MIND & MATTER

A DURATIONAL PERFORMANCE USING VISUALIZED, SONIFIED, AND OTHER DATA TRANSLATION FROM PORTABLE EEG TECHNOLOGIES IN MENTAL AND PHYSICAL TRAINING

by

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A Durational Performance Using Visualized, Sonified, and Other Data Translation from Portable EEG Technologies in Mental and Physical Training

Master of Arts, 2019

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Abstract

In the moment of complete engagement in any activity, we function without conscious thought—referred to as 'the zone.' Digital technologies, from mobile devices to the Internet, can be a constant source of diversion; however, can digital tools help us get into the zone more quickly rather than simply distract us? Using open-source software and hardware, I have developed a real-time data visualization and sonification that have been recorded as performances on the website Mind & Matter, the project accompanying this paper. The performances are filmed in different locations and the visualization geolocates these locations, comparing them to the cell towers within the area. The project seeks to show waves within and around our body that are normally invisible. Each performance seeks to train both my brain and body to find stillness within. The paper is informed by the communications theorists and artists studied throughout the Communications and Culture program. I seek to answer Catherine Malabou's question of "What We Should Do with Our Brains," and how we might find agency in our brain plasticity though technological extension.

Acknowledgments

Thank you to my supervisor Izabella Pruska-Oldenhof, who supported and provided inspiration to me throughout my academic career at Ryerson University. This degree has been transformational for my personal growth. I am deeply grateful to the many talented professors who engaged us with powerful material. Whether the haunting words of Edward Bernays or the ever-predictive scripts from Marshall McLuhan, I carry these texts with me.

Dedication

I dedicate this paper to the memory of Amanda Gaspard, a former supervisor and mentor at Ryerson who worked at the Office of the Vice Provost, Research and Innovation as the leader of the marketing and communications team. She passed far too young, and I believe she would have been proud to see me complete this program.

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Introduction

In the moment of complete engagement in any activity, we function without conscious thought—referred to as 'the zone.' Digital technologies, from mobile devices to the Internet, can be a constant source of diversion; however, can digital tools help us get into the zone more quickly rather than simply distract us? Using open-source software and hardware, I have developed real-time data visualization and sonification performances that have been recorded on the website *Mind & Matter*—the project accompanying this paper, which can be viewed online at https://mind-and-matter.ca. The performances were recorded in different locations around Toronto, using geolocation to visualize my locations and comparing my longitude and latitude to those of cell towers within the area. *Mind & Matter* seeks to show electromagnetic waves within and around our bodies that are invisible to the naked eye. Each performance sought to train both my brain and body to find stillness within—the zone.

Mind & Matter was inspired by two other projects, *Mapping the Zone* and *Performetrics,* completed as part of my coursework in the Communication and Culture program, which I will describe in this paper. In the sections that follow, I describe the objectives as well as the technical and aesthetic decisions I made in the process of creating *Mind & Matter*. In this paper, I contextualize this project within the practices of neuroaesthetics and digital culture, relating them to the relevant literature and outlining how I believe my project may contribute to artistic practice: by introducing an alternative form of quantification through visualization and resisting the biopolitical ideology of 'normalization,' which claims there is one normative ideal to which we must all strive.

This project is a culmination of diverse, personal interests in the fields of communication and cultural studies, my yoga training, and recent developments in wearable, body-quantifying technologies and neuroaesthetics. My project has brought together diverse interests into an

aesthetic form that I use as an artistic probe to explore digital culture and neuroplasticity, as seen through the critical lens of Catherine Malabou and neurobiological lens of Norman Doidge. I seek to answer Catherine Malabou's question of "What We Should Do with Our Brains," and how we might find agency in our brain plasticity though technological extension. I question if normalized data is positive without a full critical understanding of the creation of this presupposition.

Mapping the Zone (2014) was an artistic project that involved recording my brain data while concentrating, and then creating smoothed bivariate histograms and sonifying the data to create a video (https://vimeo.com/1140288990). In this project, I began using the Muse Headband, a consumer-oriented electroencephalography (EEG) technology (developed by Toronto-based company) in combination with data visualization. EEG is "a monitoring method of recording the electrical activity of the brain" at the scalp (Electroencephalography, 2019). The commercial application of this wearable technology is for improving meditation. Specifically, Muse Original Headband "is a research-grade EEG device that passively senses your brain activity and translates it into the guiding sounds of weather to help you stay calm & focused" (Meditation Made Easy, n.d.). The headband has 7 sensors: 2 sensors on the forehead, 2 behind-the-ear sensors, and 3 reference sensors (Meditation Made Easy, n.d.).

