Tying Tourettic Threads Together

A Thesis

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Abstract

Across a spectrum of activities, there are several threads that run through my works. This thesis highlights the commonalities in an energetic and fragmented practice. Experiments outlined within cover a broad range of activities; fabrication of new parts to hack existing systems and change their functionality; designed electronic and mechanical interfaces that allow the viewer to take on new perceptions; affective approaches to computing that become metaphor for neurological processes; designed modular systems that can be fabricated from downloadable digital files and allow the user to explore their own creativity. This selection of works created during my time at The Ohio State University in the Masters of Fine Arts program illustrates my process of self-discovery. In trying to define the audience my work is intended for, it has becomes clear that insofar that there is such a distinction, my work operates within multiple audiences. Part of my journey has been to identify how the elements of my work are operating on these audiences so I can leverage the strengths of each audience in creation of a unique aesthetic.
To Ernie, for finding me
To Albhy, for pushing me
To Melissa, for saying yes
To Maya, for being my buddy
Vita

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Field of Study

Major Field: Art
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Chapter 1: A map to find my way

Being random is in my nature. My genes have predestined me to be statistically variant. My brain chemistry is outside the bell-curve in that I have “too much” neurotransmitter saturating my cells. This roughly equates to having “too much” thinking – I literally cannot turn it off. Well, there are some ways... But, this overthinking means that I am always working on something. The upside is that I tend to be a fairly productive artist. I tend to experiment a lot, and to follow my impulses, and don't necessarily have a “reason” for why I move in a particular direction. The downside is that in the context of an MFA program, I found it difficult to draw a clear line tracing the development of my work.

Thankfully, an activity that proved to be quite useful was simply mapping the relationships between my various works, and then later analyzing those maps and looking for patterns.

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1 I use “too much” in quotes because disorders like Tourette's are really disorders of perception. What is too much? What defines normal? If we say a kid with ADHD “has trouble focusing”, this is because he does not fit into the industrial-revolution model (sit at your station and work). So does the ADHD kid have a problem? Or is he normal, and all the “normal” people are retarded (literally slow)?
Some of the maps of orbits and relationships were visually interesting, like the map in Figure 1.1, but they did not help me establish a through-line. That came with the next version of my map.

More linear maps like the one in Figure 1.2 helped me to see patterns in my work. It was this map that allowed me to see the lines that ran through my various
works. And in seeing those lines, I made it my goal to produce a work that would
tie them all together (more on this in Chapter 5). In this map, the x-axis
(horizontal) is time, and the y-axis (vertical) is used to help me identify the
audience that the work is more associated with, “art” or “design”. I simply placed
the works on the map base on the axis, and then tried to draw lines through them
based on areas of research that are of interest to me.

Of course, trying to map my creative output with such a linear system is bound to
be problematic and self-contradictory. But I think that having the map is better
than not, as it allowed me to see patterns I was not aware of. For example, the
line called Tourette’s breaks in the middle but is resumed later (more on this in
Chapter 4).

Let's take a look at some of the elements of this map. Of course, these through-
lines are chosen by me in the sense that I picked things that seemed to describe
multiple works. So I should explain what each line means to me, and why I think
it helps to tie my works together. Also, I see the entire map as being a space of
open-source and hacking as this is the overall context of my work.

**Systems**

A system is made up of objects that are interconnected. The objects interact with
each other through various interfaces, and it is their interaction that makes the
whole system synergistic.
**Off-the-shelf parts**
In order to reinforce a culture of hacking, it is important that my work interfaces with off-the-shelf parts when possible. Even though 3D printing and other fabrication technologies allow you to create designs that are completely free of dependency on any standard, I think their most powerful use is when the parts you design intentionally interface with existing standards. Of course, one positive effect of using manufactured standards is that you have lower cost and parts are easier to source. But just as important is that dependency on existing systems makes it more likely that you will remain relevant to that system.

