

Nesting Complex Systems

by

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Submitted to the Department of Architecture in partial fulfillment of the requirements
for the degree of Master of Science in Art, Culture and Technology at the
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ABSTRACT

This thesis discusses an artistic method of engaging with complex systems. The engagements take the form of inserting a certain something (an object, a task, a conversational prompt, myself) into a complex system with well-defined and elaborate technical processes serving specific and declared goals.

The insertion is not meant to interrupt, disrupt, or destroy the system. The inserted thing is foreign to the system and is often understood as unproductive or absurd by it. However, the system can digest and process the thing successfully and spit it out the same way it does with what the system is meant to and does take in every day.

This insertion is an act of nesting in the biological sense—making a nest from concocting foreign materials with existing materials—where the thing inserted becomes an anchor or an entry point from which a particular network of existing knowledge and relations are drawn out and revealed. Then, rigorous observations about what is revealed are made; materials produced by these encounters (between the things inserted and the systems) are collected.

This gesture of insertion is an attempt at understanding a complex system without abstraction, reduction, or simplification. It is not possible to “see the whole picture” of these complex systems. However, one could, nonetheless, engage with it and allow a part (perhaps arbitrary to the system) to speak to the whole.

The projects presented in this thesis engage with the complex systems of nanoscale fabrication, campus building construction, synthetic biology, and imaging technologies in the sciences. These seemingly disparate fields are united by an investigation of how emerging science and technology challenge an understanding of what a person is and how a person understands, as well as an interest in the very costly infrastructure that supports the new developments.

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1. INTRODUCTION

The projects included in this thesis demonstrate a method of working with the complex systems supporting science and engineering research situated at MIT.

The engagements take the form of inserting *something* (an object, a task, a conversational prompt, and a person) into a complex system with well-defined and elaborate technical processes serving specific and declared goals.

The insertion is not meant to interrupt, disrupt, or sabotage¹ the system. The inserted *thing* is foreign to the system and is often understood as unproductive or absurd by the system as a whole (composed of both people and things). However, the system can digest and process the *thing* successfully. It spits out the foreign thing the same way it does to what the system takes in on a daily basis.

The insertion enacts the system and the thing inserted becomes an anchor or an entry point from which a particular network of existing (but somewhat hidden) knowledge and relations are drawn out and revealed. They reveal themselves like how a ripple appears on surfaces. The ripples form, observations of the subtle effects spun off from these ripples are made, and materials produced by these encounters (between the things inserted and the systems) are collected. Like a ripple, the insertion does not alter the system in a significant or noticeable way; it does not leave a permanent mark. However, the systems before and after the insertion are not one and the same. These encounters between the things inserted and the systems are “mutually constituted” as put by feminist physicist Karen Barad.² For example, in a project titled *This Is Walnut* (2016), which will be discussed in more depth in chapter four, an ordinary walnut is inserted into the complex system of scientific imaging at MIT. It is presented to the system as a task, that there be images made of it. The everyday object—the overtly mundane walnut calling no scientific attention—creates an entry point for engaging the system of image construction across fields, machines, and people.

This gesture of insertion is an attempt at understanding a complex system without abstraction, reduction, or simplification. It is not possible to “see the whole picture” of these complex systems. However, one could nonetheless engage with it, and allow a part (perhaps something arbitrary to the system) to speak to the whole.

This gesture is guided by an inquiry into the potential conflation of two notions sharing the same word: “nesting.” To *nest* is to make a home for oneself. To *nest* is also to fit, put, encapsulate, or place one thing within another thing—yielding layers of things. This second definition of “nesting” affords a topology that one can think with. In each of the projects presented in this thesis, the insertion could be understood as an act of nesting in the first sense of the word, from which a topology of nesting, in the second sense of the word, is drawn out. For example, in *This Is Walnut*, the system of scientific imaging becomes a site to be nested in, from which a nested understanding of the system is created.

¹ The image of a sabot (a simple wooden shoe associated with the lower class in France during Industrial Revolution) being thrown into a machine at a factory comes to mind.

² Karen Barad, “Meeting the Universe Halfway: Realism and Social Constructivism Without Contradiction,” in *Feminism, Science, and the Philosophy of Science*, ed. L. H. Nelson and J. Nelson (Dordrecht: Kluwer Academic Publishers, 1996), 161-194.

While each of the projects marvels at the ingenuity of the complexities in procedures and processes encountered, they suspend beliefs with regards to what value all the effort ultimately produces. It is from this perspective that each of the projects examines the necessary operations that enable production.

The systems engaged in the projects included in this thesis are nano- and micro-scale fabrication, campus building construction, synthetic biology, and imaging technologies in materials science, civil engineering, electrical engineering, and biomedical sciences. These seemingly disparate areas of interests are united by asking the question, how does the cutting-edge of science and engineering challenge understanding of what a person is and how a person understands, as well as a curiosity of the very costly infrastructure that supports new developments in science and technology.

Chapter two presents the theoretical framework that dovetails this thesis. Chapter three, four, and five present and discuss three projects that demonstrate the methodology described above: In *Nesting* (2015), a constructed object—a series of nested cubes levitated by water—is used as a prop in conducting interviews with people in different disciplines about how they use the spatial notion of “nesting” (as evoked by the constructed object) in their work. In *This Is Walnut* (2016), various labs at MIT are presented with the task of making images of a walnut. *Project Lin Daiyu* (2016-17) engages in a conversation between four Taiwanese students of different disciplinary backgrounds in Cambridge, Massachusetts. Together, they brainstorm what would be a new biomaterial that could signify Lin Daiyu, a culturally significant female character created in the eighteenth-century Chinese classic, *Dream of the Red Chamber* (also called, *The Story of the Stone*).

Chapter six narrates the ongoing process of a final engagement with MIT, produced in conjunction with the creation of this thesis, putting it to work. In this final project, tentatively titled *A Studio In A Lab*, the content of an “art studio at MIT” is moved into a chemistry laboratory under renovation at MIT. This ultimate insertion enacts the system of campus construction, under the jurisdiction of Department of Facilities (and subsequently the Department of Chemistry as well as local construction companies). The insertion can be understood as an act of “nesting” in the sense that a nest is created by concocting a lab bench with materials from an art studio. At the same time, this nest is a site of production for another art project to be exhibited at MIT’s student art gallery, thereby creating an art project nested within another art project. The project nested within is titled, *I Saw It, I Lost It, Then I Went Looking for It*. Chapter six is followed by the conclusion which points to further lines of inquiry beyond/underneath this thesis.

2. THEORETICAL FRAMEWORK

This chapter lays out various conceptual departures grounding this thesis and touches on core concerns driving the practice.

2-1. The Nonhuman Turn: Towards a Conflation of Categories

The nonhuman turn has shown up in many disciplines in recent years. It is a turn of attention away from treating the human as the default subject position and subject of concern. It is a call to turn our attention towards the worlds of materials and animals, other entities and species.

Developed out of the nonhuman turn is a conceptual maneuver of teasing out the way ideologies create the non-deserving other (for example, the queer body) and exclude it. In this way, the human and the nonhuman dichotomy creates two hierarchical categories that justify forms of oppression and violence (against the inferior nonhuman category). Presumed in the human and non-human dichotomy is that the one cannot be without the other. The political project is to do away with the categories and dismantle them either by redefining these categories (as exemplified by Laboria Cubonki's *Xenofeminist Manifesto*),³ or by problematizing the boundary between the two, arguing that all persons (or, agents) are both human and non-human (for example, as seen in Latour's *We Have Never Been Modern*).⁴ This kind of a move can be characterized as a flattening—a flattening of hierarchical ontological categories. For example, in Jane Bennett's *Vibrant Matter*,⁵ she proposes an ontology of entities that attributes equal agency to humans and things. In other words, she advocates for the flattening of the ontological categories of subjects and objects.

The idea of taking objects seriously as things—and given equal priority as agents—is woven into every project here. Moreover, a straightforward kind of flat ontology is challenged. An over-arching concern lies in the potential for criticality in the *process* of conflating distinct notions and collapsing gaps and boundaries (between categories). Therefore, the primary site of investigation lies in the moments of inhabiting the state of becoming (i.e. during the process of conflation) that can even fail or go nowhere.

“Conflation” here does not mean an unintentional confusion between two words or ideas. It is not about fusing or merging two notions into one, nor is it about making a pun. Rather, it is the active process of closing the gap between two ideas. However, since the two ideas are ultimately distinct, this process reaches some limit and can simply fail. Conflation is something more forceful, where there is more traction, than juxtaposition or finding similarities between two ideas. Yet, it is less violent than homogenizing or fusing two different things together. Think two squishy balls being squeezed into each other but ultimately keeping their own shapes.

In response to the nonhuman turn and flat ontology, projects presented in this thesis ask, what can be the productive consequences of *conflating* ontological categories?

³ “Xenofeminism: A Politics for Alienation,” Laboria Cubonics, accessed May 6, 2017, <http://www.laboriacuboniks.net>.

⁴ Bruno Latour, *We Have Never Been Modern* (Cambridge, Mass.: Harvard University Press, 1993).

⁵ Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham, N.C.: Duke University Press, 2010).

2-2. Decentering the Human Subject Position in Knowledge Production as Inspired by Continuous Critique of Modernity

There is an angst around embracing versus resisting the logic of modernity—an angst that ebbs and flows at different times in different cultural and geopolitical spheres; an angst rehearsed and rehearsed countless times in countless forms. The latest developments in science and technology at any given time tend to take a big blow from critiques of modernity.

Philosopher Luciano Floridi lays out our contemporary condition by tracing an arc of the de-centering of the human subject. It begins with the revolutionary moment with Copernicus, when we⁶ realized that where we physically reside is not the center of the universe; and with Darwin, when we realized that we are not the center of the biological sphere; then with Freud, when we realized that we are no longer the center of our own minds; and finally, with Alan Turing, where we are now, not even the center of the informational sphere. The simplicity of this narrative is attractive, even though it may be overly reductionist. The upshot is: we need to take seriously an examination of our centrality in knowledge production.⁷

This thesis's examination of science and technology is inspired by a desire to untangle the potential conflation between resisting and embracing modernity, as well as a call to decentralize the human subject position in knowledge production. The starting point is to pay attention to the impulse behind the embrace. For example, in *This Is Walnut*, addressed in chapter four, the initial question is: what is it about datafication and quantification that is so attractive? Quantification allows for both centralizing and consolidation of power, but it also democratizes. The biological act of counting brings to mind practices of discipline via repetitions found in many religious traditions, which may be somehow soothing to us.

2-3. Producing Representation and Circulating Production

In approaching MIT and its many systems in operation to support research in science and technology, attention is paid to what endeavors are deemed essential and worthwhile and what endeavors are cast aside as non-deserving of mention, yet without which, the overall system would not be able to carry forward and perpetuate itself. MIT's public outreach efforts lead one to believe that MIT produces practical and empirical knowledge—facts about the world and practical solutions to problems in the world. Therefore, efforts of the institution that produce empirical and practical knowledge, and people who are directly responsible for those efforts, are deemed the most noble and worthy.

A more cynical take could be that MIT's primary output is journal articles. Along the same line of thinking, as an institution of higher education, it also outputs a workforce that goes on to output journal articles at other institutions. With this lens, one could say the purpose of MIT, as a research university heavily focused on science and engineering, is producing representation (the stories that these journal articles tell) and circulating production (the journal articles, a workforce, and more). Even if these

⁶ "We" here is taken to be the collective, taken-for-granted, essentialist and humanist's human subjects.

⁷ Luciano Floridi, *The 4th Revolution: How the Infosphere Is Reshaping Human Reality* (Oxford: Oxford University Press, 2014).

representations are stories of the world, they do become operative as facts once circulated, as they become a basis for beliefs and actions out in the world.

In this thesis, whether and how these stories become empirical and practical knowledge is peripheral to the overall investigation. It does not seem generative to say that science is just a bunch of stories (and that the stories are ultimately products of social values of the time). After all, discoveries in the sciences and advancements of technology have very real short- and long-term consequences. Projects presented in this thesis are informed by these debates; yet attempt to sidestep them by trying not to take any of these positions for granted.

2-4. Infrastructure at a Cost

Viewing MIT as an infrastructure for producing representation and circulating production leads one to focus on how and where these operations take place. What does it take for MIT to be producing stories of the world and what else does it circulate beside these stories?

The peculiar nature of infrastructure is that it always underlies *something* (a set of activities that produce some outcome), and often the infrastructure is only visible when the *something* is no longer being successfully supported. In other words, when the material and social systems that make up an infrastructure are operating successfully, the infrastructure is largely invisible. Only during the moments of breakage, failure, and incompleteness, does the infrastructure reveal itself.

If we consider journal articles to be the primary production of MIT as an infrastructure, a lot of byproducts are also produced—the leftovers, the residue, or the tailings. Byproducts include everything that goes to waste, such as the excessive packaging that accompanies cell samples, emptied printer toners, and broken electronic parts. Byproducts also include the undesired production such as exhaust air, chemical waste, or excrement of lab animals. This thesis takes an interest in the in-between stuff that is neither undesired output nor waste: the stepping stones, the catalysts, and the contingencies. This in-between stuff performs important functions that the desired output hinges on. For example, in *This Is Walnut*, where infrastructure for image construction at MIT is explored, what is highlighted is the ways that most of the images being produced are stepping stones in stages of research and sometimes they are contingencies that circulate as public outreach material.

Moreover, each project exhibits or contains a kind of infrastructural failure. For example, in *Nesting*, the constructed object of a nested cube often fails to retain the water that separates each layer. This failure is not intentional; it is part and parcel of the prototyping process. However, as the water leaks, the nested cube object gradually loses its centrality (which potentially suggests a lack of hierarchy between the layers).

2-5. Synecdoche

This thesis proposes an artistic method that affords a way to perceive complex systems of science and technology production without reduction, simplification, or abstraction by way of the rhetorical device “synecdoche,” in which a part is made to

speak to a whole. In *Seeing Like a State*,⁸ anthropologist James Scott analyzes typical strategies of control used by modern states such as census and mapping. He argues that in order to control and manipulate its population, the state uses strategies of simplification, reduction, and abstraction in order “to see the bigger picture.” These strategies are similarly employed in science and technology where the subject of analysis is some set of natural phenomena of the world. One criticism of Scott is that he is analyzing the modern state using the same framework that he critiques. The projects presented in this thesis tests out the strategy of synecdoche in an attempt to address the entirety of a complex system without making claims about it by way of reduction, simplification, or abstraction.

2-6. Nesting as a Biological Act vs. a Topological Mental Prop

The double meanings of “nesting” and their potential conflation further specify and illustrate this of idea allowing a part to speak to a whole—the idea of synecdoche.

To nest is to make a home for oneself. The act has a biological basis evoking the bird concocting materials it collects and some pre-existing structure it finds. The act signals an intrusion with minimal impact, not through persuasion or seduction or some explicit exchange of value, but through combining stuff, forging associations, and dwelling. It is closely related to concepts including embedding, embodying, nestling in, being pregnant, and making kin. The nest as an entity is a space that symbolizes home, a stable site to return to, and a place where provisions and possessions are stored or where nourishments can be received. Gestures of insertions in the projects can be conceptualized as acts of nesting, where the aim is to create a nest in a structure foreign to the thing inserted. The nest subsequently serves as an anchor from which further journeys of inquiry are made. This notion of the nest illustrates “the part” that has the potential to speak to “the whole” in the literary device of synecdoche.

The other sense of the word “nesting” describes a spatial relation where one thing is fitted within another thing (sharing some similarity based on certain parameters), such as in the case of Russian dolls. This process of nesting points to a topological spatial notion that one can think with—this is a proposition tested out in the project *Nesting* (see chapter three for further discussions). This second meaning of “nesting” bears the mark of abstraction and is closely associated with ideas of recursion, induction, fractals, and reflexivity. This thesis is not an illustration of the conceptual mode of nesting in the second sense of the word. To rely solely on the topological mental prop of nesting for understanding complex systems would be to fall back on understanding through abstraction, the very thing to be sidestepped. Rather, the core concern is, can the potential conflation of nesting in these two distinct senses be a kind of synecdoche?

As mentioned above (in chapter 2-2), to conflate two ideas is not to fuse them together or to reduce one to another. The interest lies in the active and generative process of closing the gap between two ideas. A pregnant mammal exhibits something close to the threshold of the complete conflation between the biological nesting and the topological nesting (where the two concepts collapse into one). Because, residing in a pregnant mammal is a body within a body, and at the same time, the pregnant mammal’s womb is quite literally a nest. Though, one could argue that a fetus body does

⁸ James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998).

not quite resemble a pregnant body. Perhaps an even closer proximation to the complete conflation is exhibited in a nursing marsupial where the pouch is literally a nest. I will return to the question of how the conflation of these two senses of nesting is a kind of synecdoche after the discussion of projects in chapter three, four, and five.

3. PROJECT I: NESTING

In *Nesting*, I made an object—a series of nested cubes levitated by water—and used it to interview people in different disciplines about how they use the notion of “nesting” in their work. Can spheres of knowledge production be imagined as nested islands? And if so, can the hierarchies be collapsed? What is that in-between space? The interviews taken as a whole are a performative act that attempts to collapse, flatten, or bridge disciplinary gaps and hierarchies.

In this project, I tried to push the topological sense of the word nesting to an extreme. Hence, nesting in the biological sense was intentionally bracketed. The complex system being investigated is a lax presupposition that there exists a common mental landscape present in academia across schools, departments, and disciplines. In other words, I was interested in ways of thinking, mindsets, or by extension subjectivities that are present in the infrastructure, contributing to the makeup of the so-called academia. The object of insertion in this project is the nested cube I designed and prototyped. That being the case, the site of “making a home” is the collective mental landscape of academia.

The construction of the artifact paralleled the gesture of nesting in the biological sense. Namely, I was developing this object at the same time as I was bringing various prototypes of it to interview my interlocutors. The interview process was in a state of becoming—each interview built upon the previous ones—echoing the objects going through design iterations in the prototyping process.

Below is a synopsis of the conceptual journey taken in bringing this project from its inception to its final presentation. Each snippet pins a moment in time as the project developed and is labeled with date, location, and people involved in that moment (whenever applicable). This chapter concludes with some reflections on the project.

09/29/2015

This project began in thinking about the production of disciplinary spaces in relationship to artistic research using the topology of an island.⁹ Marc Shell, in *Islandology: Geography, Rhetoric, Politics*, defines an island as “land on which, when on walks along its coastline in one direction, one eventually gets back to where one started.”¹⁰ I asked: What about the notion of “nesting”? Surely, given this definition of an island, multiple islands could be nested. *What if we think of disciplinary spaces as a series of nested islands?* Could this help us think about what is interdisciplinary thinking and what is artistic research? This topological notion of nesting, stemmed from thinking about the concept of an island, was taken broadly at first. It could be conceptualized either as a way space is produced (i.e. nesting as a way to generate new spaces) or it could be used to describe the structure and spatial relations of existing spaces that are well-defined, stable, and functional.

