action and interpreting intention. Ruha Benjamin writes extensively

512. Laura Kipnis, "Feminism: The Political Conscience of Postmodernism?," *Social Text* (1989), 158.

513. While the name of a microscope objective is derived from its proximity to the object of study—it is the first element of a microscope that light from the object passes through—the proximity of the name to “objectivity” cannot be ignored as one that aids in upholding the idea that both vision and the image rendered by the microscope is “objective” or representative of “truth.”

on what these technologies mean for those being surveilled, sometimes to death, but Avery Gordon sums up the sentiment well:

Hypervisibility is a kind of obscenity of accuracy that abolishes the distinctions between ‘permission and prohibition, presence and absence.’ No shadows, no ghosts. In a culture seemingly ruled by technologies of hypervisibility, we are led to believe not only that everything can be seen, but also that everything is available and accessible for our consumption.⁵¹⁴

Both of these scholars may be thinking from a sociological perspective that overlaps with science and technology, but the hard sciences are not separate from the sociopolitical and so this hypervisibility shows up in the lab and in scientific practices as well. There is no need to acknowledge what might be missing if we think everything can be seen. There is nothing left out of the frame, and no questions to be asked about that which is invisible other than how to develop technologies to make them visible and therefore knowable. Benjamin asks, “by simply challenging what (as opposed to how) we see, do we really leave behind all our assumptions and prior experiences[?]”⁵¹⁵ Neuroscience would say that we literally do not, cannot, leave behind our prior experiences; they are hard-wired into our neural systems, and yet the practice of neuroscience relies on practitioners setting themselves and their experiences aside in the name of objective Science. How can we challenge *how* we see, how visual neuroscience sees, to expand it in a way that makes room for acknowledging assumptions and prior experiences?

While the idea that vision is a regime, very much influenced by the sociopolitical context of the viewer, is thinking with humans as the viewer, it could be expanded to include non-human

514. Gordon, *Ghostly Matters: Haunting and the Sociological Imagination*, 16.

515. Benjamin, *Race after Technology: Abolitionist Tools for the New Jim Code*, 171.

animals, my experimental subjects, as well. Zebra finches are social animals, meaning they maintain long lasting relationships with one another, both with mates and with others in the flock. There is no reason to believe that their perception, their vision, would not be mediated by those social structures, their learned behaviours, and their individual and collective a priori experiences. How might the questions asked in avian visual neuroscience be adjusted to acknowledge and include the expansiveness of zebra finch experience? How might my own studies have shifted if the social implications of vision for the birds themselves were included in the planning and execution of experiments? In my flight behaviour experiments, I flew birds in groups in order to avoid stress-inducing isolation and to generally encourage more flights, but it was then expected that data tidying, statistical analyses, and resultant narratives ignore, remove, or mention this fact only in passing rather than addressing it as integral to the study of these animals. Reductive biological practices do not have the capacity to address these complications and so strip them away in an effort to remove confounding factors. What new and other questions could have been asked if our study organisms were approached with curiosity rather than control? What knowledge(s) are we missing when the conditions that create the data and then analyse it are fundamentally different from the ethology of the subjects of study themselves? How can scientific practice become expansive rather than reductive, layered rather than stripped, nuanced and complicated rather than an over-simplified single story?

6.3 Expansion

“Not imaginaries of some future or elsewhere to arrive at or be achieved as a political goal but, rather imaginaries with material existences in the thick now of the present— imaginaries that are attuned to the condensations of past and future condensed into each moment; imaginaries that entail superpositions of many beings and times, multiple im/possibilities that coexist and are iteratively intr-actively reconfigured; imaginaries that are material explorations of the mutual indeterminacies of being and time.”⁵¹⁶

~ Karen Barad

Expanding neuroscience to include the unknowable and the incomprehensibility of the nervous system as it exists, fully integrated with the body, with prior experience, with memory, and with its ability to shift and change is a dream of this thesis. So is expanding neuroscience to acknowledge the biases of practitioner vision, the sociopolitical material conditions of the laboratory and the scientific apparatus, the direct influence of capital in the form of funding regimes and expectations, the dangers of reductionism and determinacy, the assumptions of statistics and the exiling of “deviant” data. Expanding neuroscience to include the context and prior experience of our subjects of study, the ethologies that drive their behaviours, their actions, their decisions, allowing our subjects of study the power to lead us in a direction of mutual interest, to guide us towards the important questions of relevance to them still another. These are some of the recommendations of this thesis, all stemming from the question of how might we approach neuroscience with abundance, with expansiveness, with room for more and other? Deboleena Roy, thinking with Isabelle Stengers’ concept of “cosmopolitics,” writes:

516. Karen Barad, "Transmaterialities," *GLQ* 21, no. 2-3 (2015), 388.

[Stengers] presents it as a means to ‘consider’ that which is not in our own manner of thinking, and to come to a place where all forms of inquiry and ways of knowing are seen as having a legitimate place in the cosmos. Instead of searching for a distinction between ‘truth’ and ‘fiction,’ or science and myth, she implores us to turn towards that unknown space where we stop silencing the question with which we are unfamiliar or uneasy.⁵¹⁷

Let us take up the questions that make us uneasy, that are unfamiliar. Let us practice a science of expansion beyond our disciplined ways of thinking.