**Tourette's**
Many of my works are inspired by, or deal directly with Tourette's Syndrome. My disorder is so much a part of my existence, so responsible for my world-view, that it finds its way into my work whether I like it or not. And as an artist and teacher with Tourette's, I feel a responsibility to use my Tourette's in an open and unashamed way to be an advocate for this syndrome that is too often misunderstood.

**Behavior**
For me, behavior is a description of what something does. The way something behaves is a result of how it is built. What I mean is if we talk about the behavior of a system, then the way the system behaves is due to the interactions between the elements of that system. The behavior of each individual human is due to the
complex interactions within our own bodies and our interactions with other
people. And the behavior of our overall human culture is due to the complex
interactions in co-evolution of us as individuals and the machines we construct.
Chapter 2: On open-source and hacking

Perhaps I am blinded by optimism. It could be that we will have a future of severely limited access due to behavior of gatekeepers. But I am optimistic. I think we understand the value of openness. I only hope we understand it enough.

I should begin with a definition of open-source and hacking. Open-source is a design paradigm. The Open Source Foundation defines it this way, “Open source doesn’t just mean access to the source code. The distribution terms of open-source software must comply with the following criteria:”, and then lists features such as “free redistribution” and “derived works”². Open-source is about the big picture. It is a long-term project about creating a digital commons, so that future generations will have access to the machines that run our world.

Hacking is a little more complicated to define, as it can range from being negative to positive. There are black-hats and there are white-hats. There are terrorists and there are inventors. The thing that all hackers share is that they are makers. Hackers use the materials of their environment to make something new or unexpected.

In the media, hacking is often perceived as the digital equivalent of breaking and entering. Some rogue hacker breaks into a secure network and steals files, or

²  The Open Source Definition, Open Source Initiative
uploads a virus – something nefarious. But many computer programmers (the people most often described by the term) would not agree with this definition. In *The Jargon File*, a glossary of computer programmer slang started by Raphael Finkel at Stanford in 1975, “hacker” is defined as “an appropriate application of ingenuity”\(^3\). This definition could be used to describe everything from an entrepreneur building a new business platform to a terrorist building an Improvised Explosive Device (IED).

Often a hack is something you do to make the system work in a way it was not intended to work. Through various conversations with students and faculty, my own definition of hacking has grown. I now consider a hack to be nearly any customization of one's environment, especially if the customization is a rearranging of or interfaces with elements that are readily available. This means that you are communicating in the same language as the system you inhabit.

In his book *Free Culture*, open-source advocate Lawrence Lessig writes about the importance of striving for our culture to be read-write not read-only. In an interview, Elizabeth Daley, executive director of USC’s Annenberg Center for Communication and Dean of the USC School of Cinema-Television clarifies this distinction:

> From my perspective, probably the most important digital divide is not access to a box. It’s the ability to be empowered with the language that that box works in. Otherwise only a very few people can write with this language, and all the rest of us are reduced to being read-only.\(^4\)

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\(^3\) The Jargon File (version 4.4.7). The Meaning of ‘Hack’

Hacking is one way to get people thinking about possibilities for treating our culture as read-write. It is important that we can talk back in the same language we are being talked to. To use television as an example, the old read-only model was “broadcast”, the new (potentially) read-write model is “broadband”. In the broadcast model, on one end of the spectrum of communication large, well-funded corporations produce all of the content, and on the other end we, the consumers, consume that content without the ability to make and distribute our own content – without being able to talk back in the same language that we are being talked to. But in the broadband model, everyone is a potential content creator. So you may still have the big content producing corporations, but you also have bloggers, vloggers, indie studios, and a whole ecosystem of small content producers that can say what they want without having to go through the traditional channels – they can talk back in the same language that they are being talked to.