⁹ “Desert Islands” in *Desert Islands and other Texts 1953-1974* by Gilles Deleuze is one of many texts that begin with thinking through the concept of an island philosophically, theoretically and materially (Deleuze 2004).

¹⁰ Marc Shell, *Islandology: Geography, Rhetoric, Politics* (Stanford: Stanford University Press, 2014): 3.

10/14/2015

I began by trying to construct an object that captures the topological notion of nesting. A prototype was made by scored acetate sheets and double-sided tape. The decision to use a cube shape and clear material comes from thinking about Hans Haacke's *Condensation Cube* (1965) and studying his various experiments exploring systems and processes of light, soil, wind/air, and water/fluids.¹¹ In *Condensation Cube*, the cube is used to reveal visually invisible features of the museum infrastructure (i.e. temperature and humidity). The work brings attention to other behind-the-scene aspects of the museum infrastructure without representing them. Theorist Jack Burnham coined the term "system aesthetics" to describe works like this as art that processes information rather than manipulating styles.¹²

10/23/2015 | Saviz | Koch Cafe (Building 76 MIT)

To get some help brainstorming different ways of getting transparent cubes nested within each other, I met up with a friend, Saviz, who is a PhD student in fluid dynamics. Inspired by Hans Haacke working with soil, air, and humidity, I asked him if it would be possible to float cubes within each other with material other than water, such as air. He responded saying sure, if you can levitate cubes made with even the lightest material in a nested structure by air, you can submit a paper to *Nature* (as it would be such a scientific triumphant). This response really struck me. This moment for me signals the coming together of two disciplines ever so lightly.¹³

10/25/2015

This mental image of disciplines coming together ever so lightly gave me an idea to make a two-channel split-screen video comparing me and Saviz performing an act of measurement to solve the same problem. With the same version of a nested cube and the same analog clock in hand, Saviz showed on the left side of the screen, would calculate with any instrument of his choosing (his laptop, a calculator, or pen and paper) the amount of time it would take for an outer cube to touch an inner cube while rotating the nested cube at the speed of the minute hand on a the clock. On the right side, I would mimic the minute movement of the minute hand on the same clock to rotate the cube, and measure with a stopwatch how long it takes for the outer cube to touch the inner cube. This project idea touched on modes of measurement and observation and perhaps puts to test notions of objectivity and legitimacy.

10/26/2015

I did not end up pursuing this project idea. However, it did help me narrow my an inquiry in relationship to the question of artistic research and the production of disciplinary spaces. I wanted to further explore the ways of thinking, ways of doing things, and ways to being motivated present at this research institute—i.e. MIT—which I had only recently stepped into at that time. What is the hegemony and were there alternatives that I had neglected to notice? This

¹¹ Examples include *Blue Sail* (1964/65), *Photo-Electric Viewr-Controlled Coordinate Systyem* (1968), and *Rhinewater Purification Plant* (1972).

¹² Jack Burnham, "Real Time System," *Artforum*, September 1969, 49-55 and "Systems Aesthetics," *Artforum*, September 1968, 30-35.

¹³ Also in this conversation, I picked up the word "levitate" to describe how the cubes are nested—they are nested as in they are levitated by an in-between material. By dictionary definition, to levitate is to float something specifically in air. English is not Saviz's first language (he is Taiwanese-Persian who grew up in Switzerland). My conjecture is that he made this word choice either because he is thinking in another language (i.e. French) or because in his field of study of fluid dynamic, the difference between air and water as a medium is not meaningful.

question spurred me to make a video work titled *Wandering Gramsciwards* (2015). It is a travelogue of an art student arriving at a research institution trying to find his position by physically finding places to read Antonio Gramsci's *Prison Notebooks* on campus.¹⁴

10/31/2015 | Rebecca | *Buddy's Diner (Somerville, Mass.)*

In the meantime, I was returning to the idea of disciplines as islands and the spatial relations of islands as nested. A casual conversation with biologist friend Rebecca helped solidify this inquiry into a project. The first thing that came to mind for her when I mentioned the idea of nesting is Lynn Margulis' endosymbiosis theory, a theory that accounts for the origin of eukaryotic cells via a cell nested within another cell. This conversation gave me the idea to start speaking with researchers and scholars in different disciplines with the nested cube object I was making.

11/10/2015 | Chris | *Voltage Coffee & Art (Cambridge, Mass.)*

One of the first people I interviewed was Chris, a historian of early modern China, who I had met only a couple of weeks prior to our meeting at an opening at MIT List Visual Arts Center. Chris said that history does not repeat itself, but it does rhyme. It rhymes in the sense that one incident is always illustrative of something larger. The idea of a nest came up in our conversation. For Chris, nesting in the biological sense is about getting comfortable; for historians, it would be about finding comfort in an era or an epoch. I was quite fixated on modes of thinking and was very much not interested in the potential conflation of the double meanings of the word at that time.

11/23/2015 | Aaron | *Green Street Grill (Cambridge, Mass.)*

Another person I spoke with was a friend Aaron from my undergrad days. Aaron was a postdoctoral fellow at Harvard's History of Science at the time. I had always been fascinated by his research in the history of how notion of the vacuum is conceived in conjunction with the study of dark matter in astronomy. Given this interest in conception of space at different scales, I thought he would have insightful things to say about the spatial notion of nesting and the limit of understanding in general. Upon being presented with the idea of disciplines as nested islands, he was provoked and irritated. He assumed that I held an implicit assertion that disciplines can be reduced to one another. For him, by thinking of disciplines as nested islands, one is already suggesting that somehow certain disciplines are more fundamental than others. He suggested that instead of thinking of disciplines as nested islands, I should think of them as nests (as in bird nests). All researchers have a nest where they are formed. It is also a place where they always return, to give something back, or to recharge. Even though I did not like how Aaron tried to persuade me to change my direction in the project, this conversation did leave an impression.

11/27/2015

I continued to conduct one-on-one interviews with researchers from various fields with the nested cube object in hand. I started to conceive of my own action as a kind of traversal of disciplines. The interviews were informal, and I tended to not lay out the questions explicitly. I would first let the object do its own work, by asking my interviewee how does their work relate this thing I was passing onto their hands (if the interview was in-person). The key questions that

¹⁴ Antonio Gramsci, *Prison Notebooks*, ed. Joseph A. Buttigieg (New York: Columbia University Press, 1992). The 9-minute video titled *Wandering Gramsciwards* is available online at <http://bit.ly/2agty8T>.

threaded together each interview were as follows: How does your work relate to this object? What is the in-between? Can the layers be collapsed? What would your discipline look like if this notion of nesting is illegitimate?

Each interview was recorded. At one point, I considered creating a soundscape using this audio material because I was finding that many of the same spatial words were being uttered. I had the idea to make the final presentation of this research by weaving together audio excerpts of the interviews by sonically overlapping utterances of the same words made by different people. This tangential thought did not materialize because I thought that mode of presentation would put too much emphasis on the lexicon of academia as opposed to mindsets or ways of thinking. However, it led me to pay extra attention to the words being used by different interviewees. I ended up highlighting all words related to time, space, and scale.

The academics I interviewed come from the following fields: Chinese history, economics, astrophysics, fluid dynamics, epidemiology, English literature, mathematics, neuropsychology, computer science, and history of science. Of these interviews, only the one with the computer scientist was not recorded. This grouping of fields and people encapsulate the breadth of disciplines I had come into contact with in the first few months of arriving at MIT through personal connections as well as chance encounters at MIT.¹⁵ Three out of the ten people (the economist, the epidemiologist, and the literary theorist) I interviewed were via Skype and they were friends I already had who I had seen in person the summer before coming to MIT. I intentionally stayed away from fields that in my mind have the most potential to veer away from the hegemony of the kind of mindset knowledge production requires at a research institution like MIT—the examples that first come to mind are theology or business administration.

12/08/2015 | ACT Cube (Building E15 MIT)

The project was presented in the form of an installation consisting of three large posters with excerpts from conversations. The physical structure of the installation is cube-shaped (see Figure 1). Extruding from two of the three poster walls are two shelves that hold various versions of the nested cube object (see Figure 2).

¹⁵ See Glossary of People for more detail on who the interviewees are and how I met them.

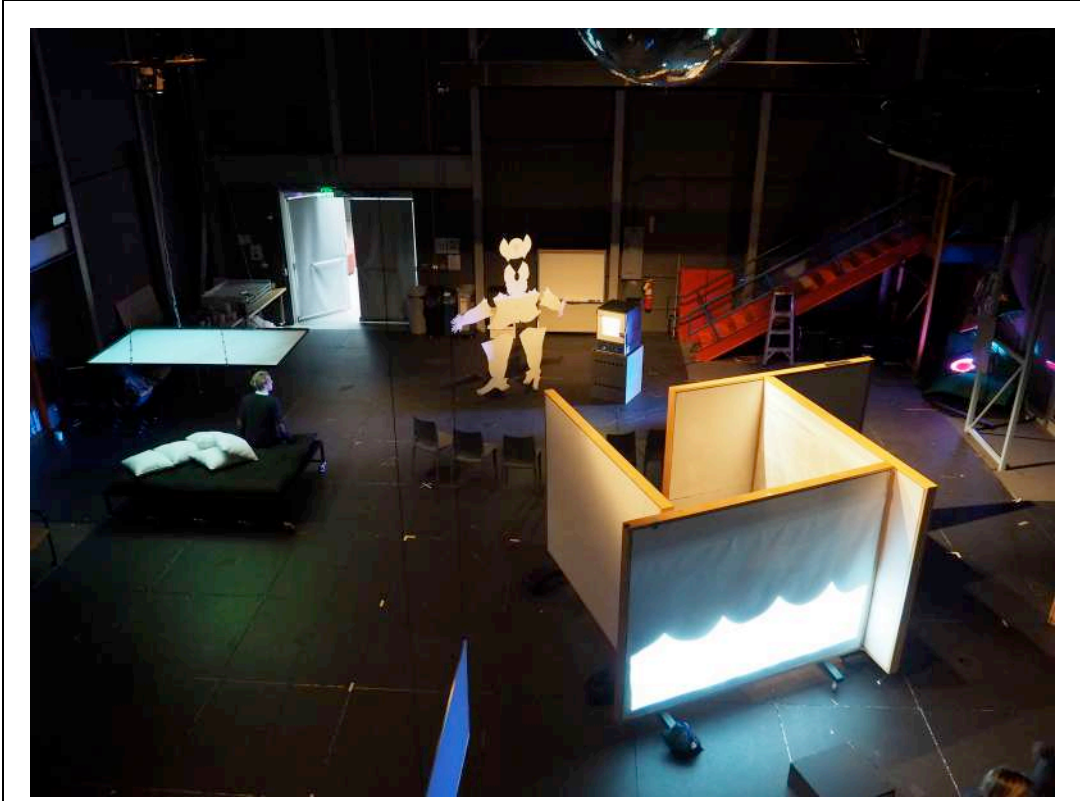


Figure 1. Installation view

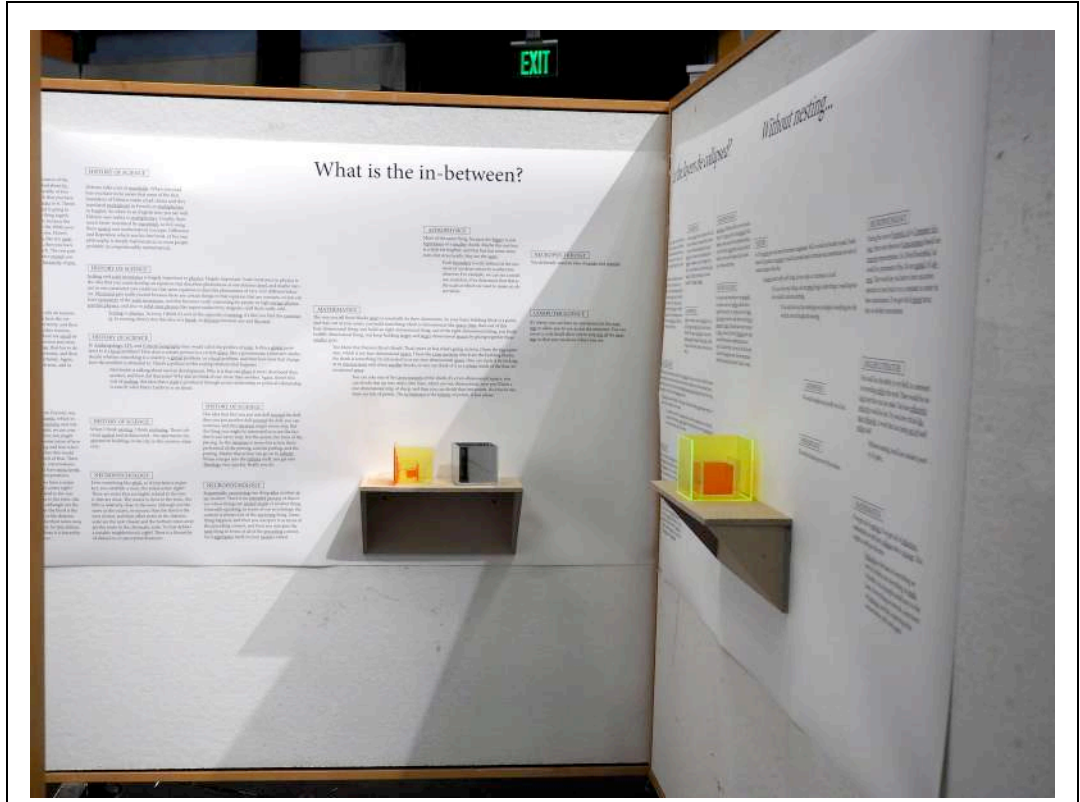


Figure 2. Installation view

The excerpts of conversations are organized by the four key interview questions laid out above. I did not include the names of the interviewees; their responses are titled by their disciplines.

On the posters, spatial and relational terms are underlined, including: recursive, larger, down, abstraction, splitters, lumpers, levels, up, little, nest, nesting, time, space, repeats, rhyme, past, present, place, future, familiar, path, twists, turns, recursion, embed, tapestry, perspective, similar, reducible, increase, repetitively, grow, scale, whole, out of, side, in, fold, small, big, repeating, boundary, closed, underside, fractals, zoom in, same, order reversible, order, left, right, directional, oriented towards, loop, core, relative, repartition, aggregation, interaction, between, outer, layers, spatial extent, specific, general, inner, hierarchy, collapsed, topological, beyond, accrete, discrete, subordination, equal, outwards, expansion, smallest, within, reflexivity, distance, induction, reduce, further, parts, space-time, cross section, intersections, in-between, infinity, back, forth, smaller, bigger, vacuum, sections, longer, groups, temporal, distinction, chunk, assembly, units, subassemblies, embedding, meta-levels, inside, outside, sequentially, extended, enclosing, preceding, aggregates, instantiate, protrusions, lattice, tensor, around, iteration, global, local, scaling, symmetry, continuity, break, division, the next, manifolds, multiplicité, multiplicities, reducing, hierarchization, center.

Names of disciplines or labels of fields are also underlined noting self-referential moments as well as moments of referencing others: history, historian, social scientists, economists, astronomy, geometry, number theory, mathematics, music, temporal arts, second-order cybernetics, symbolic AI, computer science, atonal music, theology, anthropology, STS, critical geography, physics, energy physics, particle physics, solid-state physics.

The interview excerpts included on these posters are included here in Appendix I.

In an attempt to understand interdisciplinary thinking and artistic research, this project ultimately is about questioning what means are deemed legitimate in knowledge production at the research institution that I was new to. The very methodology employed in the interviews (from its execution, chosen sample of study, to presentation) could easily be criticized for glaringly lacking in rigor if the research question is how do researchers in academia think?

Implicit in the overall project but revealed in many of the interviews is that if we can pinpoint a hegemony in ways of thinking at this institution (nesting being part of this hegemony), it would not simply be a collective output of this infrastructure. Rather, the infrastructure produces and reproduces certain ways of thinking. Many iterations of the nested cube represented to my interlocutors have clear imperfections such as water leakage or uneven and blatantly visible excess of adhesive. However, in none of the interviews, the object in hand failed to convey efficiently the abstract notion of nesting in the topological sense. Even when the nested cube lost its concentricity as the water separating the layers leaks, many interviewees still pointed to the object to demonstrate a lack of hierarchy between the layers.

A latent theme of the project emerges upon closer readings of the interview excerpts, which is the centrality of this topological notion of nesting in knowledge production under the rubric of modernity. When asked what would happen to his field if

the mental prop of nesting is not available to him, Stephen, the literary theorist I interviewed, said: "There would be no scale jump you can make. You lose reflexivity; reflexivity would be lost. Or, you lose critical distance reflexivity. A work that can jump out of itself within itself. Without nesting, you'd lose modern poetry. It's gone."

4. PROJECT II: THIS IS WALNUT

This Is Walnut is a three-part installation that explores the tension between experiences of the real and the virtual.¹⁶ Focusing on image construction in the sciences, the project asks: What is this human desire for seeing things outside of the realm of our bodily sensing capacities (capacities to take in information of the external world, such as our limited auditory, visual, and olfactory ranges)? How does the desire to see relate to understanding and to justification for doing? What constitutes visibility? And, at what point do connections images have to reality become so frail that they step into the virtual realm?

This project touches on this notion of seeing through abstraction for the sake of understanding. As described in chapter one, I inserted the task of having a walnut imaged into the complex system of scientific imaging at MIT. The task took me through various labs—each encounter built upon and enabled by a previous one—creating a nested, though partial, understanding of the complex system of scientific imaging situated at MIT. By being the person who goes to different labs with a walnut, I nested myself in the complex system of scientific imaging. The project speaks to my methodology of synecdoche in that my investigation of science imaging is limited to exactly six machines even though, surely, there are hundreds of and maybe even thousands of more machines at MIT that make images. At the same time, there is an underlying question of, what is an image, in this investigation of scientific imaging. There is a kind of “holding out” at play here. The six machines hold out for all the other machines at MIT; scientific images hold out for all images. An interest which emerged from conversing with scientists and engineers, who took time to introduce me to various imaging technologies, is how seeing is at once an aesthetic sensation as well as an act of reading data. Most burningly, this project is concerned with how the encounter with an image evokes the virtual.