This expansiveness may mean moving out of or expanding beyond the walls of the academy. This expansiveness may be too big for an academy that continues gate-keeping as one of its primary functions, that teaches a professionalism of exclusion, expects a collegiality of silence, that practices the blinding of “mind your business.” Or it may mean working within the academy but as a subversive intellectual, resisting the invisibilizing of that which does not maintain the status quo, the pathologizing and erasing of the deviant data, individuals, and practices, refusing the affectlessness of white supremacy and insisting on bringing forth the whole of the self and community. And doing the work of resistance, within or without the institution, with love, for as Audre Lorde wrote in *Sister Outsider*, “if they cannot love and resist at the same time, they will probably not survive.”⁵¹⁸ Affect must not only be acknowledged and respected as its own form of data, but as part of the foundation upon which we live and work; the drive that keeps us to task, that powers our resistance, survival, and thriving. For in resistance is hope, and in hope is resistance; all of which are kept afloat within our webs of relations, whether in the lab, in the academy, in the studio, or in the home.

517. Deboleena Roy, "Cosmopolitics and the Brain: The Co-Becoming of Practices in Feminism and Neuroscience," in *Neurofeminism: Issues at the Intersection of Feminist Theory and Cognitive Science* (Springer, 2012), 185.

518. Lorde, *Sister Outsider: Essays and Speeches*, 74.

And what can Science learn from art in terms of practices, changes to scientific methods and education, not just in terms of visual communication techniques but in terms of the actual methodologies of scientific knowledge-production? I have listed the ways in which I found an art education beneficial in scientific practice, potentially more beneficial than my peers with traditional science educations, but what are the implications of this realization for science education? Without simply taking from the arts, instrumentalizing arts-based techniques for the sake of more efficiently training scientists in traditional disciplinary expectations, how can scientific practice *change*, truly shift into new and different directions and methods in collaboration with the arts? Could this occur by celebrating deviant data instead of throwing it out? By developing methods for following the sawdust, sifting through the scraps on the editing room floor? By honouring and acknowledging the already significant role intuition and creative play in scientific practice and leaning into irrational insights and unexplainable hunches? By releasing itself from the explanatory instrumentation of scientific knowledge and the narrative of progress and instead embracing a slow and thoughtful process of entanglement, complexity, and complication? Can science embrace play as method without falling into the trap of “the fable of ‘free’ research, driven by curiosity alone towards the discovery of the mysteries of the world (the kind of candy that helps so many well-meaning scientists to set about seducing childish souls)”⁵¹⁹ I often feel like one of those childish souls, entrapped by a desire to explore the world through curiosity. How does a scientist maintain the wonder that brought them to the practice in the first place, while remaining grounded and knowledgeable about the costs; in capital and in

519. Stengers, *Another Science Is Possible: A Manifesto for Slow Science*, 6.

the lives, livelihoods, health, and well-being of its practitioners and communities across the globe that are negatively affected by scientific outputs?