Muse also has a developer kit to allow developers to use it in combination with other applications and devices. In the commercial application, you are not provided access to your raw data; in order to access it, I had to enter the developer world, with which I was completely unfamiliar and had no skills in coding. Through endless forums and how-to-instructional videos, I made my way through trial and error. I eventually learned to export the raw data of EEG

values. The resulting file was incredibly large. Therefore, I took data of smaller amounts of time and created smoothed bivariate histograms through an online data visualization software.[1]

This particular visualization software creates 3D maps of frequency data. First, I selected times where I felt I was the most focused. I then took the same data into a sound-editing software and manipulated it to enhance the effects. The sounds were noise and I played with different frequencies to bring out variety in the different waves—in this way, the project focused entirely on the process and the outcome was secondary. While there were aesthetic considerations, the result was not predetermined. Every step of the way required endless research and learning, and many hours were often lost in troubleshooting technical errors. Nevertheless, my interest in this technology and coding persisted.

For another course assignment, I collaborated with three dancers on a group project we titled *Performetrics*. It consisted of a collective dance performance, layering choreography with the biophysical metrics of dancers using several wearable technologies: the Muse, a heart monitor, a microphone, and a GoPro video camera. My part of this collaborative project involved translating their dance choreography through technology, turning the biophysical data of the three dancers into visual representations. The visualization of the brain data averaged the live feed from four channels (two on the left and two on the right—located at the ear and forehead on both sides) to two channels: left and right. These values were compared, and the greater number was shown with the word ‘Left’ and the smaller with ‘Right.’ The value was presented by the intensity of the colour, with the higher value in warm colours and the lower value in cool colours. The heart monitor was visible to the audience by connecting the app to another screen, and the microphone captured the heartbeat and breath, which they were able to hear live. The Go

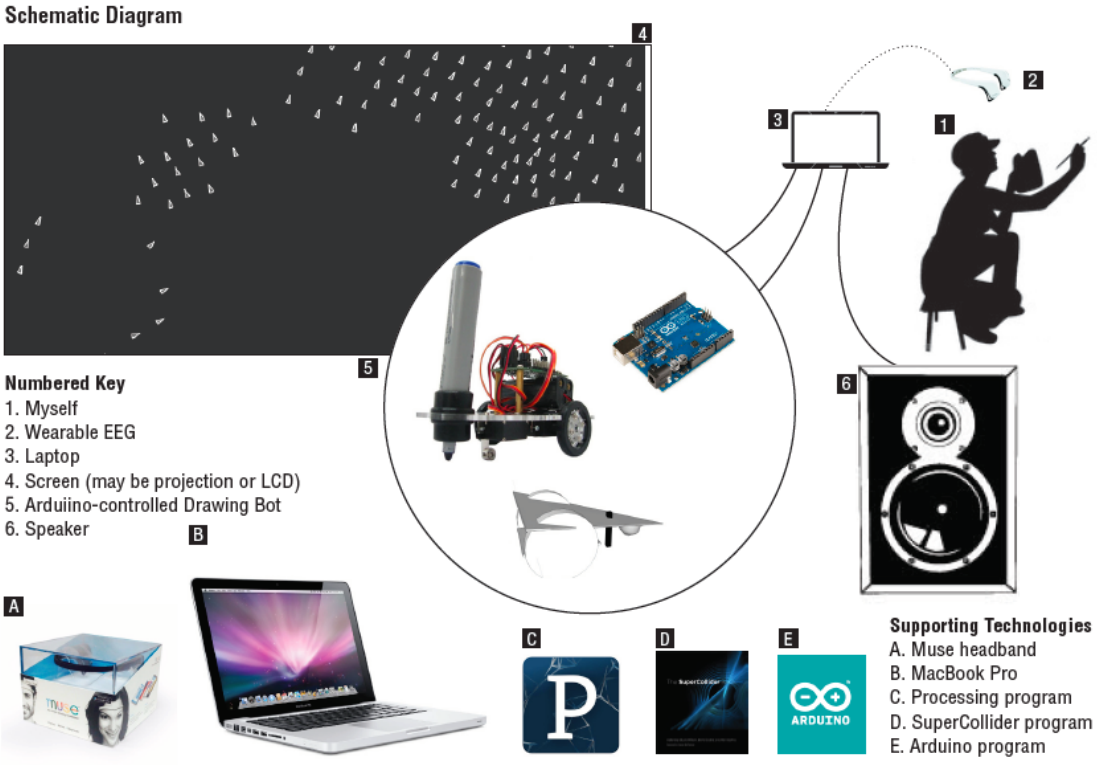
[1] Wolfram Alpha Pro: https://www.wolframalpha.com/pro/

Pro worn on the forehead of the dancer showed the perspective of the dancer throughout the performance. In this project, I began exploring data visualization through Processing, a software we were introduced to in the Communication and Culture program.