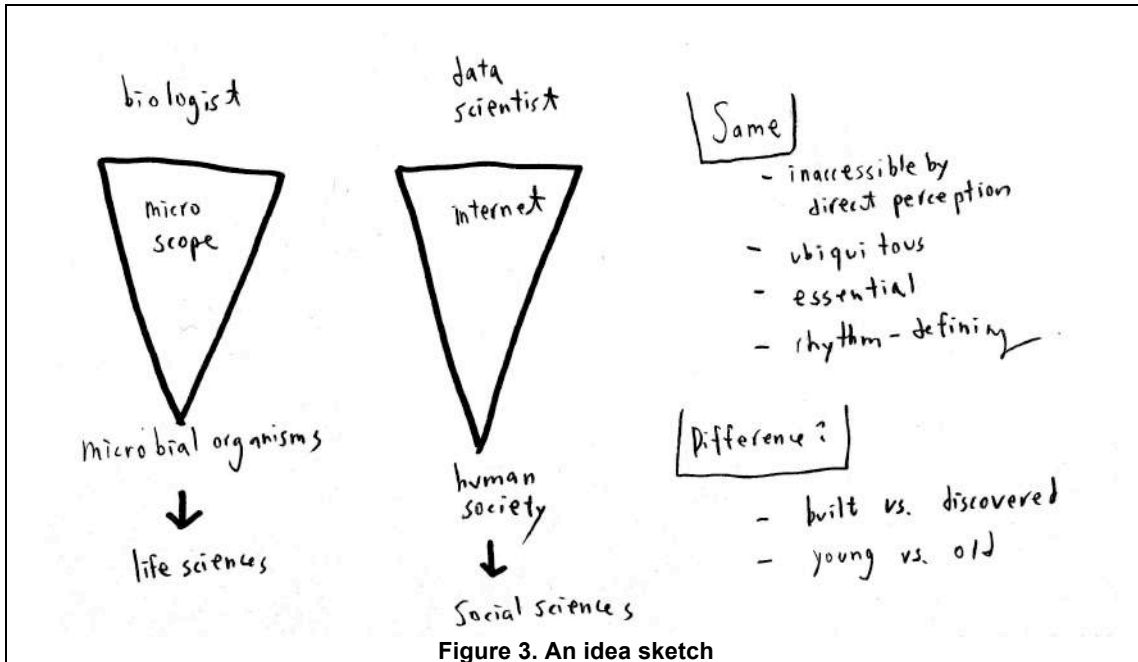
What follows are select snapshots of the process in this project from fine-turning the inquiry in the beginning to the making of an installation in the end. Each snippet pins a moment in time as the project developed and is labeled with date, location, and people involved in that moment (whenever applicable). This chapter ends with some reflections.

11/02/2015

Upon entering MIT, I became increasingly amazed by the way data, in its various forms, plays such an important role across disciplines. It seemed like less and less of everyday life is untouched by the mechanism of data collection and analysis at a large scale. I had the idea that human populations are seen by data scientists through the internet (as well as sensors and biometric devices) the way a biologist looks at microorganisms through the microscope. The patterns of behavior that are revealed by the respective mediating technologies allows for perception that is otherwise inaccessible. Surely, this is not exactly a paradigm shift—the desire

¹⁶ The virtual being something that is “as if” it were real; not to be confused by “virtual reality” which is a concept that closely resembles simulation of the real or the artificial. Katherine Hayles, in *How We Became Posthuman*, defines virtuality in a way that bridges these understandings. She says, “virtuality is the cultural perception that material objects are interpenetrated by information patterns” (Hayles 1999, 13).

for and the practices of seeing the bigger picture have already existed—it is just that increased capacity of the technologies used brings about new sets of issues. Given the growing datafication of everyday life, what is happening to experiences of the world, how we take reality to be, and how we form our beliefs? This project is a response to this larger question.



12/14/2015

The data visualization models and images that data scientists produce attempt to make visible very complex relationships. I am similarly intrigued by complexity and have a desire to make sense of very complex relationships. However, there is something about what is produced by data scientists that does not sit right with me. One aspect is that there is always something lost by simplification and abstraction—even at the point of data collection, the moments of observations and measurements. Take the wine wheel for example. Is it possible that when we are presented with a particular set of descriptors that facilitate communication of what we experience (in the case of the wine wheel, as a stepping stone towards making sense of something, to answer questions like what is this wine, or what is the value of this wine), our experiential engagement with the wine is actually limited by the set of descriptors. Something is foreclosed. Namely, not only do we have limited receptors for things in the external world that give off signals, we actually go through our days hearing, smelling, and seeing things, but not perceiving them. Something may be audible but not perceived—i.e. you hear something but you didn't know you heard it. From these conundrums, I was prompted to journey into image-making pushing the limits of visibilities, starting from the very large and the very small.

1/22/2016 | Don | Building 4-141 MIT

I signed up for a training course titled, Adventures in Scanning Electron Microscopy, offered by the Department of Materials Science and Engineering. Don, an engineer and member of the technical staff at the department, ran the workshop. Scanning electron microscopy (SEM) has become *the* microscope of the last twenty years. It is not the latest technology, though it is the

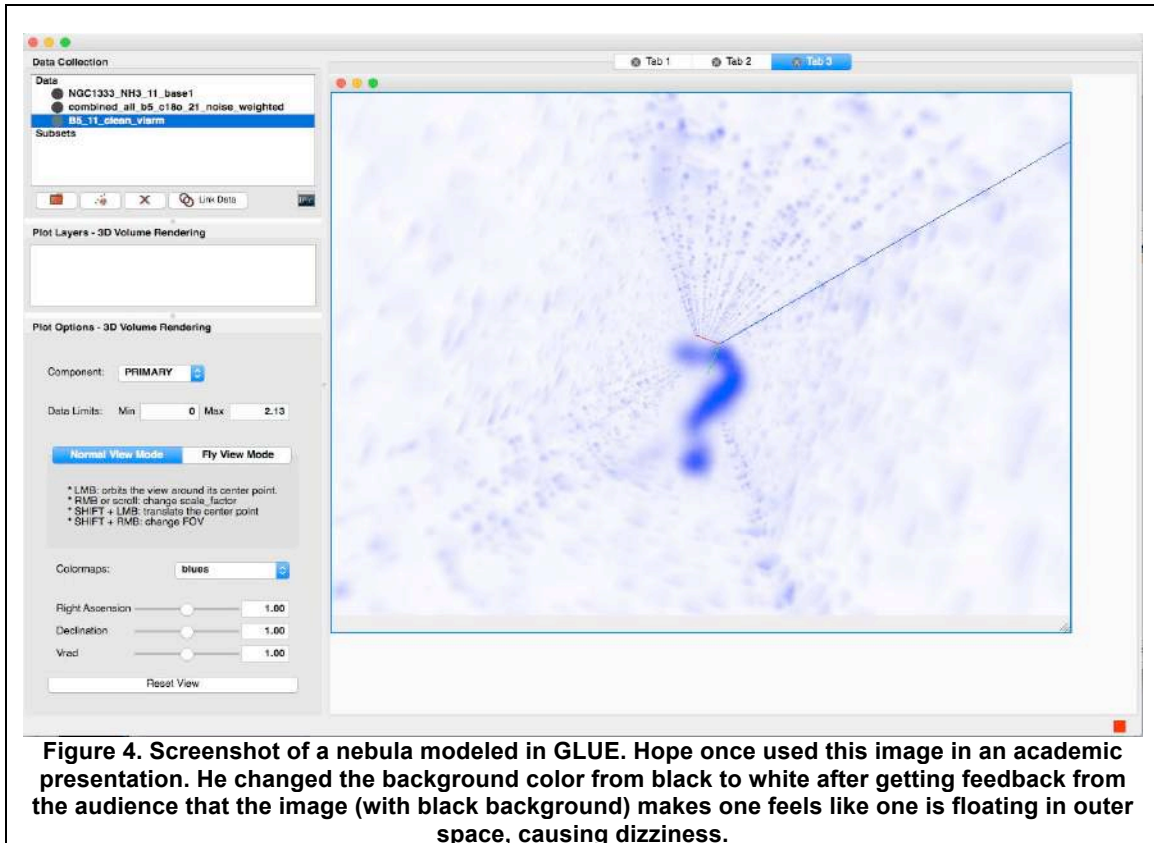
go-to microscope at the moment. Even the entry-level SEM microscopes are much less mobile and much more expensive than the most basic optical microscopes one can buy at the gift shop of a science museum. This is maybe why the SEM has not replaced the optical microscope in the public imagination of science in the making. SEM is a non-lens-based, non-optical technology that uses the refraction and detection of electrons to, in a complete darkness and a vacuum, construct images at the scale of the mirco and the nano. Encountering the SEM images for the first time, they struck me as capturing a parallel world. I trust that these images are capturing something real, but the worlds that these images evoke in my mind are not actual. Is this the kind of things Deleuze and Guattari call virtual?¹⁷

4/15/2016 | Hope | Harvard-Smithsonian Center for Astrophysics A-205

I continued to ask the question, what about images that capture aspects of reality at a scale so large or so small that humans cannot access perceptually? I went to visit a friend, Hope, who is an astrophysicist (someone I had interviewed for *Nesting*) at his office at Harvard, trying to get a sense of how he interacts with images in his work on a daily basis. Hope works with a nebula far away named Ophiuchus where a few stars are born. He showed me three-dimensional visual models on his laptop that “stitch” together two-dimensional images with the third dimension (the perspective axis) being speed (see Figure 4). The two-dimensional images are made from detection of light from outer space at a scale unfathomable to humans. It is impossible to image outer space in 3D due to scale and therefore the third axis is usually a temporal variable. To astrophysicists, space and time are not different, and light is the only thing observable.

The same software Hope uses to make the image shown in Figure 4, GLUE (developed by an astrophysics graduate from Harvard) is a statistical data visualization software that allows for understanding relationships between datasets. I found the same software demoed with FBI crime data.

¹⁷ Brian Massumi, in a 1998 essay titled “Sensing the Virtual, Building the Insensible,” traces the idea of the virtual as put by Deleuze and Guattari, following Bergson, saying that the virtual is the mode of reality implicated in the emergence of new potentials (Massumi 1998). In the introduction of his 2003 book *Parable for the Virtue*, he continues this line of thinking: “The word for the ‘real but abstract’ incorporeality of the body is the virtual. The extent to which the virtual is exhausted by “potential,” or how far into the virtual an energeticism can go, is a last problem worth mentioning” (Massumi 2003).



2/24/2016, 3/14/2016, 4/26/2016, 5/10/2016 | Don | Building 4-141 MIT

I also started to pay regular visits to Don, trying to understand his relationship to the images he is producing and assisting students to produce everyday. How do they perceive the images they work with on a daily basis? What kind of aesthetics judgment is made at the same time of perceiving the images as data? Don and I spoke many times comparing how we each perceive the black and white images that the SEM makes. Many times I asked him to explain to me what is happening at the material level rather than what function the microscope could perform. I wanted to understand from what interactions between the machine and the sample in the machine an image is produced. I was less interested in all the information that can be derived from the image and what the information tells us about the sample.

Each model from which we make sense of the world becomes a kind of imaginary world in its own right. Are there infinite numbers of imaginary worlds? Perhaps. There is an infinite number of ways to represent and reinterpret observations of the real world. This inquiry hinges on the desire to see—beyond what our bodies can immediately sense—being in conflict with the desire for grasping what is real. We cannot stop exploring, but it seems like the more devices we create to augment our body's sensing abilities, the more removed we become from the very reality we seek to come to terms with.

I presented this project in a three-part installation. There is an ordinary walnut installed as a specimen, at eye-level, enclosed in a Plexiglas box in a vitrine. Adjacent to it is a wall of images with no labels, some framed and other pinned directly on the wall, some black and white and others colored, all printed on different surfaces (paper and canvas). Then, there is a stack of tabloid-sized card stock posters one can pick up with descriptions elaborating on how each image is made from a walnut (at the level of the material), at what lab the image was made, and with whom the image was made. The layout of the poster is that these descriptions spatially correspond to the images on the wall.

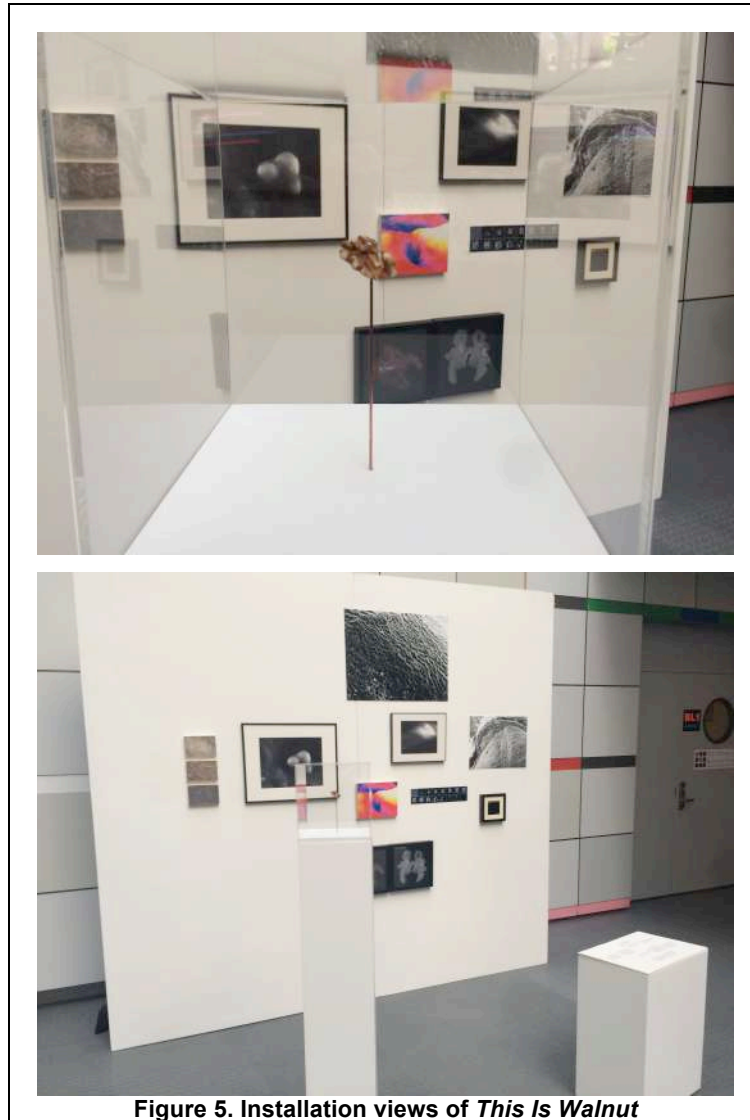


Figure 5. Installation views of *This Is Walnut*

The idea is to create a space where viewers can reflect on their daily experiences of physical reality (material and spatial), the virtual (evoked by images), and how previous conception of cognition and perception may be challenged due to the datafication of everyday life. The display asks viewers to look at the walnut as a specimen in a natural history museum and the images as artworks in a salon style gallery. Both of these display models ask of viewers a level of focus and attention that is more than what is required in everyday life. I intended the

posters to play the role of the narrator. They are placed horizontally around thigh-height in contrast to the walls of images hung vertically. The posters can be picked up and hence mobile, one could hold it in their hands and walk around the display with it.

In each of the scientific instruments I ended up able to use (with the assistance of technical staff or students), the connection to reality is so frail. I tried to learn from everyone I worked with how the images are constructed from this perspective and asked for explanation on a very material level. For each image produced, there is a long-winded journey from the moment the walnut is being exposed to an instrument, to an image on a computer screen, and finally to the object hung on this wall. Text included in the poster can be found in Appendix II.

After presenting this project as a three-part installation, I was asked by many why the walnut. A friend of mine Eduardo Navarro, an artist from Argentina, was experimenting with casting with a walnut. He was also at The Banff Center when I was there for three weeks in June 2015. Since then, I think the intricacy of the shape of walnut stuck in my mind. Though, I was not interested in portraying the walnut as a subject. A portrait is a representation of an identifiable subject, usually a specific individual, a sitter. This project, even though titled as *This Is Walnut*, is exactly not a portrait because the walnut is not the subject of the work. The walnut is not the object of insertion either, as I could have as easily used a pecan or a chestnut. I knew that I wanted something mundane, something of the everyday, and something that we tend to overlook perceptually in our daily interaction with it. I am attracted to the walnut initially because of its intricate shape. It is very relatable on a sensory level—we can image what it feels like to touch a walnut, smell a walnut, and taste a walnut, without actual sensory stimulus coming from a real walnut. That it is edible gives the project a transgressive bent, since one is not supposed to bring food into any of the labs I visited. Given what I was intending to do with the walnut—treating it as a sample, instead of snacking on it—I was allowed to bring in a whole box of walnut into the labs. That it is edible also means that one's everyday perceptual interaction of it includes the sense of taste.

The walnut also worked well logistically because it has just enough water content for an MRI for the image to be interesting, yet it is dry enough to go into the SEM (an object with too much water content might “explode” inside of a SEM as air is sucked out of the pitch-black sample chamber). In popular culture, the walnut is often praised as a superfood, having good fat, and an anti-depressant. The fact that the walnut looks so much like a human brain under the MRI evokes the hubris that is arguably behind the development of all the machines used in the project—it's all about us, to be healed, to be in control, to defend our fragile centrality in the world.

A number of the images that were included in the installation speak to failure and limitation of the instruments. One of the SEM images has parts that are shadows of the machine itself (see Figure 6). Another SEM image looks blurry, which is because the walnut is not conductive enough. These images are considered failures given what the machine is designed to do (see Figure 7). I did not include them in the installation intentionally to reveal some loophole or insufficiency of the infrastructure. I chose to include them in the installation because, for me, they evoke this sense of otherworldliness.

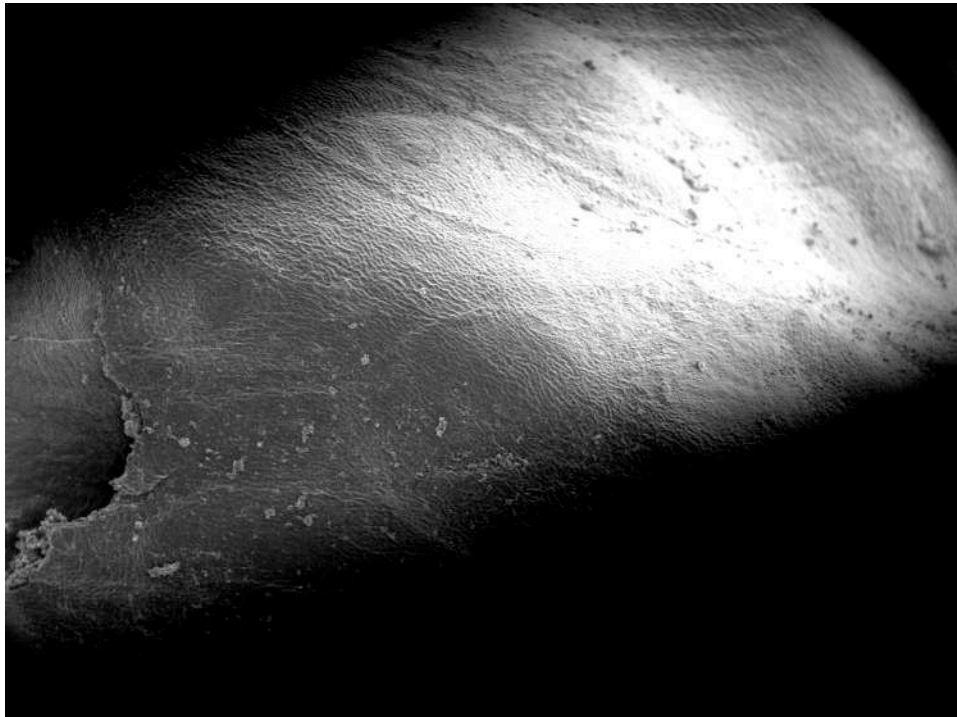


Figure 6. SEM image of walnut 19x magnified. Image made in collaboration with Donald Galler, MIT Department of Materials Science and Engineering.