Mitchel Resnick of the MIT media lab also believes in the importance of this read-write model. In his TED talk, Resnick explains:

> So young people today have lots of experience and lots of familiarity with interacting with new technologies, but a lot less so of creating with new technologies and expressing themselves with new technologies. It's almost as if they can read but not write with new technologies.5

This read-write modality has even greater implications when extended to the new wave of fabrication technologies. For example, my piece, *Play Doh Gun Factory*, makes use of an off-the-shelf Play Doh Fun Factory extruder while executing a

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My goal in this work was to create a 3D printable hack for a manufactured toy. I selected a Play Doh extruder because it accepts a plastic die plate that controls the output, and the die plate would be easy to print on any 3D printer. I selected a gun because it said something to me about the production of violence and children, especially in light of the all too common school shootings.
The 3D models necessary to print the die plate and the graphics for printing the stickers are available on my website so that anyone can download the files and make their own Gun Factory. Similar to the The Fluxkits produced by George Maciunas and the network of Fluxus artists, this is a work that is meant to be made in multiples and distributed. This is a work that can be owned by a great many people. The hack consists of two parts: the 3D printed die plate and 2D printed stickers. The stickers allow you to re-brand the extruder and are an important part of this hack. But the die plate is a hack on another level. Part of the downloadable package is a blank die plate so that it is easy for someone to create their own Play-Doh extruder hack that will extrude a different shape. In this way, the hack is a tool for future hacks.
In discussing my work as tools for hacking, my work is often compared to Golan Levin. The problem I have with the comparison is that Levin does not seem critically aware of the actual usefulness of his tools. For example, his Universal Construction Kit is described this way:

The Universal Construction Kit offers adapters between Lego, Duplo, Fischertechnik, Gears! Gears! Gears!, K’Nex, Krinkles (Bristle Blocks), Lincoln Logs, Tinkertoys, Zome, and Zoob. These adapters can be freely downloaded from Thingiverse.com and other sharing sites as a set of 3D models in .STL format, suitable for reproduction by personal manufacturing devices like the Makerbot (an inexpensive, open-source 3D printer).6

My problem with this is that it is not true. You have to read a bit, but in their documentation, there is also this note about the construction kit:

According to Wikipedia, the precision of Lego pieces is less than 10 microns. As of early 2012, however, standard Makerbot printers have an XY resolution of 100 microns (0.1mm) and a default layer thickness of 360 microns (0.36mm). We thus caution that fabrication of the Free Universal Construction Kit with current (2012-era) solutions for DIY 3D printing, such as the Makerbot, Printrbot or RepRap, may lack the precision required for reliable or satisfactory coupling with standard commercial pieces.7

To me, this feels like bad stewardship. I think that Levin puts his goals of improving his reputation as an artist ahead of whatever goals he may have of making things that will actually serve people. I have also read many comments from users that were unable to get these parts printed even using a commercial service. This is an important point. If you are going to make tools, they need to work or else you are making a gift that can never be used.

When these kinds of tools are designed well, hacking begets hacking. For example, the open-architecture of the Internet has facilitated innovation because it is so easy to hack that system. The Internet is a space for hacking. An open-source application like Apache, which runs the internet, is a tool for hacking. When you put all this stuff together, you create more possibilities for hacking. And some of those hackers will create new spaces and new tools adding more inertia to the movement in general.

So when I designed my modular robotics kit, the open-source publishing implications were always in my mind. This means the digital files that create the physical parts are created in such a way that others can re-purpose the designs and create derivative works. This modular kit is a construction tool that exists as a set of designs that can generate a set of parts that can be produced using
relatively common and inexpensive fabrication technology.

Like any modular building set, these parts together form a language. And like any spoken or written language, the parts of the language direct what you can say. I came up with a set of parts that I think of as universal, but they may prove to be inadequate for someone else’s project. Since that person has access to the source files, they can modify and add more parts to the set, thus expanding the language so it can be used to say more things. In this way, the user becomes a potential designer.

In designing an open system such as this, there is less focus on my own creative expression and more on facilitating the creative expression of the user – with the goal of helping others find their creative expression. Put another way, with an open system the focus of my creativity is on the design of the system. When a user uses the system, it is their creativity that is expressed as they use the system to construct things and in the process evolve the system further.