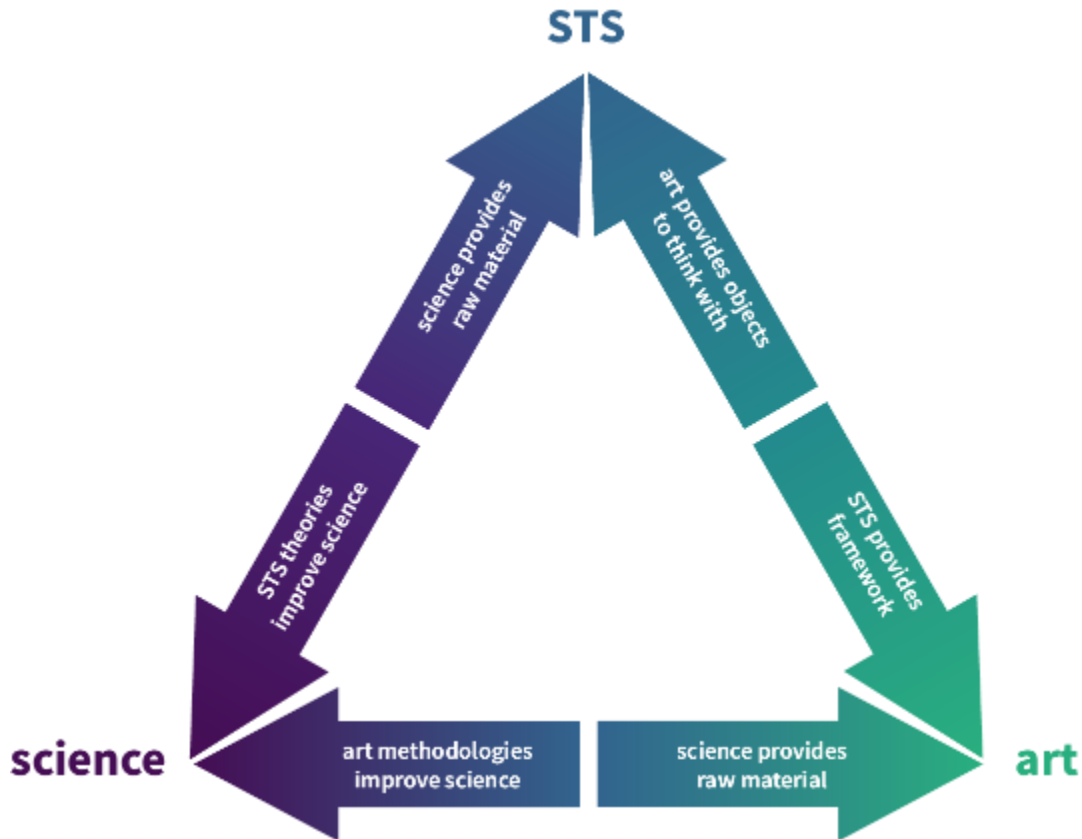


Figure 35. Schematic of my disciplinary relations. An illustration of the interstices and relations between the primary disciplines represented in the thesis. Thinking through iterations, elaborations, and expansions of these and other relationships is one possible future direction that grows from the work of this thesis.

These could become a list of recommendations—for science education, for art and science collaborations, for scientific and academic practices—but I wonder how we might, once again, learn from artistic practices even here, in the conclusion. One of the things I love the most about art and artistic production is not only the openness of the field itself—the expansiveness with which art always seems to be expanding its borders, naming more and more things and

practices and ways of being “art”—but also the expansiveness with which it approaches conclusions. The artworks I am most drawn to are those that are open, that invite the audience in without telling them how or what to see and feel. Artworks that provide a substrate upon which a viewer can bring forth and explore the interplay of their own thoughts and ideas, their own sensations and perceptions, their own memories and experiences. Sure, the artist creates their work with specific ideas in mind, modes of production, concepts to explore, materializations to manifest, and so on, but once the work is out in the world it moves through the viewing community on the community’s terms. The audience, the public, “closes” the work with their readings and interpretations, their questions and curiosities, and the audience carries their experience of the work into their own lives, contexts, and communities to be integrated, elaborated upon, or forgotten entirely. Rather than telling you how or what to read, see, and feel about this thesis, how might I leave it open enough for you to bring your own thoughts, feelings, body, and mind to the works contained within? I have said a lot in these pages, probably too much; have I left enough space for you? Is there enough substrate, enough medium, to support you in your own thoughts and feelings, to allow you room to breathe and grow, without leading you to a closed and air-tight conclusion?

This thesis, in all of its varied forms, works with the palimpsest as its base, as a means of expansion, layering, nuance, and complication in reaction against the reduction and emaciation of a simplistic single story. Originating from a time when writing surfaces were rare and therefore reused, the word “palimpsest” refers to the layering that occurred as a writing surface was wiped clean in order to make way for a new text. What is particularly interesting about this ancient recycling of surfaces is that many of the processes used to erase the previous text were not entirely effective and with time the original script might show through. For modern scholars,

this has meant ancient “erased” texts are often retrievable, either through a process of removing the more recent or through imaging techniques that are able to “see” the previous text below the current surface. There are numerous ways in which this thesis works with the palimpsestic form, sometimes quite literally as physical pages are layered on top of one another, obliterating what came before with the next, and sometimes metaphorically as one narrative replaces another while still allowing the previous to show through. The palimpsest is violent, both in the erasure of the old to make way for the new, and in the removal of the new to reveal the old. It is disruptive, with the traces and ghosts of past texts showing themselves, making themselves known in the present and future, refusing to be disappeared. It can contain the past, present, and future all at once, an object that embodies José Esteban Muñoz’s call to bind evidence and ephemerality; a queer, heterogenous object that defies boundaries and resists disciplining. It is haunted and haunting, an embodied monstrosity, capable of alchemizing individual components added into a multi-temporal entangled mess. I think of his quote that “turning to the aesthetic in the case of queerness is nothing like an escape from the social realm, insofar as queer aesthetics map future social relations. Queerness is also a performative because it is not simply a being but a doing for and toward the future.” The palimpsest as map, as relations, as being, and also doing. Layers of activity, superimposed without loss, but so thoroughly remixed that they can no longer be separated out, delineated, defined, or differentiated. I cannot cleanly separate out all the components of this thesis, though I have tried to for the sake of this text. My experiences in the lab, conducting research, managing relations, documenting conflict, internalizing disciplining, learning specialization and professionalization, cannot be separated from who I am, how I work and think, my perceptions and memories and aspirations, nor from the artwork in its multiple forms.