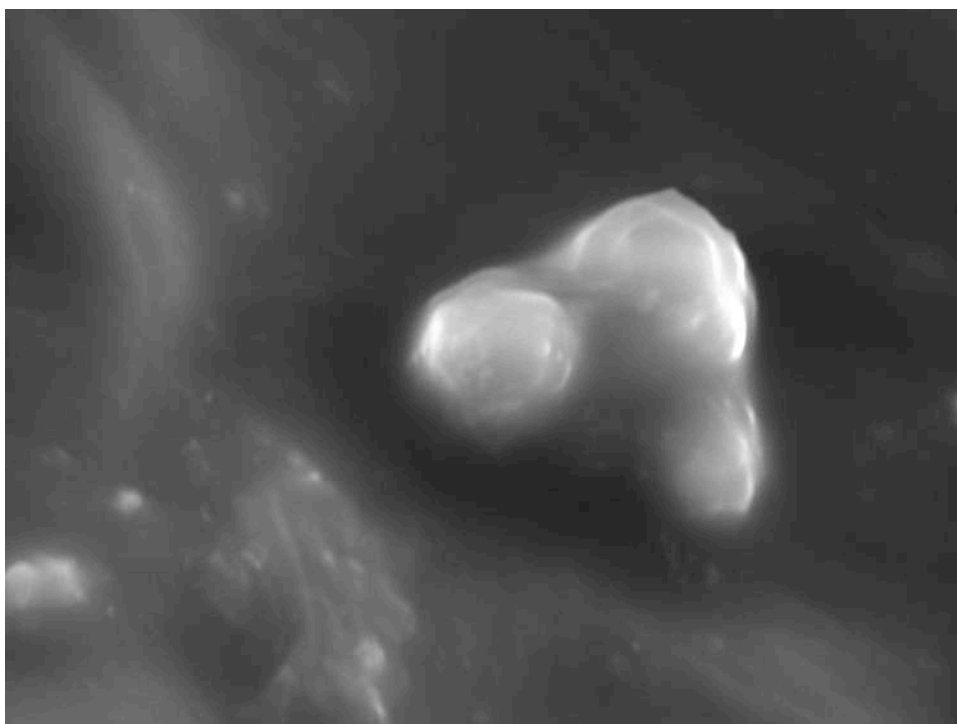


Figure 7. Section of a walnut at 5,000x magnification showing electric charges built up around non-conductive bumps on a walnut. The blurriness also comes from the electron beam going partially through the walnut. Image made in collaboration with Donald Galler, MIT Department of Materials Science and Engineering.

The only machine I used that the walnut is actually not suitable for is the atomic force microscopy (AFM). Again, I did not go looking for failures. The image is incomplete because the part of the walnut that the microscope probed was too rough (it was a tiny piece of the skin of a walnut). To the nanoscale tip of the AFM, the surface of the walnut is like an escarpment. Farnaz, the PhD student who helped me with the AFM, broke a few tips before giving up. She gave me the case with the broken tips.

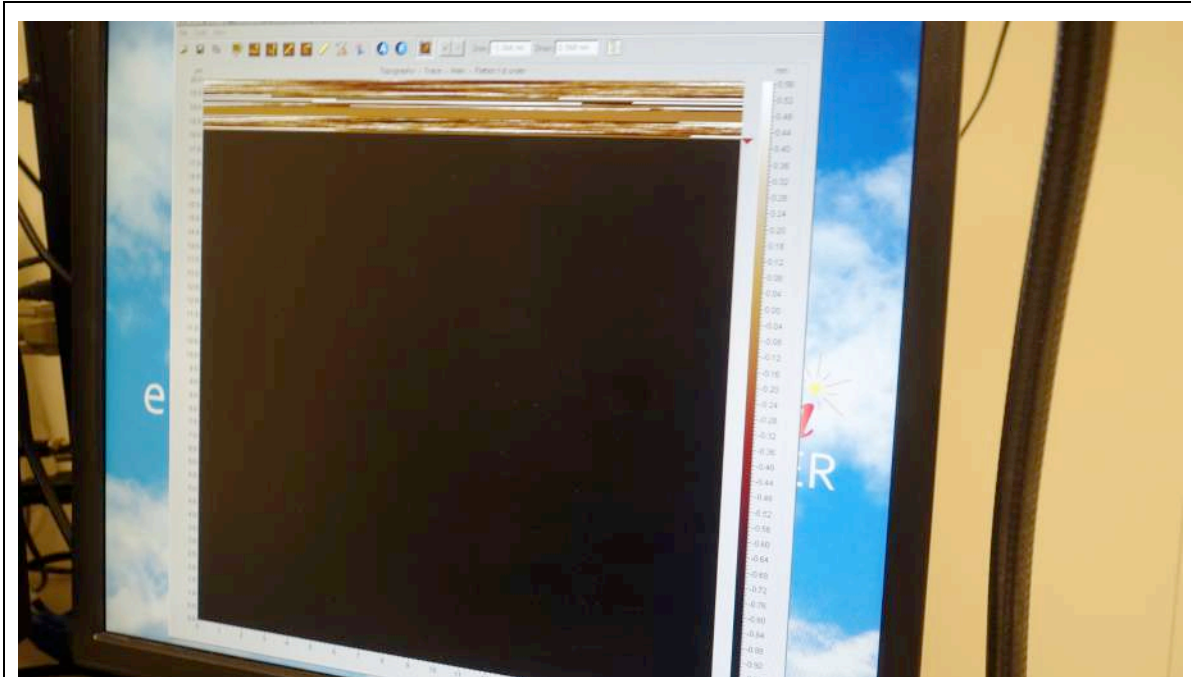


Figure 8. The incomplete AFM image of a piece of walnut skin



Figure 9. The piece of walnut skin mounted for the AFM

5. PROJECT III: PROJECT LIN DAIYU

This project explores what it would entail to create a biomaterial based on the female protagonist Lin Daiyu found in Chinese classic, *Dream of the Red Mansion* (also called, *The Story of the Stone*; written in the mid-eighteen century and first translated into English in parts in 1812). The main component of the work, which may become part one of a larger project to come, is a video recorded brainstorm session bringing together four Taiwanese students including myself in Cambridge, Massachusetts. The four of us each reside in a different field including visual art, literary criticism, bioengineering, and astrophysics. Given a conversational prompt with the goal of creating a biomaterial, this hour and a half long conversation I conceived of and facilitated surfaces questions about the nature of matter and its entanglement with meaning and culture. Viewed as an insertion, the conversational prompt examines a system composed of a mixture of cultural, linguistic, and disciplinary references latent amongst the four interlocutors who are similar in age and united by the identity of being a foreign Taiwanese student in the US pursuing graduate research—an identity loaded with geopolitical implications especially during the time of Cold War.

The journal entries presented below are snippets of thoughts that solidified over time during the course of developing this work. Each snippet pins a moment in time as the project progressed and is labeled with date, location, and people involved in that moment (whenever applicable). This chapter ends with a brief remark about what the project is ultimately about and inquiries that can be developed further.

8/21/2016 ~ 8/31/2016 | *the American Southwest*

On a ten-day road trip through the American Southwest in summer 2016, I became intrigued by how land artists of the 1960s in America (such as Robert Smithson and Nancy Holt) conceived of land and the industrialization of the land they were working with and alongside. At sites such as the *Spiral Jetty* (1970) and the *Sun Tunnels* (1976), they created meaning and expression out of material (soil, earth, concrete, rocks) and processes not so different from those employed by industries at the time (digging for oil, treating a vast area of land as wasteland and perfect for nuclear testing).

One way to think about the land is to think of it as the physical environment that supports our lives. Therefore, I make the association that, in our present moment, industrial processes are being applied to microorganisms that surround and support our lives (yeast, bacteria, and etc.). Many of the alterations bioengineers make are permanent marks on what can be considered this category of “nature”, the same way that atomic bomb testing, for all intents and purposes, left a permanent mark on the Trinity site.

Another way to think about land is to think of it as a constant that allows us to orient ourselves spatially. There cannot be a horizon without there being land. The perceptual experience of the land in relationship to the body is of great interest for the land artists. Part of this interest is that through material and spatial manipulation, we can be made to feel very small or very large in relationship to something of the same size. One of the things the land artists were grappling with is the question of how our perceptual and conceptual relationship to land is shifting given the industrialization and militarization of land. What would echo Smithson’s and

Holt's process and thinking today? I turned to the industrialized processes of working with living organisms in biotechnology and the scale of the molecular. How does our perceptual and conceptual understanding of the physical environment change as materials are engineered at the level of the microorganisms by way of industrialized processes?

10/04/2016 | Zijay | Building NE47 MIT

In an attempt to better understand the industrialized processes of working with living organisms and materiality at the scale of the molecules, I decided to visit a bioengineer and a materials scientist at their labs.

I met with Zijay, a PhD student in the Synthetic Biology Group at MIT. I knew about him from the Taiwanese Student Association, but have not met him before in person until this point. During our first meeting, he gave me a tour of his lab and gave me a crash course on the cutting and pasting of plasmid DNA. For the next three weeks, I met with him weekly. I learned that he works with yeasts to create sensors that function as water quality tests. A number of other ideas struck me. One is that life and death is not more significant of a distinction than say hard and soft or some other sets of qualities when he speaks of living organisms he works with and manipulates. The living and the death are states of being, and each provides a set of sensing and responding properties that may or may not be important for the task at hand.

10/28/2016 | Karim | Building NE46-615 MIT

In the meantime, I visited Karim at his lab. Karim is somebody I met at a leadership program that has people from all across the institute and somebody I started to speak with since the *This Is Walnut* project. It turned out that Zijay and Karim were at the same lab in Dubai for their master's work. I learned from Karim the various lexicons around materials science. For example, I learned that a polymer refers to a "soft" matter. Karim said I could think of a polymer as a chain, a necklace, or a string of spaghetti where a unit of something repeats throughout the chain. As a materials scientist, Karim thinks of properties of materials as stemming from atomic structures. He spoke of the production of silicon wafers an industrial triumph because in each disk, there are gazillions of atoms perfectly aligned side by side. I was often confused as he jumps back and forth between speaking about polymers, rubbers, glass, metal, semiconductors, and other different generic categories of materials. He said that I just need to remember this: order is the special case, chaos is the norm.

10/18/2016, 10/24/2016, 10/30/2016 | Zijay | Building NE47 MIT

After a number of meetings, I told Zijay that I wanted to create a new biomaterial of some kind, as an artist. The proposition itself was as vague to me as it was to him. I was thinking of Smithton's work and how cultural expression and meaning were created based on the moving around of dirt and rock, through manipulating the land via industrialized processes. Zijay asked me what kind of a material did I want to create and what would it be for. I explained to Zijay the idea that artists can manipulate the same matter as engineers but create meaning through an aesthetics encounter instead of solving problems or creating something functional. One memorable conversation during these visits is when we spoke about how a material that is designed to be a coating can be sad, because its primary function is to serve and protect other materials. To evoke even more sadness from thinking of a coating material, Zijay mentioned that there is a lot of effort at the moment going into developing a coating material that "self-heals." Through these exchanges, I arrived at a simple yet very ambitious premise. I wanted to know what it would take to create a new biomaterial, the way artist Yves Kleins was able to "create a

color.” Furthermore, would this act of creation parallel what Smithson did with the rocks in the Great Lake?

Continuous visit to Zijay’s lab did bring me closer to certain important moments that later shaped the work. Lin Daiyu came up in one of these conversations with Zijay. I brought up her name as a way to illustrate a set of ready-made meaning and expression. I thought of her because many of her characteristics seem to run counter to properties that I took materials scientists to value (a conjecture arrived at through conversations with Karim and Zijay)—she is unstable in her health, sporadic in her temperaments, and by herself useless and unproductive. Although, upon further analysis of her character, the fact that she is sensitive, and the fact that she is consistent in how she responds to external pressures actually make her traits quite attractive to materials scientists. Unknown to me at that time, this complication became a source of contention and reflection later on.

10/31/16 | *ACT Cube (Building E15 MIT)*

While having these exploratory conversations with Zijay (conducted in Mandarin), I was reflecting on my own position as a Taiwanese student at MIT. As an exercise, I pulled together a number of objects together (what I had collected over the couple of months prior to this time) and arranged them on the desk of my studio (see Figure 10).



Figure 10. A material sketch containing silicon wafer, my mother’s graduation picture from 1978, discarded tips of atomic force microscopy, hydrogel, computer punch card, autoclaved and sealed petri dish, autoclaved dropper caps

The composition included a computer punch card, my mother’s graduation picture from National Cheng Kung University’s Department of Engineering in Tainan, Taiwan in 1978 (she later studied Computer Science at Indiana University from 1981 to 1983). The other objects were a silicon semiconductor wafer in a zip lock bag (a souvenir from a visit to the Microsystems

Technology Laboratory at MIT), a piece of stiff and translucent hydrogel, assorted plastic lab ware Zijay gave me, and the case holding the broken AFM tips Farnaz gave me.

11/26/2016

Then, it occurred me that bringing a few people together into a conversation around the task could be the way forward. I thought a brainstorming conversation bringing together different backgrounds, languages, and disciplinary lexicons would unpack what this task is really about for me and bring some focus to how I should proceed. In addition to Zijay, I invited two other people into this conversation. Between the fact that I had been in conversation with Zijay only in Mandarin and that I was thinking about the genealogy of Taiwanese students pursuing advanced science and engineering degrees in the US in the postwar decades, I decided to invite two other Taiwanese students living in Cambridge: Hope and Perry. Hope is the astrophysicist I have engaged with in both *Nesting* and *This Is Walnut*. I was primarily interested in what he would have to say about scale. In *This Is Walnut*, we spoke at length about images and data visualization as a tool in his astrophysics work. Through our friendship, I also knew that Hope is well versed in film criticism and Marxist theory. To me, these various backgrounds provide multiple potential bridges between the four of us in conversation. Perry is a visiting fellow at Harvard from Nagoya University in Japan. I know that he would be able to speak to the nature of a fictional character and more specifically the Chinese classics, *Dream of the Red Mansion*. Given his research on the representation of the 1968 student movement in Japan through film, literature, and anime, I also knew that he could speak to how a character like Lin Daiyu would traverse through different cultural contexts and across time since her creation in eighteen-century China. Unknown to me at the time of setting up the brainstorm session, Hope had read *Dream of the Red Mansion* quite obsessively when he was in high school (which would have been perceived as not only being nerdy but also being quite a romantic) and Perry read passages of the book daily in order to clear his mind of Japanese and English grammar when he did translation work while living in Japan.

11/28/2016

While getting deeper into planning the shoot, I realized that I had never prioritized the production of an object or a material. I was serious about creating a new material, but I was also quite open to the possibility of failure. It was always about the process of creating something unknown—to actually go through with the process—in order to reveal something that perhaps would not have been encountered if no effort to actually engage was made. I knew that some narrative or ideas would emerge even if the task were not carried through to its proposed end.

I did not discuss in advance with each of the interlocutors what we were going to talk about as a group. All I said was that we were going to together to “make up Lin Daiyu” as a biomaterial. I informed them in brief who the other two interlocutors were, and that the meeting would not take more than two hours. They also knew before coming in that they were going to be filmed. At the time, I did not exactly know what I was going to do with the footage.

12/03/2016 2:30pm | Zijay, Hope, Perry | Building 4-144 MIT

I was quite happy with the formation and believed that the conversation would flow freely given our shared cultural identity and cultural references, despite a somewhat absurd task and different disciplinary backgrounds. The formation of bodies seen in the video is not pre-planned (see Figure 11). What was formed was that I sat next to Perry and across from Zijay. Hope was diagonal to me. This means that the science and engineering are one side, the artist and

the literary critic are on the other; me and Zijay, the makers, sit facing each other, and Hope and Perry, the theorists, sit facing each other.



Figure 11. Video still of *Project Lin Daiyu*

What I did not anticipate was a discussion about form within the first half an hour of our discussion. The first question that came up was: “Can matter signify?” I steered the conversation towards asking if matter can signify without symbolic meaning through culture using the example of gold (an excerpt of the conversation is in Appendix III). Then, also unexpectedly, the conversation turned to an ontology of things proposed in 1920s Japan that reverses the western order (with human on the very top and inanimate objects at the very bottom) as part of an intellectual movement to resist Western modernity.

12/03/2016 4:00pm | Zijay, Hope, Perry | Building 4-144 MIT

The second part of the conversation, started after a short bathroom break, was focused on pinning down who Lin Daiyu is in our minds. In this conversation, we did not look to authorities on the internet for the answer. I intentionally told them prior to our meeting that there was no need to prepare for this conversation and that it would be fine even if none of us have read *Dream of the Red Masion*. Knowing a little bit about each of them, I knew that they would have *some* idea of the characters. For me, the point was to see what we consider her to be, collectively. During the conversation, we casually threw out ideas we have of her as a character who takes up a fair bit of weight in our share cultural references. I started with the idea that she is always sick, and how I was fascinated that visual representations of her tend to have this slanted-ness to it. At the end of this second part of our conversation, we listed a number of attributes or characteristics of her.

We collectively decided that the final task of the conversation was to translate these personality traits that we pinned down for Lin Daiyu into physical properties. And, we decided

that these these physical properties had to be in English. With this list of English physical properties at hand, we can then ask Zijay the bioengineer to figure something out.

To my own amazement, the conversation was quite focused and on track throughout. The intellectual energy was sustained to the very end even though an implicit consensus gradually formed during the conversation that the task at hand was probably never going to be carried out. We did not know where we were headed with the ideas or why, but we collectively put in the effort to continue the exercise, with great joy and curiosity.

The project juxtaposes fictional character creation with bio-organism creation. With both of these endeavors, we can ask: When does something become new? What qualifies as a creation, when in both cases, the endeavors are simply to cut and paste aspects of what already exist and then perform synthesis? Does it have to do with how functional or compelling the synthesized entity is? Fictional characters are illustrative of something beyond itself. On the other hand, new biomaterials in the field of bioengineering are perceived to perform functions that are framed as “better solutions” to existing problems. Or, their creations have more to do with whether and if they circulate beyond the systems that incubated them.