As with the Play Doh Gun Factory, the 3D and 2D designs can be downloaded and fabricated by anyone with access to a 3D printer and laser cutter. This means that the potential audience is quite broad across a range of skills, and I cannot assume that the user is highly trained in technical concepts. Part of my work in publishing a construction set such as this is to make everything as easy as possible for the user. One way to do this is through documentation.
I think it is critical to create clear, concise documentation. Without documentation, it is easy to create a “gift” that will never be opened. If users don't have an easy way to make use of your system, then your system may never be adopted. To this end, your documentation should leverage universal imagery (diagrams) when possible. This will allow for even a more broad adoption as it extends the possible scope of your project because it is less dependent on specific literacy.
Chapter 3: Analog and digital

Why is there a difference between art and design? I recognize that there is a difference, but to think of them as exclusive modes of thinking is polemical. In reality, these two disciplines lie at either end of a spectrum and few creative practitioners operate in only art or design exclusively. My practice often moves back and forth between the two, and many of the discussions about my work struggle with this difference. But what is this difference really about?

Figure 3.1: A paradigm for the design process

There is an existing model for design as a trajectory beginning with research, in the “fuzzy front end” (left side of Fig. 3.1), and proceeding toward production, where the design becomes more defined (less fuzzy). This progression from fuzzy to defined is about making choices. As you choose certain options, you must exclude other possibilities. It is in this way that it is often said that art is about asking questions and design is about answering them. This is an old point of view
however, and the lines that divide art and design are not nearly so clear.

Figure 3.2: Art and design as trajectories

I do think this diagram is useful in a discussion about the difference between art and design. We can think of the different fields as having different trajectories. As a field, design is aimed toward creating solutions. The goal is to refine the idea from a set of questions to a set of answers. And if design is about creating solutions, then art is about creating problems. The goal is to ask questions, to leave enough ambiguity that the audience can find their own interpretation within the work. A criticism I have heard often is that my work is too much of an answer, that the viewer was unhappy because my work seemed like a solution, or was “too well designed”.

This dichotomy can be carried over into a discussion about analog vs digital logic. One thing I’ve learned building robots is that digital and analog each have their place. Digital is cut and dry, yes or no, with nothing in between. Analog is a gradient of possibilities, everything along the spectrum from yes to no.
Figure 3.3: digital vs. analog logi

Most data from our natural world is analog. Things are not either this or that. We create those categories because it makes it easy for us to organize information. We digitize our world so we can label things – and it is difficult to label something unless you determine what it is. This either/or feature is also what allows us to have war, sports, and the concept of the Other. We decide that someone is or is not equal to us – and often there is no in-between.

Figure 3.4: Grey Walter's tortoise (left) and Tilden's BEAM robot (right)

My understanding of the power of using analog logic comes from the work of William Grey Walter and Mark Tilden. In 1949, William Grey Walter created a simple analog robot he called a tortoise which had a photo sensor that caused it
to move toward the light (photophillic). With his robotic experiments, Grey Walter was really asking a question about where intelligence begins. Mark Tilden continues this question currently by making simple responsive systems with only analog logic. As Tilden said in an interview in 2000, when you use digital logic,

"You get million-dollar robots that can barely walk around in a box. Every animal on this planet thinks in analog. Nothing in the universe thinks in digital except for the computers we've built. And computers can't live off the desktop. We use neurons in a chaotic way; the firing of these neurons matches the complexity of the world."

In my own work, I use a mix of analog and digital logic to create complex random behavior that feels life-like (whether you consider these systems alive or not). It is generally easier to think through the programming of digital logic. However when you add in analog logic, you add complexity and retain the range of possibility that comes with the range of values. This range of possibility gives you something more closely related to a living system — a collection of impulses that resonate and interact and allow for emergent behavior. You can then add a layer of digital choices to create the kind of complex, learned, repetitive, gestural, behavior we see in living organisms. From my experiments, I have found that it is necessary to mix both analog and digital logic to simulate the kind of behavior we see in a neurological disorder like Tourette's Syndrome.