Plate 1. Photo from *Performetrics* (2015) Project

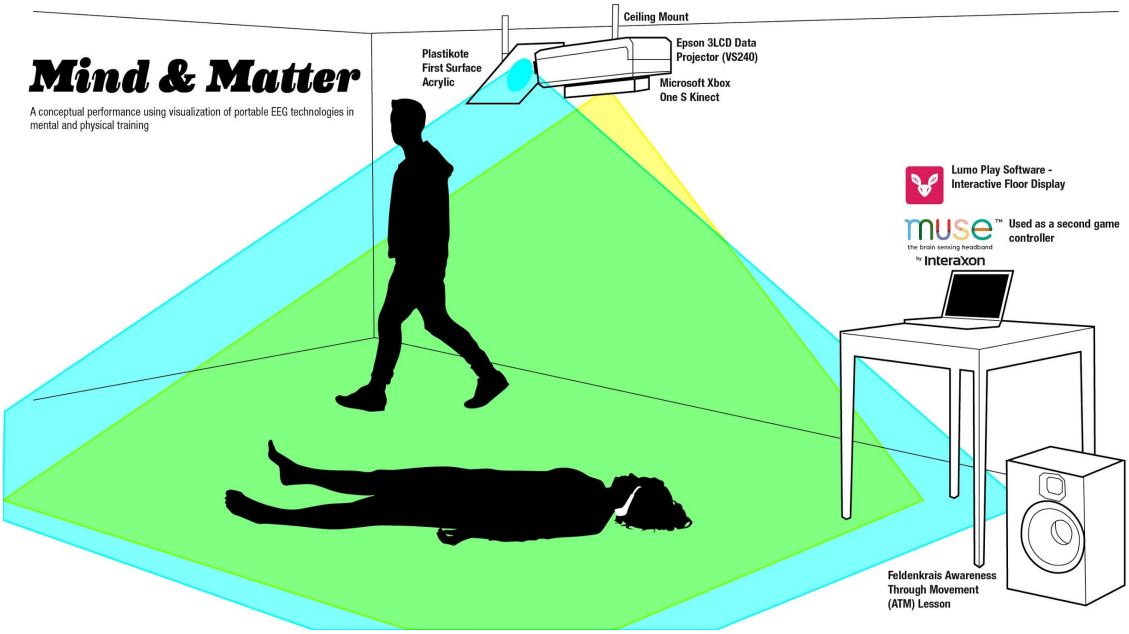
I initially aimed to write a thesis for my master's; however, I eventually changed to the project option, in order to continue the work that I had started with those two projects. I set out to continue working with the Muse and biophysical data visualization. There were several iterations before arriving at the final version of this project. The shifts were a result of both budgetary and time restrictions. One iteration of the project (see Illustration 1) was to connect DrawBots to the Muse Headband to draw out the brainwaves on paper. Having DrawBots moving around an entire room seemed impractical and the cost of creating the bots untenable.