This project set out to make a nest within the emerging field of synthetic biology, yet it turned towards the amalgam of cultural, linguistic, and disciplinary references shared between Zijay, Hope, Perry, and me. At the end, the four of us together made an earnest attempt at nesting within the system of synthetic biology. Even though the attempt was not frivolous, our effort barely made contact with bioengineering. The conversation ended with Zijay saying: “I’ll think about it, let’s all think about it.”

6. PROJECT IV & V: I SAW IT, I LOST IT, THEN I WENT LOOKING FOR IT & A STUDIO IN A LAB

A work in progress is the last project included in this thesis. This final engagement with MIT consists of two gestures of insertion one within another. In *A Studio In A Lab*, I effectively move my artist studio at MIT into a inactive laboratory space in a different space that is about to undergo renovation for a total of five weeks.¹⁸ This process engages with the complex system where an academic department, the facilities department, and a contracted construction company come together. The three units of operation come together to facilitate new faculty members' research and related needs with regards to space. The space I inhabit during these five weeks is in a state of transition, it's an idling space in some sense, it's a space in limbo in some way.

While based in the studio I set up for myself by way of “nesting”—concocting materials, forging associations, and dwelling—I make another project titled *I Saw It, I Lost It, Then I Went Looking For It*. This project nested within will be exhibited at a student gallery on MIT campus in yet another building,¹⁹ ten days after I exit the studio lab.

In *I Saw It, I Lost It, Then I Went Looking for It*, I insert myself into the complex system of micro- and nano-scale fabrication of silicon wafer situated at MIT Microsystems Technology Laboratories (MTL). This system, focused on fabrication at a scale not available for the naked eye, is juxtaposed with the system of space-making at the scale of the human bodies and machine bodies. The work involves locating and cutting out a 0.1 by 0.1 mm feature made on a silicon wafer that I first encountered in a fleeting moment.

Below and in Appendix IV is an archive of fragments of writing that together tell the stories of how I “nested” in these systems. In the form of journal writing, these materials focus on each and every interaction that pertains to the gestures of insertion—interactions that enable me to “nest” or interactions that are produced by the insertions. The story starts with how I began the engagements with MIT Campus Construction and with MTL. Then, it goes into how I arrived at choosing a chemistry lab in Building 18 (the Dreyfus Building) as a site of insertion with the intention to make an in-situ art installation. Meanwhile, I made some concrete decisions about making another project using the fabrication facilities of MTL. What follows after are key interactions leading up to the “move-in”, such as meeting people from the Department of Chemistry for the first time. At the same time, I make concrete steps towards gaining formal access to MTL as a non-engineering student.

Appendix IV contains complete logs of each day I spend based at the studio lab from April 18 to April 28, 2017. Given that this thesis is produced in accordance with institute deadlines, I include only a work in progress report of this final engagement with MIT.

¹⁸ I move from the Weisner Building (Building E15), designed I.M. Pei and built in 1985, to the Dreyfus Building (Building 18), designed also by I.M. Pei and built in 1967. Both of these buildings, in their architecture and in their naming, celebrate and honor the high modernist spirits of rational inquiry in art and science. In the first three weeks, the space was overseen by Campus Construction and the Department of Chemistry. In the last two weeks, the space would be overseen by Columbia Construction.

¹⁹ The Stratton Student Center, which is designed by Eduardo Catalano and built in 1963.

02/26/2017

I still get lost sometimes navigating the campus because there are so many construction sites. Between the eighteen months I've been here, I've seen entire buildings go up or torn down, they seem to come and go as rapidly as the students do. The Writing Center, the International Students Office, the bookstore all have completely moved out and settled into new spaces.

I met Dick January of 2017. He had a construction helmet on and was looking out to the nano building construction site from the connecting corridor between Building 8 and 16. I asked him when the building will be done and we started chatting. He was way more lively than anyone I've met randomly around here. I complained to him a little bit about my first semester. He said MIT students are automatons but he wouldn't want to be anywhere else. He gave me his business card and said I can e-mail him if I needed anything, just mention that we met at the window overlooking the nano site. Turns out, he's the Director of Campus Construction.

In the meantime, I was taking a 5-day training at the Microsystems Technologies Lab, the MTL. Most of the clean room facilities that the nano building will have are now at this lab, built in the mid 80s. In fact, you can see the nano building going up right from the old lab. Scott is the person running the training. A very forgetful and disorganized person. He often forgets where he's left the gloves he just took off. He'd tell us to never touch a wafer with your fingers, while doing it. We often had to wait around for ten, fifteen, or twenty minutes at a time, for a wafer to bake, for the machines to their jobs essentially. So, Scott talked a lot about his commute, as he had just transitioned from driving to taking the train. The other four students are real quiet. Scott tried to engage with us by asking questions, like is this plane concave or convex? Usually I know nothing about the subject matter, but could take a pretty good guess. I had the confidence because I had met with my friend PG the week before and he gave me a crash course on what a semiconductor metal even is.

Dick put me in touch via email with Janis who is the program manager for renovation and space planning. She sent me a list of potential spaces that I could work in. We only ever e-mailed and spoke on the phone. Biss and Katie are the two project managers I've met so far. Janis is their boss. Biss met with me and he is managing a clean room being built on the fourth floor of E15. Payette is the name of the architecture firm designing the space. The same firm that designed my favorite place on campus. Biss said it'd fine if the installation will have seaweed or tofu in it. Jim Harrington wouldn't even need to know.

Katie showed me this space on Albany Street. She told me that she is managing eleven projects at the moment. She used to be a carpenter, but it was too macho for her, she went back to school for management and she loves her job now. She said it's a little bit like herding kittens, you just have to hire the right people, the engineer, the architect, and the general contractor.

7. CONCLUSION

This is one way to sum up the projects presented in this thesis: *Nesting* is about thinking (how to think, what to think with); *This is Walnut* is about seeing (how does one see, how does seeing amount to understanding and grounds for doing); *Project Lin Daiyu* is about making (how to bring something into being, what happens to what is created); and finally, the nested projects that inhabit a chemistry laboratory are about being (how to be in a new environment and how to be around new people).

Another way to sum up the projects could be that they each explore the limit, or a threshold—the point where something is rendered senseless or illegitimate. They each do so *not* in an attempt to mark that point. Rather, the intention is to inhabit the space leading up to that point in order to see if one could blur or collapse that boundary. *Nesting* deals with the limit of knowing, questioning at which point does a way of thinking lose its potential to be a means for knowledge production? *This is Walnut* deals with the limit of seeing. At what point does the relationship an image have to reality become so frail that we no longer consider the image a picture of some slice of reality? *Project Lin Daiyu* deals with the threshold where a synthesis of existing things becomes something made—becoming a creation of some sort. Finally, the nested projects (*I Saw It, I Lost It, Then I Went Looking for It* and *A Studio In a Lab*) push on how one could be within an institutional framework without breaking any rules or resorting to lying.

In developing the nested projects that push on how one could be, it came to the surface that encountering the other and gaining layered access by way of trust is a big part of each and every project that came before. Trust of the other (partially produced by dwelling, by forging associating, and by concocting materials) is what has ultimately enabled the “nesting” in these complex systems. Moreover, it is precisely in the moments of encountering something unknown (enacted by the insertions), is there space and an opportunity for trust to develop.²⁰

7-1. Conflating Nesting (in the Biological Sense) and Nesting (in the Topological Sense)

In *Nesting*, the interviews, enabled by the nested cube, circle around four questions about nesting in the topological sense. The questions are posed again here in relationship to the methodology of nesting complex systems put forward (and put to task) in this thesis.

1. How does the work relate to this object?

One way nesting seems to appear in my methodology is that at each step of the process, there are clues that lead to more clues. One relationship enables another, and another, and another. The projects are led by these layers of relationships. Access (to a person, or to be able to carry out an activity) always seems layered; there are many hooks to jump through.

²⁰ This resonates with the ethical practice that Judith Butler advocates for in *Giving An Account of Oneself*, where the main ethical question comes down to how one ought to treat others because each encounter with the other is an opportunity to re-establish who one is and what one has done—or, in Butler’s words, “to vacate the self-sufficient “I” as a kind of possession” (Butler 2003, 136).

2. What is the in-between?

Maybe this in-between is trust, which takes time to develop. Sometimes following one clue that doesn't quite make sense serendipitously leads to another clue that brings everything together, or opens up to yet another layered process.

3. Can the layers be collapsed?

If this is a question of hierarchy and not chronology, then perhaps. No one encounter is necessarily more important than another, and the success of the projects do not hinge on any particular relationships. This is not to say that any one layer is dispensable; each project is constituted by each and every encounter and relationship.

4. What would the discipline look like if this notion of nesting is illegitimate?

If the spatial notion of nesting is unavailable to artists, I think the notion of self-criticality would need to be re-conceptualized (for better or worse). Being self-critical as an artist is the process of looking at what one has made, to stand outside of it, which requires this idea of nesting. Stepping outside of one's own work in order to examine it is not about being able to make objective evaluation of some sort; it is to remove oneself as the creator (or executor) having a special access to the intension behind the work. This is important because by stepping outside, one could begin to imagine how the work is received by others who do not have access to one's own thinking. This seems to be a very important aspect of art-making in the contemporary moment.

An additional question remains: Is there a center? Does the practice or do the projects have some sort of a kernel? Perhaps the nest in the biological sense functions as a center on the metaphorical level.

7-2. Conflation As An Aesthetic Act?

No longer the center of the informational sphere, as philosopher Luciano Floridi puts it,²¹ how are we to situate ourselves in the complex informational systems that we live within? In *After Art*, art critic David Joselit writes: "'Hits' and 'cookies' are the keys to searchability online. The greater the scale of a network...the harder it is to retrieve any particular unit of information. Hits and cookies are the keys."²² As the world becomes more complex, these keys Joselit speaks of become more valuable. Having access to these keys allows one to navigate the complex systems in one way. The methodology presented in this thesis, the conflation of nesting in two different senses, suggests another way to traverse complex systems.

There is a double bind here in that as the world becomes more complex with developments in science and technology, one is to find new ways to understand its position in it in order to navigate, and, simultaneously, the very notion of personhood (the question of what a person is) is challenged by the same developments in science and technology.

²¹ Floridi, *The 4th Revolution*.

²² David Joselit, *After Art* (Princeton, New Jersey: Princeton University Press, 2013), 80.

One final question remains with regards to the methodology presented here: what happens to the nest that has been built? Is it then absorbed by the system by becoming a part of it (even only as a collection of memories and minute traces)? In other words, what is left behind after the insertions are completed? Or, is the insertion removed or withdrawn after a certain amount of time? Is there a counterpart to the insertion? If the nests stay in some sense in perpetuity through documentations and memories, how can the nests be returned to, and what would that do?

APPENDIX I

Below is the content of the posters in *Nesting*. These excerpts of interviews are organized by disciplines here in a random order. Words underlined are spatial and relational terms.

HISTORY

Recursive, what can you put inside something else?

When you think about doing projects in history, often you start from a small story. Historians are not antiquarians and we don't just love things for the shiny values of the beautiful thing itself, we always ask: What is it an example of? Finding a story that is illustrative of something larger. So, I spent a lot of time following the lives of the, not even the one percent, the point zero zero zero zero zero one percent in China in the 1950's, 60's, and 70s. I don't do it just to learn about how they spend money and can joyride around in a Jaguar in the 1960's in Shanghai. I do it because it tells me something about the political culture of the early People's Republic, or the changing ways families strategize to survive, or different roles, gender roles, youth culture. So, it's in the service of some larger theme.

You can move up and down the ladder of abstraction. Historians are splitters rather than lumpers. All the other social scientists are always big into the most general levels of things. We like to talk about that, but our starting point is the little detail. We do the little details first, and then we think, ok, how can we step up a level, and be in conversation with other people.

Who knows, maybe people start to nest because the more they do a certain time or era, the more they get comfortable with it.

The other way I take nesting, is to mean, getting comfortable. Finding comfort in a context. Historians are better with time than with space. Sometimes, people get comfortable in an epoch and would want to stay in that era.

History never repeats itself, but it does rhyme.

History is both a technical and academic pursuit, it is also a real world thing with political implications. A lot of times, the writing of history is put in the service of other sorts of aims. History and talking about the past is actually a way for people to talk about the present and what their values are. So, people can through history, try to nest and feel comfortable with the place that they find themselves in now, by telling meaningful stories about the past, that justify or explain who they are or how they came to be.

We don't do the future. That's actually one of the best things about it is that we don't have to predict anything.

The most honest thing we can do is to try to think deeply about making the past familiar, because the past is a different weird place and they do things very strangely there. And the other thing we try to do, is make the present strange. That is, all the stuff we take for granted in life, it doesn't have to be the way that it ended up. There is a particular bizarre path it took with all sorts of twists and turns, and to show that, oh ok actually it's kind of weird that this and that happened and maybe it could have gone another way.

So if the recursive part were barred from human imagination. Well, we would not be able to speak. Fundamental of all grammar is recursion. It would be extremely hard to formulate and communicate any sorts of complex thoughts without that.

Recursion doesn't really justify things, it's just a prop, or a mechanics, or a tool.

If you can only point at things, and not embed things in other things, it would impoverish our ability to talk about anything.

If you could never say that something was an example of something else, that would be a war on thought and reasoning.

To jump from level to level, you do it implicitly, you write on many levels at the same time for different audiences. The Mahayana buddhists have this doctrine of expedient means, which is that you pitch your message to people at the level they can understand it.

Maybe there is a breakthrough moment of coherence for just reasons of your mind as a relevance making machine, like things snap into place, and you suddenly realize that. It's not moving up or down, but it's there, like a tapestry, sort of different levels are visible depending upon how you move your perspective, but both can be coherent the whole time.

ECONOMICS

In my own discipline, the tendency is to say oh my goodness this problem is similar to that other problem is *similar* to some other problem. But, I see it more as like I'm accustomed to solving a particular kind of problem so I'm going to see everything like the same problem I'm used to. You know that joke about if you have a hammer you think every problem is a nail. Economists tend to have their preferred way of doing it and so they want to show that every problem is reducible to their particular perspectives.

There are ways that capital seeks to increase itself, even repetitively, repeats certain processes to grow.

ASTROPHYSICS

Because the scale we're dealing with is very large, even supercomputers cannot compute the whole universe. We use a box, throw stuff in it to have it simulate physical phenomenon. But this is a special box. We assume that when stuff comes out of one side of the box, it comes back in from the other side, in order to maintain the principle of mass conservation. We can't simulate the whole universe, so we use this box, set it on repeat, to simulate the universe. Imagine we take the universe, fold it up until it can fit into this box, so that our machines can run simulations in it.

The hope is that we can use the small stuff to prove the big stuff. It's called repeating boundary conditions. Boundaries are not treated as closed, things don't bounce back when they hit the boundaries, instead, things go out from one side, and will return from another side.

If you find a galaxy near the edge of the box, we don't really know if there will be another chunk of it that comes from the underside of the box. We don't really know.

All astronomy simulations are basically fractals. It doesn't matter the scale, the same laws apply. You zoom in anywhere, and it'll look just like the big box, indistinguishable by machines or trained eyes. The laws are the same everywhere in the box. It doesn't matter how many times the small box repeats itself, whatever you observe in any of the small ones will be the same as what you see a bigger box.

More of the same thing, because the bigger is just repetitions of a smaller chunk. Maybe this one box is a little bit brighter, and that box has some more stars, but structurally, they are the same.

Each boundary is only defined at the moment of an observation by a subjective observer. For example, we can see a medium-sized box if we determine that that is the scale at which we want to make an observation.

We would be helpless and possibly out of jobs.

Order is not absolute. Space is reversible, so if you call left as right and right as left, we don't notice a difference. But, time is directional. We are always oriented towards the future. Though, time could be on a loop, nobody knows. Again, it depends on the observer.

FLUID DYNAMICS

Where nesting becomes apparent is when they try to investigate the behavior of red blood cells or different kind of cells in fluids. When you have cells with soft membrane and inside you have the nuclei, so then they investigate the dynamical behavior of the whole cell, and the core, relative to each other, in the fluid.

Most often you want to study how the fluid will affect the repartition of the cells within the fluid. Some location you might have aggregation of the cells, some others you won't have these. So you have interaction between the cell and the fluid and between the membrane of the cell and its core you also have interaction.

The nuclei within each cell will affect how the cell itself moves in the outer fluid, so you have the two layers.

EPIDEMIOLOGY

The way that comes to mind when I think of nesting is the spatial extent that an idea applies to.

When I look at disease transmission, sometimes I would take a case that's very specific that I think would be a type of contact between two people, say the transmission is most likely to occur. And then that I can build out from that. If it's most likely to occur there, is there a version of that that is similar, but a bit more general, and I can kind of keep going further and further out.

The interesting thing is, as you get further and further out, you have more and more data. So the small thing, the inner nest is the most specific, but maybe you don't have enough data to prove your theory in the very specific case. Then you can kind of go out to the more general levels where you can prove your theory with more cases.

Often what I do is identify what levels of the hierarchy can be collapsed. Empirically, you look at if things can be collapsed or not. I also think of layers of an onion. Yes, sometimes they can be collapsed.

I think of it like a topographical map. Sometimes when you're looking around, when you're probing levels of this model you realize, ok wait a second, actually these two different levels of the model that I think are two different levels, are actually very similar, therefore, I can collapse them. But there is still a hierarchy beyond those two layers. So, just some of the hierarchy can be collapsed.

The whole discipline goes out of the window.

ENGLISH LITERATURE

Ron Silliman uses this technique called the new sentence. Rather than having the line for the unit of a poem, it's the sentence. So you have a kind of more prose-like shape and syntax to the writing. But, it doesn't accrete meaning. So sentence by sentence you just have one thing and another that are discrete. There are jarring relations between them, but they are not strategized. It's actually important that there's no subordination between sentence and sentence, that everything is on an equal plane.

Say what Silliman did was interesting is that there is this nesting for his project so that there would be a poem that has seven sentences per section, and there are seven sections, and that's one of seven books that's then a larger project that has twenty-six letters. It expands outward outward outward, but there isn't any hierarchy amongst them. There is just the expansion of words.

The smallest unit would probably be blank space. He talks about blank space having an impact, or that a lack of an impact is also an impact.

It's a political move for the Language poets, because it's imagining how you can be discrete units without being a larger whole. What that *big* thing is is never determinate, it's never just one thing. There is no climax.

You would lose the ability, in my field, to comment on something within that work. There would be no scale jump that you can make. You lose reflexivity; reflexivity would be lost. Or, you lose critical distance reflexivity. A work that can jump out of itself within itself.

Without nesting, you'd lose modern poetry, it's gone.