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Chapter 4: On Tourette's

My relationship with Tourette's Syndrome is complicated. Sometimes I hate my Tourette's; this is partly from the aching muscles, headaches, and creaky joints of repetitive motion, and partly because I have a lot of emotional baggage about my disorder. Sometimes, however, I love my Tourette's. The energy and creativity that comes with this imbalance in brain chemicals is exhilarating. Tourette's is on a spectrum including disorders such as ADHD, Autism, and OCD. The disorders on this spectrum are all the result of chemical imbalances, and can be thought of as a kind of universal brain hack.

A bio

The onset of my disorder was when I was 8 years old, but I was not diagnosed until I was 20. During this 12 year gap, I lived in a state of being frightened, ignorant, and self-loathing. This was obviously not good for my self-esteem. However, the most difficult part for me is that I internalized defense mechanisms that still guide my behavior today. I tend to expend a lot of energy being subconsciously aware of other people's gazes, knowing when I'm being observed, and I struggle to hide my twitches as much as possible.

I believe that this hyper-awareness is at the root of my oversensitivity to
feedback. I am often on the defensive – even when I don't intend to be. It has been a real challenge for me through this MFA program to receive criticism about my work though most of the criticism I received was valuable to my evolution as an artist once I had time for reflection. I found the critique structure to be very intimidating, and I think I have grown a lot in my ability to present with confidence, though it still scares the hell out of me. Still, as is clear from the map below, my work is far from done and will continue to evolve.

Figure 4.1: my map with only the Tourette's line of projects visible

Somewhere in the middle of my journey through this MFA program, I fell off track. The line that represents Tourette's stops, and then starts again. On reflection, I am becoming aware that this is because of my being too sensitive to feedback. There were a series of off-hand comments that I now remember hearing, but not processing. These comments caused me to lose confidence and to get back into my old stubborn “I don't have a disability” mindset.

Getting diagnosed with Tourette's did drive positive change in my life. At the time, I wanted to try school again (I had already failed the first two attempts).
This time, I went to the Learning Disability center at my college. They gave me tests and then prescribed strategies so I could learn how to do well in school. It worked. I stopped failing and started getting good grades. Having the label helped me move forward. In fact, if I had not embraced my disabilities, I would not be in a graduate program now. I would have given up on school long ago.

However, having the label that comes with the diagnosis for Tourette's still makes me very uncomfortable. I still don't tell my students unless it comes up, and only then sheepishly I mutter the word. When Tourette's is on the table, I never want pity or even special treatment though seeing my own dysfunctional relationship with my disorder has pushed me to be more of an advocate for Tourette's. I must never be afraid, in part because I want to increase awareness, but also because Tourette's is so friggin' cool.

**A universal brain hack**

Tourette's is a spectrum disorder, which means the case-by-case intensity ranges from mild to severe. So when we say someone “has Tourette's”, what we mean is that they have enough Tourette's that they get to say they have Tourette's. When you ask “how common is it?”, you also have to ask “at what intensity?”. So potentially, a lot of people have Tourette's (maybe even more often than not) if you are talking about just a little Tourette's.

This universality is part of what makes it interesting for me to explore my own Tourettic impulses. Tourette's is a label for a kind of behavior that is caused by
seemingly random impulses. But lots of human behavior is driven by seemingly random impulses. So where does Tourette's end and “normal” begin?

Figure 4.2: What's Your Tourette's website screenshot

What's Your Tourette's is a curatorial project that deals with human behavior. The site features hundreds of citations from around the web. Each citation uses the term Tourette's in a non-clinical way. These are postcards from the edge between Tourette's and normal. These are examples of how people identify with the undying Tourettic impulse, and how behavior is sometimes a result of forces that are beyond our conscious control.
Another way I have explored my relationship with Tourette's is through the creation of interfaces. I have three works, each with its own unique interface, that simulate Tourette's for the interactive user (Fig. 4.3). I’ll cover the first two here, then the last one in the final chapter.