Illustration 1. First Schematic for Mind & Matter



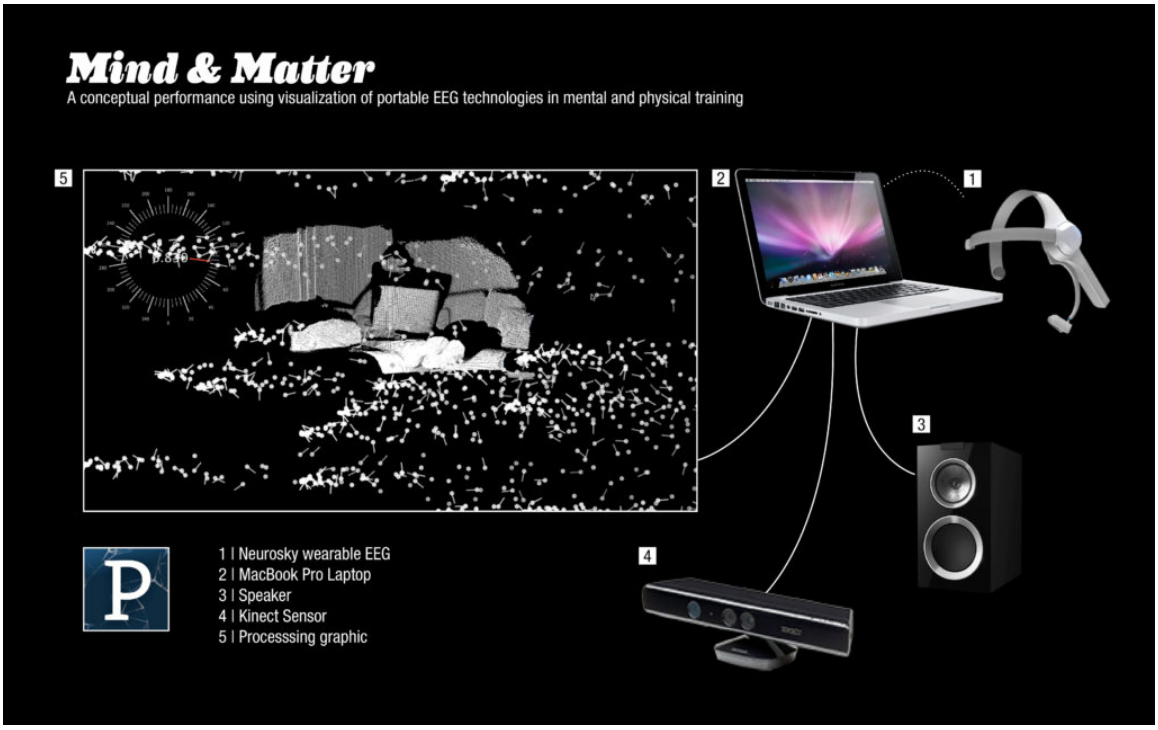
In another iteration of the project (see Illustration 2), the Muse headband was to be connected to an interactive projection. Yet the technologies had no way of working together without a significant investment in having the interactive technology developer Lumo Play customize it.

Illustration 2. Second Schematic of Mind & Matter



The final version (see Illustration 3) connects the Kinect Sensor and the Neurosky EEG while displaying a graphic on a screen through Processing. The change from the Muse to Neurosky is addressed in the next section of this paper, as are the technical details of the project.

Illustration 3. Final Schematic of Mind & Matter



1: Reviewing the Objectives

At the outset of the project, I wrote the following artistic manifesto:

> MANIFESTO
> Max Horkheimer and the Frankfurt School warned of the dangers of losing our individuality to the capitalist structure. “Individuality, the true factor in artistic creation and judgment, consists not in idiosyncrasies and crotchets, but in the power to withstand the plastic surgery of the prevailing economic system which carves all men to one pattern” (Horkheimer, 273). Innately aware of the agenda set by early capitalists and with the aid of those such as the grandfather of public relations, Edward Bernays, they criticize the tactics used to mould the individual mind. These goals were not simply to boost consumption, rather to use propaganda in peace time to control the masses and maintain civil society while accumulating the majority of wealth. The intrusion of this agenda into the private sphere of leisure time and home life has gone far deeper into the individual body and even the brain. As early adopters of unconscious thought theory, capitalists have used the strength of the unconscious mind for their own purposes. We are trained to fear each other to divert attention from these transformative effects. “Evil does not stem from nature, but from the violence committed by society against human nature striving to develop” (Horkheimer, 276). The capitalist agenda has no conscience and no one, including children, is protected. “Under the surface of their organized civic life, of their optimism and enthusiasm, men are apprehensive and bewildered and lead a miserable, almost prehistoric existence” (Horkheimer, 287). True emancipation is the ability to imagine a future different for ourselves and the vehicle for re-enlivening this imagination is through art. Our most intimate work of art is our own brain. Through modern neuroscience, we now accept the plasticity of brain’s evolution although as noted by Catherine Malabou, “Humans make their own brain, but they do not know they make it” (Malabou, 2008). “Plasticity thus adds the functions of artist and instructor in freedom and autonomy to its role as sculptor” (Malabou, 2008). Can we reclaim our artistic authority and remodel both our physical and mental being to our own vision? Can we overcome the capitalist agenda so deeply entrenched even for our psyche to envision a different future for ourselves? This is the ambition of Mind & Matter – a real-time visualization of brain data for my own brain training. Can I overcome the fears, doubts, and anxieties of modern society to achieve whatever I choose including optimal physical performance?

Overall, my objective was to work with a wearable EEG technology, and not use it for recording meaningless data that then contributes my personal information to big data through sharing for capital consumption. By ‘meaningless data,’ I mean a stream of data that, without the right tools for understanding, are simply a stream of data with no meaning to me. I wanted to

manipulate it for myself in a way that I could potentially use it in a training capacity for an artistic intervention. Could I bring forth meaning from these electromagnetic waves of data?