MATHEMATICS

You'd call it induction in my area. A lot of the time, the way you understand a geometric space is you show it's built out of smaller spaces that look like it but are a bit simpler. Each of those are in turn built from smaller spaces that look like it but are a bit simpler. Kind of all the way down. Whatever question you ask about the larger complicated space, you reduce to a question about its building blocks, and you turn to a question about their building blocks, until your question kind of disappears. That's the thing almost all mathematicians do.

It's not fractal because the process ends eventually, you get to the smallest block where things are very simple and you answer your question for that block.

There is a different way that nesting comes up, which is fractal, in something called conformal field theory. If you take a very thin material, imagine a sheet with a lot of different electronics on it, and each electron is vibrating at some speed, at some angle, and is interacting with its neighbors...and you want to know the overall property of the sheet, conductivity, electrical alignment... Most of the time, it depends on how close you're looking at the sheet. If you zoom in, things will start to look different, you zoom in further, they look more different, that's the normal state of affairs. Mathematicians are interested in looking at the exceptional cases where at a specific temperature, magnetic field or whatever, you get to something called the critical phase, critical phase transition, where no matter how much you zoom in, everything always look exactly the same. It's a fractal basically. It happens at phase transitions, for example, when water turns into ice, or water evaporates into air.

It's when a very large system, a system with billions and billions of constituent parts, which has an input of some external variables like temperature, magnetic fields, or pressure, as you change that external variable, suddenly the property of the system will undergo dramatic transition like

from being solid to being liquid, or from being magnetic to non-magnetic. And it is at that point you can find this fractal behavior.

You think of a two dimensional surface, on the surface you have some measurable properties, so you have some sort of function on your surface. It turns out it's just incredibly useful for studying two-dimensional spaces in general, the geometry of two-dimension. You can learn a lot about what is possible to do with two-dimensional surfaces in general in mathematics by using the objects that occur naturally in conformal field theory and then just running with it. It becomes a model. It tells you a lot about general things about geometry. Eventually, you can use that stuff to study number theory, or statistics.

The way you tell these blocks apart is essentially by their dimensions. So your basic building block is a point, and then out of your point, you build something which is dimensional, like space-time, then out of this four-dimensional thing, you build an eight-dimensional thing, out of the eight-dimensional thing, you build twelfth-dimensional thing, you keep building larger and larger dimensional spaces by gluing together these smaller guys.

You know that Damien Hirst's Shark? That's more or less what's going on here, I have the big aquarium, which is my four-dimensional space, I have the cross sections which are the building blocks, the shark is something I'm interested in in my four-dimensional space. One can study it by looking at its intersections with these smaller blocks, or one can think of it as a whole inside of the four-dimensional space.

You can take one of the cross sections of the shark, it's a two-dimensional square, you can divide that up into strips, into lines, which are one-dimensional, now you'll have a one-dimensional strip of sharp, and then you can divide that into points. As it turns out, there are lots of points. The in-between is the infinity of points, if you please.

Usually the smallest block is the simplest block, and then you understand your simplest block, and then you piece that understanding together to get the bigger block. You piece the understanding of the bigger block together to get the still bigger block. But it's not always like that. Sometimes you go back and forth. The flow of information is not always necessary from smaller to bigger.

If we got rid of nesting, if we get rid of induction, mathematics would just collapse into a vacuum. You might as well just all retire.

Induction is the basis of everything we ever do. Maybe not everything, in math. Probably a lot of people would say it is the basis of everything we ever do, some form of induction, just like, expecting what worked before will work again.

NEUROPSYCHOLOGY

In Music, you have all these nested structures. You have phrases, there are groups of phrases that constitute motifs, and then there are sections and even longer. So of course the nesting is in time, that's temporal nesting. In speech we have the same things. There is nesting of the primitive phonetic distinction and those are parts of syllable that we recognize in chunk. Then those are parts of words and phrases, clauses, and sentences, paragraphs and whole works.

Have you heard of Herbert Simon, *Science of the Artificial*? That was his book. He talked about hierarchical assembly. So there's this parable of two watchmakers. Let's say there's a watch that you have to put together that has a hundred parts in it. There's a ten percent chance that any one part is going to be faulty. If you try to put the whole thing together and test it, it's never going to work, because the probability is small that .99 raised to the 100th power would be a significant fraction of one. However, if you break it into subassemblies, like ten units each, ten subassemblies of ten parts, then you have a very good chance of making a watch. The one part

that fails you do it again. So if you have nested constructing test processes, you have a hierarchy of processes.

In the temporal arts, many theories rely on tension relaxation dynamics. In drama, you have the creation of tensions, conflict, and uncertainty, and then it gets resolved, and then there's another tension, conflict, and uncertainty. Usually, there are small situations, but then there's an arc of tension and relaxation. There are many kinds of things, that has to do with this setting up tension or uncertainty, and then overcoming it, going to a state of certainty. Again, in music that's everywhere, and in drama, and in sports.

Second-order cybernetics. Heinz von Foerster was a proponent of second-order cybernetic, which involves in some ways recursive interactions and relations between observers. For example, we are communicating. I have some sense of how you might interpret what I say and you have some sense of how you would interpret what I'm saying and how when you say something you interpret what that would mean to me. There are multiple levels of that. There are multiple embedding of that. So, conversations can have meta-levels. So when you have meta-levels, you have a hierarchy of level, of interpretation.

Even something like pitch, so if you have a major key, you establish a tonic, the tonal center right? There are notes that are highly related to the tonic that are close. The octave is close to the tonic, the fifth is relatively close to the tonic although not the same as the octave, or unison, then the third is the next closest, and then other notes in the diatonic scale are the next closest and the furthest notes away are the notes in the chromatic scale. So that defines a tonality neighborhood, right? There is a hierarchy of distances, or perceptual distances.

During the wave of Symbolic AI in Computer Science, there were theories of consciousness based on recursive representations. So, David Rosenthal, he would be a proponent of this. It's not spatial, it's abstract. They would say you have to have recursive operation in your brain or in a computer in order to have consciousness. If you got rid of nested structure, we abolish consciousness.

You definitely need an idea of inside and outside.

Sequentially uncovering one thing after another after another. There is an extended process of discovery where things are nested inside of another thing. Generally speaking, in terms of our psychology, the context is always sort of the enclosing thing. Something happens, and then you interpret it in terms of the preceding context, and then you interpret the next thing in terms of all of the preceding context. So it aggregates itself, in your nested context.

Atonal music. Whether you like it or not is another matter. It's trying to get rid of tonal hierarchy. What happens is that you don't have expectation built up, you don't have the context that you had, at least for tonality. So one way of looking at that is it allows you to explore other things.

COMPUTER SCIENCE

Oh, it's everywhere. The for-loop. The tree data structure is a nesting structure.

First you have an abstraction, then you instantiate. Abstraction is the unit where you can't nest anymore.

Not all components are enclosed, some even have protrusions.

To avoid a for-loop, you'd use matrix multiplication, which is a lattice. And you get a tensor if you nest lattices.

It's where you can have an operational in the nesting, to allow you to can access the structure. You can insert a code that'd allow you to pop out of the nesting, so that you can know where you are.

HISTORY OF SCIENCE

This idea that first you put one doll around the doll, then you put another doll around the doll, you can continue, and this iteration might never stop. But the thing you might be interested in is not the fact that it can never stop, but the action, the form of the placing. So the iteration is more this action that's performed of the putting, and the putting, and the putting. Maybe that action can go on to infinity. When you get into the infinity stuff, you get into Theology very quickly. Really you do.

In Anthropology, STS, and Critical Geography they would call it the politics of scale. Is this a global problem? Is it a local problem? How does a certain person in a certain place, like a government, a minister maybe, decide whether something is a country, a global problem, or a local problem, and then how does that change how the problem is attended to. There's a politics to this scaling relations that happens.

Neil Smith is talking about uneven development. Why is it that one place is more developed than another, and how did that arise? Why did we think of one more than another. Again, there's this sort of scaling, this idea that a scale is produced through social relationship or political relationship is exactly what Henri Lefebvre is on about.

Scaling and scale invariance is hugely important in physics. Hugely important. Scale invariance in physics is the idea that you could develop an equation that describes phenomena at one distance level, and maybe variant in one parameter you could use that same equation to describe phenomena of very very different behavior. Physicists gets really excited because there are certain things in that equation that are constant, so you can have symmetry of the scale invariance, and this becomes really interesting for people in high energy physics, particle physics, and also in solid-state physics like superconductivity, magnets, stuff that's really cold...

Scaling in physics. In away, I think it's sort of the opposite of nesting, it's like you find this continuity. In nesting, there's also this idea of a break, or division between one and the next.

When I think nesting, I think enclosing. There's obvious spatial and architectural... the apartment, the apartment building, in the city, in the country, whatever.

Deleuze talks a lot of manifolds. When you read him you have to be aware that some of the first translators of Deleuze made a bad choice and they translated *multiplicité* in French, to multiplicities in English. So when in an English text, you say well Deleuze says reality is multiplicities. Usually, that's much better translated by manifolds, so he's using these spatial and mathematical concepts. *Difference and Repetition* which was his first book, of his own philosophy, is deeply mathematical, to most people probably incomprehensibly mathematical.

In a certain sense, depending on your perspective or purposes, one way of nesting could be seen as equivalent as another. So, maybe one way of reducing hierarchy would be to talk about how the hierarchization is relative. That does have some resonance to physics. Some of the Soviet physicists that I study are really interested in contesting that and saying that actually there is no way in which the earth could be the center because they are interested in this philosophical idea that the Church is wrong.

APPENDIX II

Below is the collection of texts as they appeared in the poster in *This Is Walnut*. They serve as captions for the images of walnut presented in the three-part installation.

The **scanning electron microscope** (SEM) shoots a beam of electrons on a sample. The detector makes an image based on how the electrons bounce from the sample. In this image, at 5,000x magnification, electric charges built up around non-conductive bumps on a walnut. The blurriness also comes from the electron beam going partially through the walnut. Image made in collaboration with Donald Galler, Department of Materials Science and Engineering.

SEM image of walnut 1,000x magnified. The brightness on the upper-right corner indicates a closeness to the detector. Image made in collaboration with Donald Galler, Department of Materials Science and Engineering.

Surface topography of the walnut using **optical profilometry**. Image made in collaboration with Julia Carpenter, Department of Civil and Environmental Engineering.

SEM image of walnut 19x magnified. The darkest areas show where the electrons didn't reach. Image made in collaboration with Donald Galler, Department of Materials Science and Engineering.

At 130x magnification, this SEM image shows an area of walnut that is about three dollar bills in length by four dollar bills in width. Image made in collaboration with Donald Galler, Department of Materials Science and Engineering.

A series of images made with **polarized light microscope** (i.e. an optical microscope with a polarized light filter), which reveals light waves oriented in a direction that are not visible to the naked eye. The blurriness comes from the shallow depth of field in the microscope. Image made in collaboration with Julia Carpenter, Department of Civil and Environmental Engineering.

Magnetic resonance imaging (MRI) uses an external magnetic field to force a particular alignment of water molecules in the sample chamber. By measuring how quickly the water molecules relax into their original position (slowly rotate spirally), an image is constructed. White areas indicate more water content. Black could either mean hollowness or an absence of water in the sample. Image made in collaboration with Wei Huang, David H. Koch Institute for Integrative Cancer Research.

A 3D model of the walnut imaged by a **X-ray microtomography (microCT)** scan. The pink part shows lesser density, in contrast with the blue part. Density here refers to x-ray blocking power, or, number of atoms per unit volume. Image made in collaboration with Milton R. Cornwall-Brady, David H. Koch Institute for Integrative Cancer Research.

Lying on a small tray and stationary, the walnut receives or blocks a cone beam of x-ray which, together with the detector opposite to it, rotates around the walnut. This image shows a cross section of the 3D model produced by the scan. Image made in collaboration with Milton R. Cornwall-Brady, David H. Koch Institute for Integrative Cancer Research.

An attempt at imaging the walnut by an **atomic force microscope (AFM)**, which captures surface topography (i.e. roughness and height) and softness/hardness of the very small by probing it with a nanoscale silicon tip cantilever. The walnut is too rough for the AFM even at the nanoscale. Image made in collaboration with Farnaz Niroui, Organic and Nanostructured Electronics Laboratory.

APPENDIX III

Below is an abridged transcript (translated from Chinese) of the one and a half-hour long conversation in *Project Lin Daiyu*. The 8-minute video is available online at <https://vimeo.com/197193743>.

Me (artist):

can matter express something?
could it have expression/signification?
or in english, maybe we would use the word "signification"
what meaning or connotation could matter have?
i was talking to another friend karim
for example, gold
during earlier times, early western chemistry, or in alchemy
gold connotes or expresses nobility
it expresses a noble sentiment

Hope (astrophysicist):

so when you say signification, you are talking about something cultural?

Perry (literary critic):

like societal meaning?

Me:

but then later on, because of development in science
it became a catalyst
because, gold, when it is not something you can hold in your hands
gold particles
if you look at it structurally on the molecular level, it is actually a catalyst
yeah
because of the development of science, its possible meaning seems reversed
so, should we say that the meaning is unstable?
but then, how exactly can matter connote or have meaning?
does it need to go beyond culture?

Me:

i think on this side

Hope:

there's another segment

Me:

form, or figure
even aura, or...

Perry:

more cultural or societal

Me:

yeah, some kind of expression, maybe expression should go here
to express, is it a verb?

Hope:

expression right, but...
i was thinking
signification
expression
on different levels?

Perry:

but for example, does this matter influence human
awareness or consciousness?

Me:

maybe the matter itself has consciousness

Perry:

its own consciousness? okok

Me:

maybe this... ah this pen
it...
shoot
this could go here
could i put equal signs across all these levels?

Hope:

what are the relationships between them?

Perry:

oh this is interesting
i want to tell.. but i'm not actually super familiar with it
there is a Japanese thinker named Hanada Kiyoteru

Me:

let's write it down

Perry:

Hanada Kiyoteru, he's very interesting
he thinks the idea that humans are on the very top of the hierarchy
with animals, plants, and minerals below
the inanimate, inorganic
there were all these thinkers in Japan dabbling with different ideas
how to surpass the West in its conception of the hierarchy
he's very interesting
he said to treat the mineral as the core, to put it on the very top
he thinks minerals, like gold or diamond
they also have consciousness
it's just that we are not able to communicate with them
he put the mineral on the very top, and establish his own worldview

Zijay (bioengineer):

did he give some examples?
like how could minerals influence people?

Perry:

let me think
at that time in Japan, the most important mineral was coal,

gold as well, in Jinguashi, near Jiufen
he said, these things
because we
we found the coal and ways of using it, so it changed our way of life
it's not that we used it and excavated more of it, it's the other way around
matter influences people a lot a lot
how do i put it
it's not that people go use this thing
it's just that we don't pay attention to what is changed
he cares very much how matter and humans interface/interact
what is that
let's not put humans so high up
he thinks that matter has awareness/consciousness
to be a bit extreme
we could say that it's not that we found and excavated coal
coal wanted us to discover it
it wants to burn

Me:

it wants to burn
it wants to be burned
or it wants to burn

Perry:

it wants to use human's hands to be burned away
it wants to become something else

Me:

we haven't really discuss Lin Daiyu
i don't know, i actually don't know her very well
i just know that she has a weak constitution and is always sick

Hope:

saying that after you cough...

Me:

very weak
oh and i noticed that in one of these books

Zijay:

pictures?

Me:

she's so curved in these pictures
in every picture, her entire body is curved

Zijay:

like with a thin waist and big butt?

Me:

no! it's from being weak, it's like she can fall at anytime
can't stand up straight

Perry:

it's like a crumbled tissue paper hanging in a painting

Zijay:
so she's soft, is she?
she can drift away anytime

Hope:
bad constitution

Me:
i'm thinking in general, in Chinese classics
having a firm back represents certain character traits

Perry:
a firm back, like Wu Song?

Me:
yes! he stands up very straight
i feel like Lin Daiyu is the opposite
she's always

Perry:
slanted/crooked

Me:
very soft... you know what i'm trying to describe
i know i know i know
what's a better term

Perry:
in Chinese, sometimes you see expressions like
"go be slanted over there"
"go be slanted"

Me:
really?
it means to go lean on something and rest up
not to sleep
this is an old usage

Me:
old? how long ago?

Perry:
like during the Qing Dynasty
Qing, the Qing Empire

Perry:
smart like icy snow, die of unknown cause
what is this

Hope:
oh, Daiyu is the one who returns the tears
returning tears
it says... first chapter
"along the banks of the Ethereal, it came upon a Crimson [Grass]...
by the side of the Rock of Three Incarnations." that's Baoyu
"...grateful for the care lavished upon her by the Stone..."

...I can repay him with my tears, should both of us be sent down to the Red Dust."

Me:
a cry baby

Perry:
this figure/character is pretty well conceived
yes, she likes to cry
grass is always slanted, and she's always returning tears
Cao Xueqin is pretty good
yeah... wait, how come

Zijay:
she is grass?

Perry:
she is grass
drifts around as the wind blows
she's always drifting
since she was little, she traveled with her parents because they were moved around for different official posts
drifting everywhere

Me:
Daisy's parents

Perry:
yeah, she lost her mom at an early age

Me:
sea cucumber is pretty amazing

Perry:
Daiyu becomes sea cucumber!

Me:
because it's black, it's tough but soft

Perry:
that's right, it is tough

Me:
and it's kind of gooey, its shape
yeah it's gooey
not very stable
not very active, it barely moves

Perry:
wait, but is it smart?
this is the key issue, is it smart?

Hope:
i don't know

Me:
are we making a smart sea cucumber?

Hope:
you mean material-wise or...
a smart animal

Zijay:
don't know

Me:
sea cucumber

Zijay:
i don't know sea cucumber well, sorry

Hope:
sea cucumbers don't have brains right?

Perry:
doesn't seem very smart then

Hope:
there's a nervous system

Me:
smart in the material sense

Perry:
okok

Me:
well, Zijay, you can think about it

Zijay:
oh, i will think about it, for sure
everyone think about it

APPENDIX IV

Below is the collection of logs from the nested projects *A Studio In a Lab* and in *I Saw It, I Lost It, Then I Went Looking for It*. There is one entry for each day spent in the chemistry lab from Tuesday, April 18 to Friday, April 28.

2017-04-18

I moved in officially today. I brought three objects with me: A laser cut pink square that I salvaged from Media Lab garbage first semester here; Two wooden things that have this chemical smell. I found them on the way to meet PG back in January of this year. Some lab at electronic engineering was throwing them out.

There is a dead plant in the cubicle part of the space, where it is officially not a lab. Each student gets a desk in that area.

There is a strange sound. There is a background white noise also. Very soothing, a great place to write my thesis really.

Brian clearly had been anticipating me. It would have disappointed him probably if I didn't end up coming today.

Met Jake, a graduate student who supposedly runs the labs. He removed one snorkel for me. He will get the other one some other time.