6.4 World-making

My hope here is that this thesis can serve as a form of world-making; a means of expansion, proliferation, and imagining towards a different possible future. While for me the scientific process does not continue, perhaps someday it will be resurrected in an unrecognizable form, one that is able to “appropriate and reimagine science and technology for liberatory ends.”⁵²⁰ For now, I must remain content with the development of a practice that transforms the scientific into something else entirely: art and writing in multi-temporal and hybrid forms that acknowledges the past and its ghosts (is situated), while continuing to work towards the future. Repetition, iteration, and (re)telling in different forms, are world-making and knowledge-producing in and of themselves. My hope is for the creation of Natalie Loveless’ chimera, as described in her theorizing of the field of “research-creation.” Loveless writes:

research-creation... is designed to produce polymaths skilled at working in multiple modalities, not just vocalities. It produces hybrid forms, defamiliarizing and uncanny, that oscillate between more than one “species” of production and that result in “offspring” that are often unthinkable, illegible within the current institutional frameworks of academia. It creates a chimera.⁵²¹

I also think of this description of the disabled, queer, multi-lingual, polymath Rydra Wong, the heart of Samuel Delany’s science fiction novel *Babel-17*: “She cut through worlds, and joined them—that’s the important part—so that both became bigger.”⁵²² How to cut through the bounded, divided, disciplined worlds within the academic structure, not to cut them down but to

520. Benjamin, *Race after Technology: Abolitionist Tools for the New Jim Code*, 195.

521. Loveless, *How to Make Art at the End of the World: A Manifesto for Research-Creation*, 56.

522. Samuel R. Delany, *Babel-17* (Boston: Gregg Press, 1976), 205.

join them together, so that they collectively become bigger, become more, become other. A desire for “this imagining to generate more such imaginings, such that the nodes on the map and the map itself multiply, proliferate, regenerate.”⁵²³ This effort is a medicinal practice, one that reminds me “that we and ours have been building livable worlds all along, despite and against forces aligned to steal our light, and that we will continue to do so no matter what comes our way.”⁵²⁴

523. Kafer, *Feminist, Queer, Crip*, 18.

524. Maynard and Simpson, *Rehearsals for Living*, 28.

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Appendices

Appendix A

PhD Experimental Animal Use Record and Vivarium

	Species	Age	Sex	Bird Code	Mass (g)	Sac/Died	Arrival Date	Sac/Died Date	Experiments
2	Taeniopygia guttata	Adult	Male	TAEGU-0308	14	Sac	09/02/2016	9/9/2016	TAEGU-AG-EPHYS-16-22
3	Taeniopygia guttata	Adult	Male	TAEGU-0309	17	Sac	09/02/2016	9/10/2016	TAEGU-AG-EPHYS-16-23
4	Taeniopygia guttata	Adult	Male	TAEGU-0310	15	Sac	09/02/2016	9/16/2016	TAEGU-AG-EPHYS-16-24
5	Taeniopygia guttata	Adult	Male	TAEGU-0311	17	Sac	09/02/2016	9/17/2016	TAEGU-AG-EPHYS-16-25
6	Taeniopygia guttata	Adult	Male	TAEGU-0313	13.5	Sac	09/02/2016	9/23/2016	TAEGU-AG-EPHYS-16-27
7	Taeniopygia guttata	Adult	Male	TAEGU-0314	17	Sac	09/02/2016	9/24/2016	TAEGU-AG-EPHYS-16-28
8	Taeniopygia guttata	Adult	Male	TAEGU-0315	17	Sac	09/02/2016	9/25/2016	TAEGU-AG-EPHYS-16-29
9	Taeniopygia guttata	Adult	Male	TAEGU-0318	13	Sac	09/02/2016	9/30/2016	TAEGU-AG-EPHYS-16-32
10	Taeniopygia guttata	Adult	Male	TAEGU-0320	13	Sac	09/02/2016	12/14/2016	TAEGU-AG-EPHYS-16-33
11	Taeniopygia guttata	Adult	Male	TAEGU-0321	17	Sac	09/02/2016	12/14/2016	TAEGU-AG-EPHYS-16-33
12	Taeniopygia guttata	Adult	Male	TAEGU-0322	14	Sac	09/02/2016	1/18/2017	TAEGU-AG-EPHYS-16-34