In my two previous projects, I had explored consciousness. The conscious mind is subject to numerous decision-making heuristics or mental shortcuts, best suited to decision-making tasks with limited variables. The unconscious mind excels at solving complex tasks with numerous variables ("Unconscious Thought Theory"). In the moment of complete engagement in any activity, we function without conscious thought—referred to as 'the zone.' Our time in the zone can be our most productive, yielding our highest performance. Digital technologies, from mobile devices to the Internet, can be a constant source of diversion; however, can digital tools help us get into the zone more quickly rather than simply distract us?

2: Relationship to the Relevant Literature

I draw upon three key authors in my literature review: Marshall McLuhan, Catherine Malabou, and Norman Doidge. However, I also reference other theorists and philosophies and I have thus organized this section into the following subsections:

2.1: Parameters & Definitions

2.2: Marshall McLuhan

2.3: Eastern Philosophy Turned to Western Mindfulness

2.4: Open Source: Pushing Against the Capitalist System

2.5: Neuroscience & Philosophy - Catherine Malabou & Norman Doidge

2.1: Parameters & Definitions

My project is exploratory and founded in playfulness and creative practice. By 'playfulness,' I refer to Donald Winnicott's *Playing and Reality*. Winnicott traces two forms of consciousness in children playing: the conscious and unconscious. Imaginary play involves taking something material and transforming it into something else, such as a box into a castle. There is a dialectical relationship created: "These conditions are associated with what is usually called creativity. It is in playing and only in playing that the individual child or adult is able to be creative and to use the whole personality, and it is only in being creative that the individual discovers the self" (Winnicott, 1989) . This performance also embraces McLuhan's valorization of the artist and his celebration of play[2] in the face of the numbing effects of media revolutions, implying both types of mindful presence. Moreover, my project has no capitalist agenda. It is not made for consumption but as simply play and exploration; as such, there are limitations to being both the performer and technical director at the same time. Its future iteration could divide could separate the two roles, so that the project could be approached as a more technical study—either qualitatively through descriptions or reflections of the performer on the experience, or quantitatively through observation, interviewing and data collection.

'The Zone' is central to this project and much has been written by philosophers and psychologists working in the area. Alison Gopnik, in *The Philosophical Baby: What Children's*

[2] McLuhan discusses play in *Understanding Media*: "The artist must ever play and experiment with new means of arranging experience, even though the majority of his audience may prefer to remain fixed in their old perceptual attitudes" (McLuhan, 2013). For McLuhan, play was more like experimentation or exploration, which is what artists do.

Minds Tell Us about Truth, Love and the Meaning of Life, describes two types of consciousness: 'spotlight' and 'lantern' consciousness (Gopnik, 2011). As an adult, when we are completely focused, she describes this as spotlight focus. We are consumed by the activity and lose a sense of time and inhibit taking in things around us. Babies, on the other hand, are trying to learn as much as possible in a restricted time frame and therefore, absorb all experiences at once in a lantern consciousness (Gopnik, 2011).

> Lantern consciousness - that vivid panoramic illumination of the everyday - is often one part of some kinds of religious or aesthetic experience. Lantern consciousness also seems to accompany other kinds of activities, such as falling in love, hunting, or event mania. But there are also many other kinds of religious and aesthetic experience, other kinds of exaltation and ecstasy, that have different qualities.
>
> For example, I'd argue this expansive lantern consciousness is almost the opposite of the distinctive adult happiness that comes with what psychologists call "flow." Flow is the experience we have when attention is completely focused on a single object or activity and we lose ourselves in that activity. Is the sort of experience that comes from executing plans beautifully and efficiently - the experience of dancing or shooting a basket or writing really well. In flow we enjoy a peculiarly pleasurable kind of unconsciousness. When we're completely absorbed in a task we lose sight of the outside world and even consciousness of the particular action we must take. The plan just seems to execute itself. Lantern consciousness also seems unlike the kinds of religious experience that result from sustained concentration on a single object, or the kinds of mystical experience in which the world seems to disappear altogether. (Gopnik, 2011)

The goal during the performance was spotlight consciousness but certainly, with enough practice, it could become the experience of flow.