**The Tourette-O-Tron**

The *Tourette-O-Tron* is a device that induces, in the user, a set of behaviors, both mental and physical, that can be considered a realistic\(^9\) approximation of that user having Tourette's. More specifically, the user wears an arm band (for twitch detection) and an ear bud (for a twitch cue) so the device can impel them to execute Tourette-like behavior. In the context of the user and their relationship to the Tourette's simulation, we can call this work

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\(^9\) By “realistic” I mean a convincing approximation of the disorder based on the experience of myself and others.
read-only because the user reads their Tourettic impulses from the *Tourette-O-Tron*. In this work the assumption is that the user does not have Tourette's. They are the receiver; the device supplies the Tourette's.

![Image of Tourette-O-Tron](image)

**Figure 4.5: Tourette-O-Tron inside (left) and with sensor and ear bud attached (right)**

When various participants were asked to wear the device for an hour, an interesting result emerged. Each person developed their own unique relationship to their temporary Tourette's. Each had a specific way they thought about their twitches and while they all had to move their arm, each subconsciously came up with a particular kind of motion. It was interesting to me that no two participants were the same. In addition to the physical uniqueness, they also developed a unique mental model to cope with their twitches. All participants expressed a newfound and intimate understanding of what it might be like to live with an impulse disorder.

The most important aspect of designing the *Tourette-O-Tron* was that it would give a natural experience without the technology being a distraction. This means
that the device needed to be small and lightweight so it could be worn without the
user being constantly reminded that they were wearing a device. I also wanted to
use the most common and least expensive parts possible so that these units could
eventually be produced in large quantity for use in increasing awareness about
Tourette's.

Figure 4.6: Tourette-O-Tron custom circuit board with Arduino attached

The Tourette-O-Tron is built around the popular Arduino platform. I selected a
low-power board\(^\text{10}\) to minimize the weight of the batteries. To make the device
easy to use with accessible jacks so sensors can be plugged in quickly, it was
necessary to develop a custom board to hold the micro-controller, jacks and other
electronics.

\(^{10}\) I used the Arduino Pro Mini (currently made by SparkFun) which runs at 3.3 volts, so it can run on 3
AA or AAA batteries.
To facilitate distribution of this device, the next phase for me is to develop a custom PCB and enclosure\textsuperscript{11}. This will not only lower the price, but also give the device a finished look and durability that will allow it to be adopted easily by non-technical users.

**Dance Of The Freak**

![Figure 4.7: Dance of the Freak 3D model (left) and built installation (right)](image)

*Dance of the Freak* is an interactive sculpture that allows someone to reenact one of my twitch memes. For me, a twitch meme is a phrase of movement – i.e., a particular motion or set of motions that is repeated over and over. Each person with Tourette's has specific phrases that are particular to them. A meme is any behavior that can be copied, and in this piece I was thinking of one of my own specific movement phrases that could be copied by the person interacting with the work.

The piece is designed as a carnival game with flashing lights and a carnival

\textsuperscript{11} A Printed Circuit Board or PCB is a board that allows you to connect everything together. A PCB is specific to the application, and fixing the design in this way allows you to mass-produce your custom circuit board. The same is true of designing an enclosure. Once you have your designs as digital files, you can make multiples with high quality at low cost.

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barker. The user stands in front of a fun-house mirror and pushes the three buttons (labeled “1”, “2”, and “3”). Each time the user pushes the buttons in the correct order, the game rewards the user with lights and sounds that flash more rapidly though also become more ambiguous. As the user twitches their way along this trajectory, they are both receiving Tourettic impulses from the game and they are controlling the arc of the twitch impulse through their interaction.

This interface is a translation of the geometry of physical impulses. It causes the user to reenact a set of distinct motions. This is accomplished by specific placement of the buttons. Each button represents a point in space derived from the original tourettic impulse that tells my body where to move in space. As the user reaches for each button, they are experiencing an allegory of that tourettic impulse. The set of motions (all three buttons) represent a tourettic twitch cycle. So each time the user completes the set of motions, they go deeper into the full arc of a tourettic episode. And the game increases its excitement level to bring the user along on this narrative.
My initial designs for this piece were for a modern arcade game – perhaps something more like Dance Dance Revolution. The only thing I knew for sure was that I wanted things positioned in space so that someone would have to interact physically in a specific way and that I would use the placement and timing of these interactive elements as a way to sculpt their behavior.