13	Taeniopygia guttata	Adult	Male	TAEGU- 0324	17	Sac	09/02/2016	3/28/2017	MSA-OPTO-001
14	Taeniopygia guttata	Adult	Male	TAEGU- 0325	20	Sac	09/02/2016	3/13/2017	MSA-OPTO-002
15	Taeniopygia guttata	Adult	Male	TAEGU- 0326	17	Sac	09/02/2016	3/19/2017	MSA-OPTO-003
16	Taeniopygia guttata	Adult	Male	TAEGU- 0327	15	Sac	09/02/2016	3/28/2017	MSA-OPTO-004
17	Taeniopygia guttata	Adult	Male	TAEGU- 0328	14	Sac	09/02/2016	3/23/2017	MSA-OPTO-005
18	Taeniopygia guttata	Adult	Male	TAEGU- 0329	12	Sac	09/02/2016	3/29/2017	MSA-OPTO-006
19	Taeniopygia guttata	Adult	Male	TAEGU- 0332	14	Died	03/31/2017	4/27/2017	MSA-OPTO-007
20	Taeniopygia guttata	Adult	Male	TAEGU- 0334	16	Sac	03/31/2017	5/18/2017	MSA-OPTO-008
21	Taeniopygia guttata	Adult	Male	TAEGU- 0335	14	Died	03/31/2017	3/17/2011	MSA-OPTO-009
22	Taeniopygia guttata	Adult	Male	TAEGU- 0338	17	Sac	03/31/2017	5/19/2017	MSA-OPTO-010
23	Taeniopygia guttata	Adult	Male	TAEGU- 0348	15	Sac	03/31/2017	5/30/2017	MSA-OPTO
24	Taeniopygia guttata	Adult	Male	TAEGU- 0349	16	Sac	03/31/2017	9/18/17	MSA-OPTO-011
25	Taeniopygia guttata	Adult	Male	TAEGU- 0350	18	Sac	03/31/2017	8/4/2017	MSA-OPTO-012
26	Taeniopygia guttata	Adult	Male	TAEGU- 0350	18	Sac	03/31/2017	4/17/2008	MSA-OPTO-012
27	Taeniopygia guttata	Adult	Male	TAEGU- 0351	19	Sac	03/31/2017	6/5/2017	MSA-OPTO-013
28	Taeniopygia guttata	Adult	Male	TAEGU- 0352	13	Sac	03/31/2017	7/19/2017	MSA-OPTO-014

29	Taeniopygia guttata	Adult	Male	TAEGU- 0353	17	Sac	03/31/2017	8/7/2017	MSA-OPTO-015
30	Taeniopygia guttata	Adult	Male	TAEGU- 0353	17	Sac	03/31/2017	7/17/2008	MSA-OPTO-015
31	Taeniopygia guttata	Adult	Male	TAEGU- 0366	16	Sac	08/12/2017	9/29/17	MSA-OPTO-016
32	Taeniopygia guttata	Adult	Male	TAEGU- 0368	15	Sac	08/12/2017	1/17/2011	OPTO-017
33	Taeniopygia guttata	Adult	Male	TAEGU- 0369	16	Died	08/12/2017	01/20/18	MSA-OPTO-018
34	Taeniopygia guttata	Adult	Male	TAEGU- 0370	15	Sac	08/12/2017	9/13/17	MSA-OPTO-019
35	Taeniopygia guttata	Adult	Male	TAEGU- 0371	17	Sac	08/12/2017	10/17/2011	MSA-OPTO-019
36	Taeniopygia guttata	Adult	Male	TAEGU- 0373	13	Sac	08/12/2017	7/17/2010	OPTO-020
37	Taeniopygia guttata	Adult	Male	TAEGU- 0374	15	Sac	08/12/2017	12/17/2011	OPTO-020
38	Taeniopygia guttata	Adult	Male	TAEGU- 0375	16	Sac	08/12/2017	5/8/2018	OPTO-021
39	Taeniopygia guttata	Adult	Male	TAEGU- 0377	15	Sac	08/12/2017	11/14/17	OPTO-022
40	Taeniopygia guttata	Adult	Male	TAEGU- 0378	15	Sac	08/12/2017	5/8/2018	OPTO-023
41	Taeniopygia guttata	Adult	Male	TAEGU- 0381	15	Sac	08/12/2017	11/13/17	TG-381-marker
42	Taeniopygia guttata	Adult	Male	TAEGU- 0382	15	Sac	08/12/2017	12/18/2005	OPTO-024
43	Taeniopygia guttata	Adult	Male	TAEGU- 0383	15	Sac	08/12/2017	4/14/18	OPTO-025
44	Taeniopygia guttata	Adult	Male	TAEGU- 0384	15	Sac	08/12/2017	7/18/2004	OPTO-026