Mihály Csikszentmihályi's *Flow: The Psychology of Optimal Experience* describes 'The Zone' as flow or optimal experience:

> These examples illustrate what we mean by optimal experience. They are situations in which attention can be freely invested to achieve a person's goals, because there is no disorder to straighten out, no threat for the self to defend against. We have called this state the flow experience, because this is the term many of the people we interviewed had used in their descriptions of how it felt to be in top form: "It was like floating," "I was carried on by the flow." (Csikszentmihályi, 2009)

Shunryu Suzuki in *Zen Mind, Beginner's Mind* refers to a similar state in a different way:

> The practice of Zen mind is beginner's mind. The innocence of the first inquiry—what am I?—is needed throughout Zen practice. The mind of the beginner is empty, free of the habits of the expert, ready to accept, to doubt, and open to all the possibilities. It is the

> kind of mind which can see things as they are, which step by step and in a flash can realize the original nature of everything. (Shunryu, 2011)

Whereas 'flow' implies expertise, 'beginner mind' implies the absence of expertise and its habits; and yet, both states, seemingly moving in opposite directions, can be described as enabling us to be more fully aware or mindful. However, when I refer to 'attention' and 'meditation' in the project, these are being calculated by Neurosky's EEG algorithm. They are described on their website as follows:

> ***Attention***
> The Attention Meter algorithm indicates the intensity of mental "focus" or "attention." The value ranges from 0 to 100. The attention level increases when a user focuses on a single thought or an external object, and decreases when distracted. Users can observe their ability to concentrate using the algorithm. In educational settings, attention to lesson plans can be tracked to measure their effectiveness in engaging students. In gaming, attention has been used to create "push" control over virtual objects.
>
> ***Meditation***
> The Meditation Meter algorithm indicates the level of mental "calmness" or "relaxation." The value ranges from 0 to 100, and increases when users relax the mind and decreases when they are uneasy or stressed. The Meditation Meter quantifies the ability to find an inner state of mindfulness, and can thus help users learn how to self-correct and find inner balance to overcome the stresses of everyday life. The algorithm is also used in a variety of game-design controls. (EEG Algorithms, n.d.)

2.2: Marshall McLuhan

Fundamentally, my project is inspired by writings of Marshall McLuhan, particularly his books *Understanding Media: The Extensions of Man* (1964) and *Laws of Media* (1988). McLuhan astutely understood the capacity of technology to affect the user in ways that were well ahead of his times. For him the words 'medium' and 'technology' meant the same thing, although he opted to use the word media for his writings. Again and again, we see McLuhan's half-century-old predictions coming to fruition, as we live them now.

In *Understanding Media: The Extensions of Man*, McLuhan argues that the medium—or the way in which media is disseminated—is more important than the message itself. The medium and their impact on people and their environments are his focus. McLuhan saw technology as an extension of ourselves as humans. From speech to bicycles, all forms of technology have forever changed our how we consume messages. For example, bicycle changed the way in which messages were distributed and lightbulbs changed when we could use them. It is in

Understanding Media that McLuhan coins one of his most famous aphorisms—"the medium is the message"—meaning that the vehicle of message dissemination is integral to the message itself (McLuhan, 2013).

In *Laws of Media*, he brings then-recent writing in neurology and neuroscience to advance his media explorations, showing that the effects of media are environmental and can be discerned through changes in human behaviour, which have electrophysiological correspondence in the patterns of activating different regions of the brain in the left and right hemispheres. He relies specifically on Robert Trotter's mapping of both brain hemispheres in his discussion of media over the past two millennia. His interest in the brain arose due to having a tumour removed from his brain, and his brain rewiring itself during and after his operation. We now know that neurons die but new ones are produced and shape new neuropathways; however, at the time, the theory prevailed that we had a finite number of neurons that died as we aged.

The dynamic and fluid state of electromagnetism, as proved by physics and advancements in electrophysiology and neuroscience, opened another way of thinking about bodies, in particular about the nervous system and the brain. This new way of thinking considered those structures as dynamic—as relays of inputs/stimuli (information) from one region to another; a communication system of sorts that relies on electric currents produced by the body (neurons) to work. In this text, McLuhan states: "The artist is the person who invents the means to bridge between biological inheritance and the environments created by technological innovation" (McLuhan & Zingrone, 1995). McLuhan recognized the role of art in connecting our bodies and environments to technological innovation through creativity. Not merely passive consumers of technology, artists have played with these tools and reimagined them in new ways, adding critical perspective in the process.

In my project, by visualizing invisible waves (i.e., antennas and radio towers, photons registered on video, soundwaves picked up by mic, and electromagnetic waves that power the devices around me in my project through several devices and code[3]), I am revealing and bringing awareness to the ways in which these waves and their frequencies inevitably affect us. By moving from place to place, the environment is constantly changing and we are then responding to this changed environment. Each space in my project was unique, not only in its architecture but also in the invisible feeling of the space and my own emotions. For example, at University of

[3] Coding used included Processing for the majority of the visualization, and Python to connect to the Combain API.