Brian mentioned that we have yet to go "shopping" at the "death closet."

Brian had two questions for me. One was about access.

I got his number, so that I can text him to go back in whenever I needed to use "lady's room".

Feels a bit held hostage if I have to report to either of them every time the biological urge arise.

They would rather do this instead of giving me card access. I wondering if at some point they made a decision that this whole endeavor is off institute record.

I said, so I shouldn't pop the door or anything like that. Emrick said yes no that's against the codes. What code? I kept quiet and didn't follow-up with that.

The second question Brian had for me was if I go by Angel, since my name, Chia Ling Chen shows up in e-mails.

Emrick made a joke. He said, I go by Lord Emrick.

Quite a number of people walk by, but I am pretty much alone with the weird sound.

Will have to make labels for all the drawers.

I opened all the drawers. Did an inventory of everything that has been left behind. Just one of each.

Did an inventory of everything. Opened every drawer. Photographed everything that has been left.

Tomorrow I should try to draw the area that I will take up.

I'm going to need to get some cleaning supplies in here.

The labs next door are empty as well. I shall further investigate in there another day.

On the white board, I start to log my time here.

I wipe my glasses with lens paper I found.

I wonder if the janitors still come in here. What if I start eating bananas and throw the peels in the trash can here. I guess you're not supposed to eat before the lab has been decommissioned, but now it is in a limbo space. I can ask tomorrow if it is against the code to eat in here.

I know the black stripes mean that the tape has been autoclaved.

I tried to collect one thing of multiple things without removing any lids or rearranging anything. This is what I found.

I tried to make a new composition of things I brought with things that I found.

I walked all the way down where the desks are and discovered the kitchen. There's even a couch.

—

Yu-Pu is the only person I know in Chemistry. She went back to Taiwan last year. Being in building 18 reminded me of her. I asked her on Facebook if she was ever in this building. She said yes, but on the second floor. She went by "he" when she was a PhD and then a postdoc here.

2017-04-19

Walked from the back door on the first floor into the building, the part that connects to the other building (the building that is sort of an extension of the infinite corridor). I should choreograph the group on May 22nd from this entrance.

Paid attention to the list of names and position at the glass door for Chemistry HQ on the third floor. My guess of what position Emrick, Brian, and Rich held was correct. I wonder if they need to redo it the vinyl text all the time, don't people come and go?

Emrick let me in. Showed me where the stairs are. He hasn't been here for long evidently. He said, even since after I've been here, there had been already two cases of real evacuations. One was from a fire and the other was a chemical spill. I will need to drop everything if the alarm goes off and leave. People are let back in from the front of the building, where there is the lobby with the half circle bench.

Didn't need to ask if the custodian comes in still. Somebody organized my stuff!

I brought in tape, cutting board, e-xacto knife, cutting mat. Basic stationery.

I also brought in stuff I got from Scott, some samples from the training, as well as pictures of my mom and a computer punch card. I won't unpack the stuff until tomorrow.

The broken gloves are thrown away, taken from the middle of my collage of things.

Note paper and pen are moved to the corner of the lab bench. This person is maybe a neat freak. My objects are also push to the edge of the surface and lined up. The snorkels were more neatly placed as well.

Kind of feels nice to be in here. There is a lot of space.

2017-04-20

Morning.

It turns out Emrick is very much talkative. We spoke for thirty minutes as I arrived, for twenty-five minutes of the conversations we stood inside of the door of “my studio.” We mostly talked about New York City, where he’s from, all of the different neighborhoods (especially Harlem and the Heights, Emrick is not a fan of Brooklyn). Emrick has spent most of his life in Manhattan and the Bronx, growing up, living, working, and hanging out. I learned that he’s only been here since October of last year. He lives in Lowell now, almost to New Hampshire. He likes being away from the city. Even though it is obvious he has a deep love for New York, he said he wouldn’t live in NYC again.

We talked about gentrification being a part of New York’s history since the early 20th century. He pulled out from his wallet the cards for one-year free entrance into the MET and to MOMA. He also showed his New York State ID, he said he’s not quite ready to transition to being a full Bostonian yet.

Emrick can talk but he is certainly soft-spoken. I’ve had to ask him to repeat what he said many times I greet him at his desk first thing in the day.

I found out that his best friend lives in Guangzhou for the past three years. I told him I was from Taiwan. He’s going to Hong Kong, Thailand, and Cambodia this August. He’s Porto Rican. He said people in Japan were so nice to him when he visited; even people in Porto Rico are not as nice to him.

Well-dressed. Both Emrick and Rich are often quite dressed up.

I asked about the coffee I had in my hand the whole time we were speaking as Emrick stepped out. He said since the lab is not active, it’s fine. It’d be a big violation if the lab were still active.

Nothing was moved from yesterday. Emrick told me he asked Rich about the cleaning staff, supposedly they are not coming in often.

I hear a phone ringing. It stopped before I could find the phone. I did find that there is a working phone in the student office area just behind the door.

I really do like being in here. Alone time. The light is motion-activated, just like how the two sets of double doors that connect this I.E. Pei extension to the other building on both third and fourth floor.

—

Afternoon.

When I left for lunch, Emrick was not at his desk. I left him a written note and texted Brian.

Brian texted me back. He misread my text and thought I was asking to be let in. After we sorted out the confusion via text, he asked me if I wanted pastry. I waited at the lobby with the half circle bench. He brought me four small pieces of pastry to the lobby! Half of a cranberry loaf, a mini cinnamon roll, a mini muffin, and a mini scone. He said: “one of each kind,” I have no idea where they came from, probably a talk somewhere in the building. It was very nice of Brian.

I ran into Tien-Ju at lunch (at the line-up of Savory Food Truck outside of lobby 7). We walked down the infinite corridor together. He was going to eat at his desk. He asked me how the project (the one with silicon wafer) was going. I told him what I decided to do. He liked it. He congratulated me for being almost done. He reiterated that the workplace is heaven compared to school (referring to school as “a sea of bitterness” in Mandarin). As a working man you even make some real money, he said. “You make money here no?” I responded. “Just a little,” he said, “can only live from paycheck to paycheck.” I responded saying, “oh yeah, the cost of living is high in the US”. He laughed, “you say that like you don’t live here.” This comment struck me, it goes beyond what was said. He seems to be pointing to some kind of a big gauge between my and his experiences here.

Picked up some libraries books relevant for the / *Lost It* project, bringing them back to the lab.

—

Duygu Demir visits.

Duygu ended up at E-18 so I had to go get her and I was half an hour later than I told I would be to Emrick. Rich let me in and checked with me to make sure everything was going well.

Duygu was my first guest, the first studio visit. She commented on the natural light being very beautiful and the space being very nice. There's even a kitchen, she said, envious of the chemistry students.

I told her about the three nested projects. She asked about the Honeywell thing attached to the wall that Gediminas also asked about when he came with Tobias and Nick. I think it's for humidity control. She said that they had to borrow one at her gallery (Salt in Istanbul) at one point. She asked about what the research will be when the renovation is finished, I wasn't able to tell her.

We had to leave since Emrick leaves work at 5pm. Outside, we continued to talk, she thought I was thrown off because it is not an active space and there's no active scientific imaging that's happening that I could investigate. I told her that it's more about the nesting, and examining the complex system, that maybe it's about trust, intimacy. She probed me to think about what the value of what I'm doing is outside of for myself, the same thing Gloria asked about the Lin Daiyu project! I guess it is all about me. I should really read more of Butler's *Giving An Account Of Oneself* Renée sent me.

She said that I was interested in visualization and the language that are used by those I encounter, interested in how to make them mine.

2017-04-24

It's Monday.

Emrick let me in. We took the elevator because I had a box in my hands. Today, I brought in some more objects from the MTL (Microsystems Technologies Lab) and all the nested cubes I was making from the project *Nesting*.

I also unpacked everything I had in the bags I brought previously, stuff from previous projects, and tried to place them on shelves and surfaces.

Brian walked in with two guys. Rob and Mike. They are removing everything from this place today! They must be the same kind of people who are hired in to decommissioned labs, the people I saw with Meredith on one of the early tours. One of them had a huge iced coffee. Mike is the one with the coffee. Brian told them the lab bench is my thesis, and that I'm a photography student. No questions asked by Rob and Mike, seem pretty straight forward to them I guess.

I can have everything and anything that's left in the whole space. People have left behind stuff when they were supposed to move out. Brian told Mike and Rob that I'm the boss.

Brian told me what the Honeywell chart Duygu asked about is. It's for indicating temperature. The fridge is still working, at four degrees. Autoclaved machines have the same kind of analog charts too. A new fridge is coming, Brian said, but people still want the same analog chart.

Mike made a comment about my wooden jars (the ones I picked up from electrical engineering's junk). He said he bartends. He'd clean them out and use them to crush stuff. I said, "What! It smells so bad. There must be some nasty chemicals". He said something to the effect of we are all full of chemicals anyway. He thinks it smells like burnt plastic.

We are the go to guys for lab decommissioning he said. Calvert and Sons is the name of the company. Their shirts say so.

Exciting day. Totally unexpected. Scored a multi-function printer and a bunch of other stuff...

Mike said at some point when I failed to explain to him what I was doing: It's art, it's meant to be interpreted, not explained.

Mike took one of my nested cube and the pink square and talked about the dimensions of reality. We only have access to one plane. He put the cube inside of the square lying flat on the lab bench surface. I liked that.

Rob invited me to go with him to the basement of building 2, maybe it's what Brian referred to as the death closet where stuff from deceased professors' labs and offices go to. These spaces are not closets are all! They must used to be old labs. The room we went to even had a "laser in use" sign outside. Rob is from around here. I lamented knowing very little about Boston.

Said goodbye to Rob, shook his hand, he was going to the basement again. He invited me to walk out with him, but I had to go check out with Emrick.

I tried not to collect too much. Rob is taking a lamp home, he paints he said.

Said goodbye to Mike. He said they're done with building 18, but they're around, work on all the buildings in the area, including EPAS. He said if I ever need a hand handling heavy things, I can get a hold of them through Brian. I shook his hand. He said, "it was nice working with you." I suppose kicking a soccer ball around and talking about the crazy moves guys playing sepak takraw make is work! Being with these guys in the chemistry student offices, dealing with the remnants of what the student leaves behind, makes the student spaces seem ready dark and sad.

Ran into Mike again at the elevator on my way out. He asked me what I'm up to in the afternoon, I told him I had a class. In the elevator, I told him I was going to third floor because I needed to check out with Emrick. I told him I don't have card access. "They're keeping an eye on me." I said. Yeah, you're a "photography student in a chemistry lab", he said gesturing scare quotes. What does that mean?! He saw through my game?

—

Katie from Campus Construction told me about how MIT prefers the exposed pipes look. Well in this case, the exposed pipes with colorful labeling look pretty sharp. You even learn a thing or two about what kind of material travels within what kind of piping material.

2017-04-25

Emrick is dressed super nice today. Gold tie, with well-fitted vast, soft white material on the front and copper-colored silk on the back, finished with tailored pants and pointy dress shoes.

I asked if he had important meetings today, he said yes several, with the Director of Chemistry. A lot of his job is to accompany the director to meet with donors. There are a lot of donors.

I have yet to give the Department of Chemistry some more thoughts.

I had previously observed that there is a whole office dedicated to matters of donors. There's some vinyl text on the door that suggests that.

Emrick said there are more private donors than public ones, I asked about the donors as we talked down the corridor on the fourth floor. Even on a rainy cloudy day the light is very beautiful.

Jackson came with me today to bring some more stuff in. I warned him about needing to be let back in even just to run to the bathroom. We both went to the bathroom before getting Emrick to let us in.

One kiwi fell out of my bag onto the ground. It made me wonder if I can still eat it. This place feels toxic just by the look of it!

I gave Jackson a tour of the whole space and made notes of how thoroughly Mike and Rob had packed up the day before. It was not 100% that's for sure. But it's quite a change from before. It's even emptier now. They left me a dirty looking white lab coat and a set of lab goggles. I wonder why.

Jackson thought the sound in the lab was creeping. He felt strangely alienated in some abandoned place with peculiar stuff.

Jackson thought I should be able to speak to the history and politics of Chemistry at MIT. What is it about this lab? It's not an arbitrary choice. Am I focusing on the material and the objects? I tried to explain how I got to this situation, tried to tell the whole story. Jackson was pretty tired and low-energy. He said he woke up at 5am and couldn't go back to sleep.

We didn't stay long at all. I left with Jackson, made sure Emrick saw him with me on the way out. I said, goodbye and see you tomorrow, to Emrick.

2017-04-27

Brian and Emrick were on a walk through when I arrived today, just after 9am. Rich let me in. He's wearing the teal sweater again. He looked tired. I noticed him slouching as we walked. I think he always slouches a little bit but somehow he seems less energetic today.

Rich said since all the labs in this building are for research, the summer isn't really any less busy.

Saw Brian and Emrick on the fourth floor. Brian is energetic and smiley as usual. Emrick is wearing such nice cloth again! I don't think I've seen him wear the same thing twice since I met him.

Rich told me technically I cannot bring food into the lab. He asked me to leave the coffee in my hands outside.

The initial excitement is starting to wear off a bit. I've moved mostly everything from my office that makes sense in here, but the lab bench is looking pretty empty still. I might have to adjust and only use one side of it.

Trying to see if the printer works. It doesn't. I'm trapped in this project!

Trapped or nested?

Meredith is supposed to come by this morning. She e-mailed me to ask if I was going to be in here all morning yesterday.

It's getting a bit boring in here. I feel isolated and abandoned, especially when the motion-censored light turns itself off. Maybe it's time to go "shopping" with Brian.

Tried to make some phone calls, to get some quotes for printing the SEM image of the silicon wafer. The reception is really bad in this building, even by the windows. Is it like over in building 39 where there's so much metal that the signal is being interfered? I could ask Brian later.

Feeling trapped, I tried to call Raafat. Right then, Meredith and Brian walked in.

Meredith came in with Brian with a brand new hard hat that has my name on it! It's so very sweet of Meredith. I like how she made it a surprise too. Her e-mail only said that she was going to come by to give me something yesterday. I had thought maybe I had to sign some things and was a bit scared.

She informed me that construction is going to start on the 15th, a bit later than what was planned, and gave me a run down for their schedule. The 15th is the mobilization date. Demo starts on the 16 and lasts for 2 days. On the 18th, partition goes up, and from 19 to 22 they will build a new wall. On the agenda for the 22nd is roughing in the MEP (mechanical, electrical, and piping) and fire protection. They asked about my thesis defense (i.e. the final review). They sounded like they would really like to come. Brian said he sits in on all the students' thesis defense. Although sometime, the work is top secret (like if it's something to do with Exxon and Mobil), in which case the defense is not open to anyone.

Brian and Meredith asked about the graduation mug shot of my mom I had in a sleeve on the lab bench. They were here when I wasn't here recently! They thought it was me. I told them that it was my mom from 1978 and that she was the only graduating engineer in her undergraduate class. That resonated with Meredith. Meredith studied engineering as well and commented that even now there are not a lot of female students in computer science and engineering.

I asked Brian about the sound, he couldn't figure out why either why that sound doesn't go away when the fume hood is properly closed. It is supposed to be the sound of air being drawn into an open fume hood.

I learned that you can lift the entire front of the fume hood up. Also, the grey gadgets with thick wires underneath each fume hood are for heating up chemicals. Students don't use them anymore. Now, they used something that has magnet in the solution for stirring, I couldn't fully understand how the heating works. I just know that it heats things up very very hot very fast.

Usually one side of the bench has three individual workbenches for three students. Zijay my engineer friend and Rebecca my biologist friend at the Broad both get more personal space it seems. The other side is for shared equipment. I couldn't really understand what kind of equipment exactly.

We walked around a little bit together. I asked about the logo Concept™ that Gediminas pointed out when he came. It's just a line of products from Fisher Hamilton. Brian launched into a whole conversation about the way chemical companies (who make chemicals as well as chemistry equipment) buy up each other and all that. Fisher is huge, he said. Hamilton was big too, but it got bought up. Supposedly, Hamilton lost its place in the game after it moved its manufacturing to Juarez, it had to do with the drug cartels wanting a cut but Hamilton not into it. I just got a glimpse of the stories. Meredith knows about this stuff too from her current job as well as her previous job.

Alice is the name of the professor who was here before, she's moved to Stanford. Alice told Brian that the new space is not as nice. Brian and Meredith told me PhD students tend to move with their PIs. So, there will be something like eleven new students who will be transferring from Wisconsin, where the new hire is coming from. They are actually hiring two professors, both tenured. They are big shots and a power couple. Meredith emphasized that and hence the construction has to be well-done and done on time. Brian remarked that the field is quite competitive, people have always moved around for better opportunities and it happens a lot even though the move is such a big operation.

I asked how come Emrick and Rich dress so nicely when they are coming in and out of labs all the time. I wouldn't want to get any chemical residue on my cashmere sweaters. Brian laughed. He said that's why you see him in jeans and sweatshirts most of the time. Brian gets "his kids" (ie. the students at the labs) to sign his sweatshirts when they leave. One of the sweatshirts might be worth a lot of money one of these days if a student goes on to get a Nobel Prize, he joked.

I said goodbye to Brian and Meredith affectionately. Brian said Mike and Rob could take me to go "shopping", to find anything I need in storage, if he's too busy. Meredith said she'll be around more once construction starts.

After Brian and Meredith left, I called Raafat back. Yusef was home too. Yusef tried to advise me and said that I should stage an experiment with surreal instruments. Raafat suggested to stick with the notion of nesting. How is this space different by nature of me being in here and interacting with everyone and everything? I have to make the final review tour a part of nesting, people are guided to come into my nest. Raafat's suggestion would be the more subtle way to go.

Met up with PG for lunch.

I asked him to meet me at the MTL event, a member lunch, where there would be free food. We both didn't want to stay there because the food was not enticing and PG doesn't want to be in another one of these meetings. He said they just talk about how you should not work in the labs alone after 9pm and things like that. We went to Savory Food Truck.

I told PG the nano project title is going to be *I Saw It, I Lost It, Then I Went Looking For It*. I told him in English and he thought of true love right away without me mentioning it. He said for everyone making devices in the MTL, it does require true love because each layer is so delicate and you can easily ruin days of hard work with one small misstep. For example, when you look at what you've made in a microscope, you can ruin it by going too close, wanting to see from closer up.

By explaining to me what he's doing, PG gave me a good refresher course on the basic principle of silicon wafer fabrication. It's always fun for me to try to understand what's going on at the material level. Words like attraction, switches, are evocative to me. PG tried to use this bizarre metaphor to help me understand the diagram. The non-conductive in the middle layer is the sea, and one shore is the silicon substrate and the other shore is the metal. Only when there are enough people (positive or negative charges) crowded at the edges of the shores, can the charges go through. Therefore the barrier is essential. I still don't fully understand. This was him trying to explain to me why there must be a non-conductive material between the silicon wafer and the metal layer.