45	Taeniopygia guttata	Adult	Male	TAEGU- 0385	14	Sac	08/12/2017	4/28/18	OPTO-027
46	Taeniopygia guttata	Adult	Male	TAEGU- 0386	14	Sac	08/12/2017	12/18/2005	OPTO-028
47	Taeniopygia guttata	Adult	Male	TAEGU- 0387	13	Sac	08/12/2017	5/18/18	OPTO-029
48	Taeniopygia guttata	Adult	Male	TAEGU- 0392	17	Sac	08/12/2017	4/28/18	OPTO-030
49	Taeniopygia guttata	Adult	Male	TAEGU- 0393	17	Sac	08/12/2017	7/18/2008	OPTO-031
50	Taeniopygia guttata	Adult	Male	TAEGU- 0394	13	Sac	08/12/2017	4/16/18	OPTO-032
51	Taeniopygia guttata	Adult	Male	TAEGU- 0395	14	Sac	08/12/2017	4/16/18	OPTO-033
52	Taeniopygia guttata	Adult	Male	TAEGU- 0396	15	Sac	03/06/2018	7/18/2008	OPTO-034
53	Taeniopygia guttata	Adult	Male	TAEGU- 0397	13	Euthanized	03/06/2018	4/28/18	NA
54	Taeniopygia guttata	Adult	Male	TAEGU- 0400	14	Sac	03/06/2018	8/17/18	OPTO-035
55	Taeniopygia guttata	Adult	Male	TAEGU- 0401	15	Sac	03/06/2018	1/30/2019	OPTO-036
56	Taeniopygia guttata	Adult	Male	TAEGU- 0402	14	Sac	03/06/2018	8/20/18	OPTO-037
57	Taeniopygia guttata	Adult	Male	TAEGU- 0403	14	Died	3/06/2018	01/20/2020	OPTO-038
58	Taeniopygia guttata	Adult	Male	TAEGU- 0404	14	Died	03/06/2018	5/25/18	OPTO-039
59	Taeniopygia guttata	Adult	Male	TAEGU- 0405	13	Died	03/06/2019	01/29/2019	OPTO-039
60	Taeniopygia guttata	Adult	Male	TAEGU- 0406	17	Died	03/06/2018	2/21/2019	OPTO-040

61	Taeniopygia guttata	Adult	Male	TAEGU- 0407	15	Died	03/06/2018	10/22/18	OPTO-041
62	Taeniopygia guttata	Adult	Male	TAEGU- 0409	15	Died	03/06/2018	7/18/2008	OPTO-042
63	Taeniopygia guttata	Adult	Male	TAEGU- 0410	14	Sac	03/06/2018	2/08/2019	OPTO-043
64	Taeniopygia guttata	Adult	Male	TAEGU- 0411	16	Sac	03/06/2018	08/16/2019	OPTO-044
65	Taeniopygia guttata	Adult	Male	TAEGU- 0412	14	Sac	03/06/2018	12/19/2018	OPTO-045
66	Taeniopygia guttata	Adult	Male	TAEGU- 0413	14	Sac	03/06/2018	12/18/2010	ethanize
67	Taeniopygia guttata	Adult	Male	TAEGU- 0420	16	sac	09/27/2018	03/14/20	ZFVG/2visual02
68	Taeniopygia guttata	Adult	Male	TAEGU- 0421	14	Sac	09/27/2018	1/11/2019	OPTO-046
69	Taeniopygia guttata	Adult	Male	TAEGU- 0423	14	Sac	09/27/2018	1/11/2019	OPTO-047
70	Taeniopygia guttata	Adult	Male	TAEGU- 0427	16	Sac	09/27/2018	1/11/2019	OPTO-048
71	Taeniopygia guttata	Adult	Male	TAEGU- 0428	16	Sac	09/27/2018	1.24.2019	OPTO-049
72	Taeniopygia guttata	Adult	Male	TAEGU- 0430	15	Sac	09/27/2018	03/20/20	OPTO-050
73	Taeniopygia guttata	Adult	Male	TAEGU- 0433	15	Sac	09/27/2018	1/11/2019	OPTO-051
74	Taeniopygia guttata	Adult	Male	TAEGU- 0456	14	Sac	04/12/2019	10/18/19	ZFVG
75	Taeniopygia guttata	Adult	Male	TAEGU- 0456	14	Sac	4/12/2019	10/18/2019	ZFVG
76	Taeniopygia guttata	Adult	Male	TAEGU- 0457	20	sac	04/12/2019	03/24/20	ZFVG/2visual03