Toronto's Daniels building, I initially tried to set-up my project in the basement, but the space felt cold and sterile with full concrete surfaces and no access to Wi-Fi. When I moved up to the rose window room, the space was full of light and I immediately felt more relaxed. At University of Toronto's Hart House, I had not asked permission to use the space and every sound was startling. There were birds inside the room that were flying around and the wind slammed some shutters. At the fitness facilities, I was in quiet yoga studios with no interruption and was able to focus fully. In contrast, at Ryerson's Student Learning Centre, the presence of the security guard caused the performance to be cut short.

McLuhan's four laws of media are a tetrad of questions to assist in exploring any new technology and its effects. My project relied on McLuhan's four laws of media to gain better understanding of the consumer EEG technology and its effects, which were framed as the following questions:

1. **"What does the artefact enhance or intensify or make possible or accelerate?"**
   Consumer EEG technology makes possible the ability to track brain activity such as attentiveness and meditation in a non-lab setting and by the consumer themselves.
2. **"What is pushed aside or obsolesced by the new artefact?"**
   It pushes aside technologically free movement.
3. **"What older, previously obsolesced ground is brought back and inheres in the new form?"**
   Former notions of mindreading return in a new way, where your brain patterns can reveal more information than previously possible.
4. **"What is the reversal potential of the new form?"**
   Taken to the extreme, it overrides our own ability to feel, focus and be in tune with our bodies.

In *Understanding Media: The Extensions of Man*, McLuhan drew on Hans Selye and Adolf Meyer's theory of stress to explain human invention and technology. All media are extensions of the human body (McLuhan, 1964); however, with each new extension of the body, there is necessarily a new burden created that can only be tolerated by the numbing of that extended body part. McLuhan uses the wheel as an example, whereby the foot, used for locomotion, is extended by the wheel, and the speed and acceleration it introduces require the

numbing of the central nervous system to sustain the burden of speed. The cutting-off-feeling sensation in the extended body part is what he referred to as 'self-amputation,' which is another way of numbing the overexcited extended body part. Further, McLuhan explains: "Any invention or technology is an extension or self-amputation of our physical bodies, and such extension also demands new ratios or new equilibriums among the other organs and extensions of the body" (McLuhan, 2013). Using visualization and sonification as an extension of self-amputation of my physical body therefore demands the rebalancing of the other senses: touch, taste, and smell.

In a time of constant stimulation of our central nervous system—one that McLuhan had predicted but did not live to see—we experience these sensations daily. This overstimulation necessitates a numbing of or amputation of our attention. Every day, our attention span seems to shorten in response to our central nervous systems having to endure constant attacks from outside our bodies.

2.3: Eastern Philosophy Turned to Western Mindfulness

In the performance within the project, I sit within the stimulation but aim to use it rather than cut it off. The locations are isolated from outside distraction, but certainly the spaces also invite internal stimulation due to the void of external activity. I do not over-focus on the feedback; rather, I let it wash over me and aid me on the internal experience.

I use methods of breathing learned in mindfulness training to calm my nervous system. These are based on Eastern philosophies, although I come to them not from their origins but from the Westernized use in mindfulness training and cognitive behavior therapy. This is an important point because I acknowledge how late capitalism has radically altered yogic philosophies to meet its own consumerist goals by capitalizing on yoga itself. Throughout my own yoga training, I have struggled with even using the term 'yoga' for what we do, which is based more on functional range conditioning than traditional yoga techniques. However, I have used the term yoga here for sake of clarity as 'movement practice' has not yet been adopted into the common lexicon.

These breathing methods include square breathing: breathing in for four counts, holding for four counts, breathing out for four counts, and holding out breath for four counts; diaphragmatic breathing and slowed breath. In the breathing module of my yoga training, we learned how in modern society, we are living in a perpetual state of hyperventilation. We breathe

shallowly and rapidly resulting in an imbalance of carbon dioxide. The long-term effects of hyperventilation are only now being studied. Increased awareness of anxiety has created a resurgence in the interest of breathing as a tool for managing stress.

It was during this breathing module that I finally understood how breathing can become soothing. The vagus nerve runs directly from the gut to the brain, as an information highway of the central nervous system; it runs mostly from the body to the brain but also in reverse, and it triggers the autonomic nervous system (ANS) to react. Our ANS makes possible our fight or flight response and has two components: the sympathetic and parasympathetic nervous systems. The former heightens our response, and the latter regulates it. Surrounding the vagus nerve is the diaphragm, our breathing apparatus, which starts in the gut. Therefore, if you engage in diaphragmatic or deep slow breathing, you are massaging this nerve. The result is a regulation of the ANS (Bergland, 2017). What people in Eastern cultures have practiced for generations has only recently been explained and understood by Western medicine and science.