Gabriel walked by as we ate our lunch at the Steam Café. Gabriel is from Singapore, he's also a 2nd year PhD student and he belongs to the RLE group. I met him also through the Taiwanese student group. We speak in Mandarin together even though Gabriel has an accent and usually doesn't know technical terms in Mandarin.

Gabriel works in a lab (<http://www.rle.mit.edu/pbg/>) where they are developing threads that are devices! Gabriel looked at my image of the thing I saw and lost and commented right away that it must have been made by FIB (focus ion beam) because the edges are so sharp. He said it could be part of a MEMS (micro electro mechanical system). I kind of have no idea what he's talking about even though I was right there when this thing was made.

Neither of them know why the cantilever is bent. They said that as is it probably has no function.

After we left Steam Café, I walked with PG to get a coffee at the student center. We talked about the project more and how I was interested in the virtual that microscope images evoke. We talked about the aesthetics of images and how when he makes decisions about what image to use in his publications, he strives to make them look as impressive as possible. Through the images, he wants to communicate to his audience that he has fabricated something impressive.

Emrick asked me how was lunch. I told Emrick about the crazy thread device Gabriel was telling me and PG about. Emrick said something about Mark Zuckerberg and telepathy but I was only half paying attention. I have this image stuck in my mind, the image of a nano-scale thread made from pulling on a 4-cm thick tube. Gabriel showed me an image on the internet. I wish it looked even more like noodles coming out of a dough.

Looking up Alice finally who had this space before. She is Taiwanese-American! This explains the traces of Chineseness in the desk area, including the box of instant milk tea I salvaged. Many of my Taiwanese friends here have Asia-Americans as PIs. Her research is in biochemistry. She studied with the guy who got a Nobel Prize for isolating the green fluorescent protein, the guy Zijay had mentioned before, who also has a Chinese-sounding name.

2017-04-28

Friday morning.

Emrick let me in this morning. Busy morning already he says. He said something like he doesn't like to make mistakes. It sounds like he's fixing some mistakes this morning. Emrick has a great vibe. I told him my left knee is hurting for no reason, he told me to not go hard on it.

There are seven or eight guys in the space as I came in. Over on the other side. I saw them walking around when I came into the building on the first floor. They all look kind of serious. No one is wearing any bright neon yellow so they can't really be construction people.

Two guys came closer to my area. I poked my head out and said you can come through this way if you want. This guy's shirt says Raw Electrical. I find out they're doing stuff with lighting.

They moved to the desk area and stood around in a circle for a good twenty minutes. I tried to sneak a photo.

Going through some of the photos I've taken so far. The people I saw with Meredith during one of the very first walk-throughs, the people who were packing up stuff wearing lab goggles, they are Mike and Rob! Also, the postcard that I read pinned up is addressed to Alice Ting, the Alice Brian mentioned, the last PI of this lab. I should have put these things together.

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11:30AM

Ran into Chung-Yueh on the way to MTL. Chung-Yueh is very young, he's a second year undergrad chemistry student. I had forgotten that he was another person I know in Chemistry. Like Yu-Pu, he's one of these kids who competed in the Chemistry Olympiad while in high school in Taiwan, of course winning gold medals. He took Alice Ting's Intro to Biochemistry class! I asked him if he goes to the teaching lab on the fourth floor of building 4. It's the one Brian said is very old, where everything is from the 50s. Dick mentioned that they're putting in a brand new chemistry teaching lab in the new nano building. Chung-Yueh said no, he's at the Whitehead Institute.

I finally finished the EHS trainings that were required to gain access to the MTL. Luda is the person to get my access card from. Scott introduced me to her last time. She was not at her desk, I waited for twenty minutes. The MTL is very much a male-majority community, though the director Vicky is female, and so is Luda the financial person who has quite a nice office. She listens to classical music all day but puts the volume on very quiet.

—

2PM

On the way to drop off the framed picture I promised Don over at Materials Science, I saw in the window display the research Gabriel told me about.

Somehow the images on the websites are more impressive. But it is cool to see the real thing, even behind a display case. It's not like noodles pulling out of dough at all. I might have walked by this display hundreds of times but have never taken the time to understand what's going on in it.

Don forgot about our meeting! Someone was on the microscope, but I didn't get his name. He let me in and at least I could leave the framed picture in the room. I haven't been back here since finishing the walnut project in 2016. It's been almost a year! I was here almost every other week visiting Don in Spring 2016. Looking around I now really do have a better sense of what everything is. I even know that the piece of gold foil lying around has to do with the crazy looking machine with a glass dome top. It's a coater that evaporates gold in order to create a conductive layer for samples going into the SEM chamber. I know exactly what they are now. I'm anticipating the nostalgic that I will have after leaving MIT.

—

2:30PM

I went back to MTL to see if Luda is there. I got my access card finally, it's totally minimal. Blank on both sides except for the black stripe. I love it.

Luda walked me down the hall to see Kurt as I would need training for anything process/machine that I were to use. Scott has already mentioned Kurt to me. Kurt and Ryan he mentioned. I was to go to Kurt for the SEM and Ryan for the wafer die saw. I only got access to the EML and to Packing. They are both labs and not cleanrooms. To gain access to the cleanrooms would cost \$1000.

Kurt was totally smileless when I first met him. He warmed up after about fifteen minutes. I told him what I wanted to do straight away, told him I'm a visual art student in School of Architecture and Planning. He took me seriously, but was also obviously intrigued. At no point did he ask me why I wanted to do what I wanted to do, just like Scott and really anyone else in the labs.

Scott is the one who knows exactly what the thing I want to find is, but he assumes I also know because I was right there when we made it! At this point, I still don't understand at all what it is. PG and Gabriel had some ideas but they also didn't really know. So I asked Kurt about it. I showed him the picture. He said it is a cantilever (this part I do already know), and that it is SiN on top of a KOH (potassium hydroxide) well. What I've been calling the swimming pool is a well. Kurt also said the cantilever could be used as an AFM tip for example. I never made that connection! I have a box of two broken AFM tips back in building 18.

The reason it is curvy is because it's too thin. It's too thin to be useful he said. Kurt thought it's silly to make a cantilever with that kind of width and length ratio, it's no good for anything. Kurt thought we made this to show you what happens when you make them too thin. Like what Scott said, the bending happened because it is stuck to the bottom at one point during the process and never came back up. He said something about Van der Waals force, which has something to do with electrostatic forces, but I didn't really understand.

Then we talked about what I'm going to need to do. Kurt thought that if I just cut it out on the wafer die saw, my cantilever would not survive, it would break off as particulates fly around during the wet process. He suggested that I first fill the wells with photo resist, it's almost like to give the cantilever some support or shock absorption I guess. I can take the photo resist out with acetone afterwards.

Kurt said that it's weird to want the cantilever remain napped down, but that makes my life weirdly easy. Scott was worried that my thing will fly off since it will be so tiny. Kurt didn't think so, because of gravity and electrostatic force.

Kurt suggested that we just get started instead of making another appointment for some other time. I would have to tell Emrick that I will be going back over to 18 later.

Kurt has three kids, I saw in a picture. His office is also pretty cramped, full of stuff floor to ceiling. He had me log into the scheduling system. He was very impressed that I kept my MTL account name and password on paper in black and white in my notebook.

The machine wasn't booked for until 3pm so Kurt walked with me to say hi to Scott. We also wanted to see if Scott would have a sample that we could use. Kurt: "do you remember Angel?" Scott was very nice and helpful as always. His office is more cramped than Kurt's. His office is always cramped, and it's different boxes or stuff every time.

Scott told Kurt what exactly it is that we made, but I still didn't catch it, it's an acronym of some sort. The part that I did get is that rather than an AFM tip, it would most likely be used as an accelerometer or as a pressure sensor.

Scott also talked about the shape of the well. It is in fact not made with focus ion beam which is what Gabriel was so sure of. The reason that the edges are so clean is because of the silicon crystal itself. Scott tried to explain that there's some crystal structure like a honeycomb shape, so when you try to etch a well, a very clean line is made. It has to do with also the fact that we were using a single crystal silicon with no defect. I don't really know what that means. It also has to do with the plane (1.0.0.) that we were removing the material from. If we would to etch along the 1.1.1. plane, it would have been very slow. There is a PDF somewhere online where I could study this up.

I also noted down Scott saying that we went 200 micron deep and undercut something by 5 micron.

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3:10PM

In the EML.

I learned to be safe, to put on haircut, coat, booties, gloves every time I come in (to protect me as well as the machines). Kurt wanted me make sure I know how to coat a wafer with photoresist. I'm using it to hold the cantilever in place during the cutting process so that it doesn't snap from vibration of the cutting.

First you squirt a bottle (IPA is what's inside) to dry and clean the fresh wafer coming in from manufacturer. Well, before that you find the right size plate holding the wafer. The wafer needs to be bigger than the plate. So far so good. Then you drip the blood-color photoresist on the wafer, and step on the foot pedal for it to spin. It's weirdly like how the ceramics wheel function. Though in this case, the speed and duration of the spinning is controlled by a computer. After spinning, you put the wafer on a heat plate, for the solvent to evaporate. More than 90% of the photoresist is solvent. I don't really know what that means. That's it.

We looked at the wafer under an optical microscope just to make sure that the photoresist is in the wells. You can by naked eye tell that there is some reddish stuff on the wafer, but you can't really see how well coated it is and if the wells are filled.

Kurt was helping a bunch of other students at the same time. Four or five boys. At one point Kurt said he has ADD. I don't know if that was a joke. He was very patient though, communicated clearly, repeated things, said them slowly. I think he has to work with students who don't speak very good English very often.

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4PM

Back to 18. Emrick went to Life Alive for lunch in Central. Took the subway there. There is one near Lowell too, where he lives, and that's how he knows about Life Alive. The universe making it easy for him, he says.

Don e-mailed a very nice note to apologize for missing our meeting. We rescheduled for next Monday. It will be good to look at the wafer coated with photoresist with him.

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GLOSSARY OF PEOPLE

In order of appearance.

Saviz Mowlavi is a second year PhD student in fluid dynamics at MIT. I met him through the Taiwanese Student Association. He was born in Belgium and raised in Switzerland by a Taiwanese mom and a Persian-Belgium dad. He speaks French, English, and Mandarin.

Rebecca Shapiro is a postdoctoral fellow at the Broad Institute. I met her through mutual friends from McGill University where we both went to for our undergraduate degrees. Rebecca works with yeasts and has a one-year old daughter named Ani.

Chris Leighton is a historian of modern China and a professor at MIT. I met Chris at an opening at List Visual Arts Center. Chris is a little bit clumsy. He came to my walnut installation with another young history professor.

Aaron Wright was a doctoral fellow at Harvard's History and Philosophy of Science during the times I was in conversation with him. I met him while working at the student newspaper at McGill University. Aaron was the outgoing copy editor when I was the incoming design and production editor.

Stephen Ross is a professor of Modern Literature at Concordia. I know him from his partner Jane who was my roommate in Toronto for about a year. I know Jane through another friend, Kevin (who I interviewed in *Nesting*). Stephen makes a mean Phở. I saw Stephen and Jane the summer before coming to MIT in Leamington Spa, UK. Stephen was teaching at the University of Warwick at the time.

Don Galler is an engineer in charge of the SEM at MIT Department of Materials Science and Engineering. His daughter is a ballad dancer.

Chen How-Huan, "Hope," is an astrophysicist close to finishing his PhD at Harvard. I met him through his girlfriend, Wen-Xin, who is a Masters of Architecture student at MIT. Hope is Taiwanese and he is obsessed with the Japanese actor Joe Odagiri.

Eduardo Navarro is an artist based in Buenos Aires. I first met him in Sharjah in February 2015. We spent many mornings eating the same continental breakfast at the Sharjah Rotana and many evenings eating the same India food at Karachi Darbar.

Farnez Niroui is a PhD student in electrical engineering. I was introduced to her first via e-mail by Wen who I met at the MIT Graduate School Leadership Institute (MIT GSLI). Farnez works on molecular switches at the nanoscale.

Tang Tzu-Chieh, "Zijay," is a bioengineer at MIT in the Synthetic Biology Group. I was introduced to him first via Facebook by a mutual friend, Hao-Shin, a Taiwanese artist currently based in Shanghai. Zijay's office is above Area Four Cafe in a building leased to MIT, which has windows that look exactly like the iPhone 5s from the outside.

Karim Raafat Gadelrab is a PhD student in the Department of Materials Science and Engineering at MIT. His lab is called Laboratory for Theoretical Soft Materials. I first met him through MIT GSLI in March 2016 and Karim is quite active in the Egyptian Student Association.

He has been very busy with a startup since last year, which makes a transparent, water-repelling windshield coating.

Chang Cheng-Chieh, "Perry," is currently a visiting fellow at the Harvard Yenching Institute. Perry speaks Japanese, Mandarin, Taiwanese, and English. We first met when he gave a short talk titled "Mnemonic of '1968' in Japan and Taiwan" at Harvard.

Dick Amster is the director of Campus Construction. His office is very colorful and quite welcoming. Dick has very lush eyebrows.

Scott Poesse is a staff member of the MTL. He started to take the train to work instead of driving this year. Scott is very forgetful but not neglectful at all. He shares an office with another person and it's always crowded in there with shipping boxes.

Shen Pin-Chun, "PG," is a second year PhD student in electrical engineering at MIT. His master's research had to do with LED lights but he moved away from that work because of the devastating consequences of rare earth elements extraction. PG is very active in the Taiwanese Student Association.

Janis Burke is Meredith, Sudy, Katie, and Biss' boss. My first non-email interaction with her was on the phone. The second was a meeting in the Jamaica Room at Campus Construction (Building NW 23) the day after I got back from Cuba.

Biss Teelucksingh works for Campus Construction. He is the project manager for the cleanroom being put in on the fourth floor of E15. Biss was the first person to explain to me the management structure of Campus Construction. We met at the McGovern building, where brain and cognitive science research is done, because he was over there for a meeting and because he likes the atrium space in that building.

Jim Harrington is the Director of Facilities in the School of Architecture and Planning. People call him Lord Jim. He also runs the Active Shooter/Violent Intruder training class.

Katie Jenkins works for Campus Construction. She is in charge of the renovation at the Francis Bitter Magnet Lab on Albany Street. Katie said her job is a bit like herding kittens.

Julia Carpenter was an exchange student from Zurich. I was put in touch with her through her PI at MIT who knows Azra Akšamija, my professor in ACT. She made some images with me of a walnut. She was surprised to learn that it is not common in American supermarkets to find walnuts still in their shells.

Wei Huang is a member of the technical staff at the Koch Institute.

Milton Cornwall-Brady was a member of the technical staff at the Koch Institute.

Brian Pretti is the facilities guy in Chemistry. I've only ever seen him smiling and laughing. Brian gets graduate students leaving the lab to sign his sweatshirts with black sharpies.

Jake is a graduate student in Chemistry. Brian introduced me to him the first day at the lab. I don't know his last name. I have seen him here and there since but haven't had another conversation.

Emrick Elisa works at the department of Chemistry. He relocated from New York only last October. He goes to Live Alive in Central Square for lunch often.

Yu-Pu Wang was one of the first Taiwanese people I met in Boston. She is now back in Taiwan and making a name for herself from being a transgender runner.

Richard Wilk is the head administrator in Chemistry. Rich looks very serious but is very kind and not intimidating.

Tien-Ju Yang is a second year PhD student at the RLE (Research Laboratory of Electronics). Tien-Ju is talkative and smiley, even when he's overworked and tired. Tien-Ju prefers work over school.

Duygu Demir is a curator, writer, and a PhD student in the History, Theory and Criticism (HTC) program. Duygu was my TA for the class and we traveled together to the American Southwest with the class. She gave me helpful feedback for the Daiyu project.

Gediminas Urbonas is my thesis advisor and the director of ACT. Gediminas has a practice with his partner Nomedas. I am the TA the class he is teaching this semester and we travelled to Cuba together in March this year.

Tobias Putrih is my thesis reader and a lecturer in ACT. Tobias is an artist. I was the TA for a class he taught. For the midterm review of that class, he made apple strudel and berry yogurt cake, and I made pumpkin pancakes.

Nick Seaver is my thesis reader and he teaches anthropology at Tufts University. His last project focuses on software engineers who make music recommender softwares.

Gloria Sutton is an art historian who teaches at Northeastern University. I spent Thanksgiving 2015 with her family at Renée and Javier house.

Renée Green is an artist, writer, and a professor in ACT. Renée has taught me a lot about what it means to be an artist, a writer, a thinker, a person.

Rob works for Calvert and Sons. I don't know his last name. He told me he paints.

Mike works for Calvert and Sons. Rob also bartends and he drinks iced coffees. He was surprised when I told him that I was turning thirty in a few months. Mike told me about this sport called sepak takraw. I don't know Mike's last name.

Jackson Davidow is my good friend at MIT. He is a PhD student in the HTC program. We actually went to the same university but didn't meet then. Jackson thinks that I would have been way too cool to be friends with him back then.

Raafat Majzoub is an artist and my colleague in ACT. Raafat goes by Redford sometimes when he is in America. Raafat lives with Yusef in Somerville. Raafat has made many many meals for me. In return, I have made pies once or twice and brought mochi ice-creams to his house.

Yusef Audeh is an artist and my colleague in ACT. Yusef has to magical power to morph one's concept of time. Yusef is a gymnast and I casted him as my talent in the video *Wandering Gramsciwads*.

Alice Ting is a biochemistry professor who was at MIT. She is now at Stanford. I found a postcard addressed to her from a student on a bulletin board in her old lab at MIT.

Gabriel Loke is a PhD student in the RLE. Gabriel is from Singapore and he's always at the Taiwanese Student Association events.

Chung-Yueh Lin is a 2nd year undergraduate student at MIT. Chung-Yueh is Taiwanese and I have been running into him very frequently lately.

Meredith Fydenkevez is with Campus Construction. She has been with MIT for long. Janis is her boss. Meredith studied engineering.

Sudy Nally work for Campus Construction and she is the only person I met who has been in the unit longer than Dick. Kevin Mclellan, the financial person at ACT, know her from year ago working at Campus Construction.

Luda Leoparde works at the MTL, in charge of finance and accounts. She has a nonchalant vibes that balances out the nervous engineers. Luda has nice pictures of Japanese ink paintings all over her office and she puts on classical music out loud.

Vicky Diadiuk is my PI at the MTL, the director of MTL. I first met her on a tour of the MTL in October 2016. She gave me a six-inch wafer in a hardy plastic ziplock bag.

Kurt Broderick works at the MTL. He's in charge of the EML. Kurt speaks slowly and clearly but he always seems a little bit on edge.

Ryan O'Keefe works at the MTL. He trained me on the wafer die saw, with great patience and form time to time laughter. The first time I met Ryan he was wearing a MIT trucker cap.