77	Taeniopygia guttata	Adult	Male	TAEGU- 0458	20	sac	04/12/2019	03/24/20	ZFVG/2visual04
78	Taeniopygia guttata	Adult	Male	TAEGU- 0459	20	Sac	04/12/2019	03/16/20	ZFVG/IOCI
79	Taeniopygia guttata	Adult	Male	TAEGU- 0463		Sac	04/12/2019	03/20/20	ZFVG
80	Taeniopygia guttata	Adult	Male	TAEGU- 0465		Sac	04/12/2019	03/20/20	ZFVG
81	Taeniopygia guttata	Adult	Male	TAEGU- 0466	15	sac	04/12/2019	03/14/20	ZFVG/IOCI
82	Taeniopygia guttata	Adult	Male	TAEGU- 0519	16	Sac	10/08/2020	04/13/2021	OPTO-059
83	Taeniopygia gutatta	Adult	Male	TAEGU- 0521	14	Died	10/08/2020	01/12/2021	TG-OP-57
84	Taeniopygia gutatta	Adult	Male	TAEGU- 0522	14	Sac	10/08/2020	02/09/2021	OPTO-056
85	Taeniopygia gutatta	Adult	Male	TAEGU- 0523	15	Sac	10/08/2020	16/04/2021	OPTO-060
86	Taeniopygia gutatta	Adult	Male	TAEGU- 0524	14	Sac	10/08/2020	02/05/2021	OPTO-052
87	Taeniopygia gutatta	Adult	Male	TAEGU- 0525	15	Sac	10/08/2020	03/02/2021	OPTO-055
88	Taeniopygia gutatta	Adult	Male	TAEGU- 0526	15	Sac	10/08/2020	03/04/2021	OPTO-054
89	Taeniopygia gutatta	Adult	Male	TAEGU- 0527	16	Sac	10/08/2020	02/11/2021	OPTO-053
90	Taeniopygia guttata	Adult	Male	TAEGU- 0528	14	Sac	10/08/2020	04/26/2021	OPTO-058
91	Taeniopygia guttata	Adult	Male	TAEGU- 0529	14	Sac	10/08/2020	05/07/2021	OPTO-061
92	Taeniopygia gutatta	Adult	Male	TAEGU- 0538	18	Sac	10/08/2020	05/25/2021	OPTO-062

93	Taeniopygia guttata	Adult	Male	TAEGU- 0538	18g	Sac	10/08/2020	05/25/2021	TG-OP-062
94	Taeniopygia guttata	Adult	Male	TAEGU- 0550	13g	Sac	10/08/2020	06/10/2021	
95	Taeniopygia gutatta	Adult	Male	TAEGU- 0551	14	Sac	12/30/2020	05/25/2021	OPTO-063
96	Taeniopygia guttata	Adult	Male	TAEGU- 0551			12/30/2020		OPTO-063
97	Taeniopygia guttata	Adult	Male	TAEGU- 0557			12/30/2020		OPTO-064
98	Taeniopygia guttata	Adult	Male	TAEGU- 0558	15	Sac	12/30/2020	05/03/2021	OPTO-065
99	Taeniopygia guttata	Adult	Male	TAEGU- 0560	14	Sac	12/30/2021	04/23/2021	OPTO-067
100	Taeniopygia guttata	Adult	Male	TAEGU- 0561	14	Sac	12/30/2020	04/30/2021	OPTO-068
101	Taeniopygia guttata	Adult	Male	TAEGU- 0565	17g	Sac	12/30/2020	06/07/2021	TG-OP-069
102	Calypte anna	Adult	Male						CA-OP-003
103	Taeniopygia guttata			TAEGU- 0559					

	Trainee	Construct	Injection site	Behaviour	Notes
2	MSA				TAEGU-0308
3	MSA				TAEGU-0309
4	MSA				TAEGU-0310
5	MSA				TAEGU-0311
6	MSA				TAEGU-0313
7	MSA				TAEGU-0314
8	MSA				TAEGU-0315

9	MSA			TAEGU-0318
10	MSA			Bird died during induction dose TAEGU-0320
11	MSA			TAEGU-0321
12	MSA			TAEGU-0322
13	MSA			silver metal band TAEGU-0324
14	MSA			red metal band TAEGU-0325
15	MSA			lt blue plastic band TAEGU-0326
16	MSA			R:white L:red TAEGU-0327
17	MSA			R:black L:orange TAEGU-0328
18	MSA			R:green L:dk blue TAEGU-0329
19	MSA			bands R:white L:yellow--died during induction dose TAEGU-0332
20	MSA			bands R:red L:orange TAEGU-0334
21	MSA			died in cage TAEGU-0335
22	MSA			bands R:white L:black TAEGU-0338
23	MSA			TAEGU-0348
24	MSA			unbanded TAEGU-0349
25	MSA			bands R:black L:brown TAEGU-0350
26	MSA			bands R:black L:brown TAEGU-0350
27	MSA			bands both: yellow TAEGU-0351
28	MSA			bands both:orange TAEGU-0352
29	MSA			bands both:red TAEGU-0353
30	MSA			bands both:red TAEGU-0353
31	MSA			bands: both orange TAEGU-0366
32	MSA			bands: both brown TAEGU-0368
33	MSA	AAV2-CAG- hChR2-mCherry	LM	bands: both white; implant TAEGU-0369
34	MSA			did not recover TAEGU-0370
35	MSA			bands: both yellow TAEGU-0371