As I explored the aesthetic choices of arcade game interfaces, I was drawn more and more to the flashing lights of older games that were on the Santa Monica pier when I was growing up. These old games were from the pre-video-game era. These games had no screens, and depended instead on their rows of small glass light bulbs and their carnival finish. With carnivals and Tourette's on my mind, I could not stop thinking about the display of “freaks” at the carnival side-show. The carnival freak is a person that on the surface appears supernatural. This is often a strange talent or a physical deformity, but is something that the average
person would not be likely to have seen before. What makes these figures interesting to me is the duality of their othering. Of course the freak was an object of ridicule (they were called “freaks” after all). As the old expression goes, we hate what we don't understand. And for this ridicule, the freak was elevated, literally up on a platform. And with this elevation, we admit that they have something the rest of us don't, that they are worthy of being raised up above the crowd. The freak is a super-human, and we cannot resist gazing upon this marvel.
Chapter 5: Tying the threads

Figure 5.1: *Echo of Motion* installation view

My thesis work feels like a metaphorical diagram of the workings of my brain. Perhaps because I experience so much neural noise, I find comfort in the process of refining a good idea. While this crazy assemblage is not my natural mode of making, I do think it is a strong metaphor for how my brain appears through the observation of my physical behavior. Physically this work appears as a torrent of articulated machinery hopelessly unfocused in their chaotic arrangement.

While my goal was not to make a piece that would allow me to satisfy both my design and art impulses in the same work, I think it ended up being that. *Echo of*
Motion, is both a modular construction kit and a performance piece, and I think because of its range, it really does tie together all the lines in my map.

This robotic installation is a system of parts that communicate and affect each other. It uses off the shelf parts where possible. It is inspired by and controlled by my own tourettic impulses, and is a reflection of my disorder. It is about behavior, about what things do, about how we move. As with past works, the individual parts I designed to make this piece will be published (made available for download) as an open-source kit.

This work touches on all the areas of my making, all the ways I find myself exploring. In that way, this work is a kind of template I may be able to reference. It is a possible mode of making that allows me to pursue all of my areas of interest, to use all of my strengths.

I am also interested in the way this work addresses multiple audiences simultaneously. I think that in as much as there is an “art” audience and a “design” audience (and in the course of this program, it has become clear to me
that it is a real distinction), this work has content for both.

Figure 5.3: *Echo of Motion* installation performance (video still)

In an “art” context, this work is affective. The strength is in its emotional connection to the audience. The shaky, chattering robots have a presence that makes them transcend the inanimate technical parts they are assembled from. While working on developing different forms, I kept in mind strange sounds of the sculptures of Jean Tinguely, and the individual personalities in the sculptures of Arthur Ganson. Visitors I spoke to said they found the robots to be funny, and kind of silly, and that they were compelled to stand and watch them, to wait for the next thing that would suddenly move. How can a machine draw people in emotionally? It may be useful to use the lens of affective computing being developed at MIT in the research group headed by Rosalind Picard\(^\text{12}\). This group studies how to use technology to alter people's emotions, and much of this is

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\(^{12}\) Affective Computing research group at MIT (see references for link). Interestingly, a good portion of this research is focused on people with disabilities, specifically Autism and Asperger's – which on the spectrum is a next-door neighbor to Tourette's.
done designing various interfaces to create different kinds of experiences.

Figure 5.4: Echo of Motion installation detail

I discovered that this affective quality could be enhanced with my own performance. When I stepped into and performed the piece, people's emotional attachment was mainly on me now. I did not tell anyone I have Tourette's, and the word did not appear in my artist statement, so for many people, I was simply up there doing a strange dance. And the range of emotions was very broad. Some experienced anxiety, saying that when I opened my shirt to expose the electronics I had strapped on they thought of a terrorist, that perhaps I was going to blow them all up. Some found it humorous – a visiting curator said he thought of Elaine's awkward dancing on Seinfeld. Some had a more complicated
involvement – one visitor, a student from dance, wept when she watched the performance (again, without knowing I have TS).