36	MSA				died during induction dose TAEGU-0373
37	MSA	AAV2-CAG- hChR2-mCherry	LM		bands: both lt blue TAEGU-0374
38	MSA	AAV2-CAG- hChR2-mCherry	LM	Forward flight/Aperture	bands: both orange; implant TAEGU-0375
39	MSA				bands: both black TAEGU-0377
40	MSA	AAV2-CAG- hChR2-mCherry	LM		bands: both green; implant TAEGU-0378
41	MSA				TAEGU-0381
42	MSA	AAV2-CAG- hChR2-mCherry	LM	Forward flight/Aperture	bands: both black; implant TAEGU-0382
43	MSA	AAV2-CAG- hChR2-mCherry	LM		bands: both yellow; implant TAEGU-0383
44	MSA	AAV2-CAG- hChR2-mCherry	LM	Forward flight/Aperture	bands: both lt blue; implant TAEGU-0384
45	MSA	AAV2-CAG- hChR2-mCherry	OCb		bands: both brown TAEGU-0385
46	MSA	AAV2-CAG- hChR2-mCherry	LM	Forward flight/Aperture	bands: both dk blue; implant TAEGU-0386
47	MSA	AAV2-CAG- hChR2-mCherry	LM	Forward flight/Aperture	bands: both red; implant TAEGU-0387
48	MSA	AAV2-CAG- hChR2-mCherry	OCb		bands: both white TAEGU-0392
49	MSA	AAV2retro-CAG- hChR2-mCherry	LM (bilateral)	Forward flight	bands: lt blue and brown; bilat implant TAEGU-0393
50	MSA	ArchT-tdTomato	LM		bands: silver and dk blue TAEGU-0394
51	MSA	AAV2retro-CAG-ArchT-tdTomato			bands: white and yellow TAEGU-0395
52	MSA	AAV2-CAG- hChR2-mCherry	LM (bilateral)		bands: SFU blue and yellow; bilat implant TAEGU-0396
53	MSA				broken leg TAEGU-0397

54	MSA	AAV2retro-CAG- ArchT-tdTomato	OCb	bands: SFU blue and orange TAEGU-0400
55	MSA	AAV2retro-CAG- ArchT-tdTomato	OCb	bands: SFU silver and green TAEGU-0401
56	MSA	AAV2retro-CAG- ArchT-tdTomato	VbC	bands: SFU blue and red TAEGU-0402
57	MSA	AAV2retro-CAG- ArchT-tdTomato	VbC	bands: SFU blue and dk blue
58	MSA	AAV2retro-CAG- ArchT-tdTomato	LM duplicate	died during surgery TAEGU-0404
59	MSA	duplicate exp num? AAV2retro-CAG-	exp num?	bands: SFU blue and lt blue TAEGU-0405
60	MSA	ArchT-tdTomato	LM	bands: SFU silver and black (found dead in cage) TAEGU-0406
61	MSA	AAV2-CAG- hChR2-mCherry	LM	bands: orange and white: implant TAEGU-0407
62	MSA			never recovered from surgery TAEGU-0409
63	MSA	AAV2-CAG- hChR2-mCherry	LM	bands: SFU blue and red TAEGU-0410
64	MSA	AAV2-CAG- hChR2-mCherry	LM	bands: SFU blue and yellow sac'd due to infected uropygial gland TAEGU-0411
65	MSA			euthanized for bad eye TAEGU-0412
66	MSA			bad foot TAEGU-0413
67	MSA/SW			white morph band: dk blue device 05 cage 7
68	MSA		Forward flight (neurolux loop)	bands: L pink R white TAEGU-0421
69	MSA			bands: R lt green TAEGU-0423
70	MSA			bands: L-lt blue R-lt yellow TAEGU-0427
71	MSA			bands: L brown R grey TAEGU-0428
72	MSA			bands: L lt blue R green cage 4
73	MSA			bands: L white R dk blue TAEGU-0433

74	MSA			euthanized TAEGU-0456
75	MSA			euthanized
76	MSA/SW			band: white
77	MSA/SW			band: orange
78	MSA/SA			No band
79	MSA			band: blue cage 7 not great perfusion
80	MSA			band: green cage 7 not great perfusion
81	MSA/SA			band: orange
82	MSA			
83	MSA			did not recover from surgery
84	MSA	LM		
85	MSA			
86	MSA			
87	MSA			
88	MSA			
89	MSA			
90	MSA			
91	MSA			
92	MSA			
93	MSA			
94	MSA			Feather loss bird, used for vibratome sectioning
95	MSA			
96	MSA			
97	MSA			
98	MSA			
99	MSA	AAV9-CAG- hChR2-mCherry	LM (bilateral)	Oculomotor Response
100	MSA	AAV9-CAG- hChR2-mCherry	LM (bilateral)	Oculomotor Response

101	MSA		
102		AAV2retro-ArchT	LM
		AAV9-CAG-	LM
103		hChR2-mCherry	(bilateral) Oculomotor Response