Figure 5.5: *Echo of Motion* installation detail of control box that runs the motors via RCA cable connections

In a “design” context, this work is effective. The strength is in the possibilities it has as a tool. From the repetition of forms, it is clear that the robots are made from a set of modular parts. The people I spoke to that were more technically minded were very interested in the implications of these designs. I have had many discussions about this work as an educational kit, in how this might be used to teach to the new STEAM (yes there is an “A” in STEM now) standards that are being established at the Federal level. I also have found interest in the fact that the parts can be produced with a 3D printer and laser-cutter because these fabrication technologies are becoming more and more available to students.
Figure 5.6: *Echo of Motion* installation detail

Figure 5.7: *Echo of Motion* installation detail
Figure 5.8: *Echo of Motion* installation detail

For this audience, it is important that these designs are easy to redistribute – both because they are digital files, and because I make them available. This is why the open-source design philosophy is so important – because this work is made possible by two of my previous projects. *Echo of Motion* is essentially a combination of my *Tourette-O-Tron* and my *modular robotics construction set*.
The *Tourette-O-Tron* has the software to read the data from the accelerometers, and to filter it to give relevant values in the context of determining if someone is twitching. All that was necessary was to add more accelerometers and wireless communication. And as happens in the open-source ecosystem, these projects inform each other. The developments I made in building *Echo of Motion* are being folded back into the design of the *Tourette-O-Tron* to make it more full featured. The *modular robotics construction set* made all the mechanical forms possible. It can even be used to describe supporting components like the enclosure for the control box (below). Here again I am experiencing feedback; the scope of the construction set is expanded with each new project I use it in because I must invent new parts to solve problems.
Somehow, I found a mode of working that let me be in multiple realms simultaneously. And this mode ended up creating a work that I am truly proud of, and one that is making a great connection with my audience(s). I think this is the most important thing I can take away from this MFA experience. I don’t have to choose a particular audience or way of working in an attempt to be cohesive in a way that is not natural to my own personality. But I do need to be aware of how my work is operating on different audiences.


Appendix 1: *modular robotics construction* set, list of individual parts

<table>
<thead>
<tr>
<th>3D printed parts</th>
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<tbody>
<tr>
<td><img src="image" alt="Rod clamp" /></td>
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<tr>
<td>Rod clamp (3D print): used to hold dowels and other rods at various angles</td>
</tr>
<tr>
<td><img src="image" alt="Shaft collar" /></td>
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<tr>
<td>Shaft collar (3D print): used in various axle assemblies</td>
</tr>
<tr>
<td><img src="image" alt="Shaft flange" /></td>
</tr>
<tr>
<td>Shaft flange (3D print): used to attach wheels, gears, and linkages to axels</td>
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<tr>
<td><img src="image" alt="Ball-chain gear" /></td>
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<tr>
<td>Ball-chain gear (3D print): used to create drive mechanisms and gearboxes.</td>
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<tr>
<td><img src="image" alt="Ball-chain gear" /></td>
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<tr>
<td>Ball-chain gear – larger size</td>
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<tr>
<td>Jack backing bracket (3D print): used to support RCA and other jacks that are mounted in paneling.</td>
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</tbody>
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| **Laser cut (flat stock) parts** |  |
| --- |  |
| ![Image](linkage_size_0.png) | **Linkage, size 0 (laser cut):** used for creating linkages, mechanisms, and frames. |
| ![Image](linkage_size_50.png) | **Linkage, size 50 (laser cut)** |
| ![Image](linkage_size_100.png) | **Linkage, size 100mm (laser cut)** |
| ![Image](linkage_sizes_up_to_500mm.png) | **Linkage, sizes up to 500mm** |
| ![Image](base_foot_for_robot.png) | **Base/foot for standing robot, or 3-way flange for axel with spokes** |
| ![Image](axle_box.png) | **Box for mounting an axle for wheels or gearboxes** |

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