2.4: Open Source: Pushing Against the Capitalist System

McLuhan astutely noted that "Physiologically, man in the normal use of technology (or his variously extended body) is perpetually modified by it and in turn finds ever new ways of modifying his technology" (McLuhan, 2013). I think that the closed system I created with this project will, in fact, start to change me if I were to continue to use it. McLuhan warns that our constant numbing can trigger anxiety, unconsciousness, and apathy. Certainly, if he were alive to see the rise of social media and its scale of amputations today, he would have witnessed first-hand this unconscious dependence on technology and apathy, which whittles away our precious, limited time without our intention. Yet, because these changes are in an open system, critical analysis of these technologies encourage our reflection on how their use is indeed changing us.

Through this understanding, we regain agency and can regain equilibrium in our lives through further uses of technology or abandonment of it. We can remove notifications, so we are not constantly disturbed by them, or use apps to meditate them or block ourselves from disruption. However, technology affects people and their entire environment, so whether one decides to turn off notifications is somewhat inconsequential—as social media has introduced new patterns of behaviour, perspective, thinking, and self-image. So, by being a social being participating in everyday activities of going to work and interacting with other humans, those

effects are already present and are shaping our own experiences and behaviour. So, unless one wishes to become asocial and live somewhere in one of the White Spot's regions[4], we will be affected and shaped by this technology. Yet being aware of how it is shaping you is the only way to reduce the impact of its effects.

As in the *White Spots* project, we can look to find spaces that are free from the networks, or use them to locate ourselves in them. However, these spaces are fewer and farther between, making disconnection more difficult. We cannot easily escape and be alone.

I suggest something further: that we can learn to develop the technology to suit our own needs, rather than simply accept what we are given; a subversion of sorts. We can share our own innovations with others to help them in their own pursuits. If we are free from the burden of capitalizing on our creations, we can use these technologies to create art or play. We can test the limits of the technology to our own end.

In section 4.1, I outline the reasons I came to use both the Muse and Neurosky developer ends from the beginning. Muse's commercial device would not directly give me my own data. They would only give me an interpreted version of the data, and the way they interpreted the data was considered proprietary. By developing this project on my own, I am the holder and controller of my own data rather than allowing it to be consumed for other intentions by the product developer. Developers of other wearables are taking even our most sensitive data and harvesting it for their own gains. Our data is important for own self-preservation, which is particularly noteworthy in applications such as in acute care. However, we should be the managers of this information and use it as we wish. This is an important element of my project.

That developing our own data is even a possibility arises from social movements that have recently emerged, as well as from the use of the Internet as a platform for exchange and sharing of code, content, and information. In free-culture and open-source software movements, makers are willing to share their knowledge without or with minimal, often optional, fees. The term 'open-source' came from the free-software movement, which began with developers in the eighties and nineties with the idea of sharing and developing software collaboratively. Richard Stallman announced his GNU Project on September 27, 1983 in the form of email on Usenet

[4] "White Spots is a collaborative multimedia project by information designer Richard Vijgen, documentary filmmaker Bregtje van der Haak, and visual artist Jacqueline Hassink" (White Spots., n.d.). The project maps the connected and unconnected parts of the world through the internet and asks others to join in the mapping.

newsgroups. GNU had a manifesto which included Stallman's concept of software freedom: "as being software that ensures that the end users have freedom in using, studying, sharing and modifying that software. The term 'free' is used in the sense of 'free speech,' not of 'free of charge'" (The Free Software Definition, 2019). Whereas the history of open source is described below:

> The label "open source" was created and adopted by a group of people in the free-software movement at a strategy session held at Palo Alto, California, in reaction to Netscape's January 1998 announcement of a source-code release for Navigator… Later in February 1998, Bruce Perens and Eric S. Raymond founded an organization called Open Source Initiative (OSI) "as an educational, advocacy, and stewardship organization at a cusp moment in the history of that culture. (Open-source-software movement, 2019)

In developing my own visualizations and sonification, I was wholly reliant on the open-source software Processing and on the generosity of the many people who share their Processing code. I did not need to be a trained coder; instead, I slowly and methodically learned to manipulate the code through trial and error. Making a change, then looking to see the visual result, was a way I slowly started to understand the code. Hours of watching online tutorials and even joining a Processing discussion group online were necessary to execute my project.

2.5: Neuroscience & Philosophy - Catherine Malabou & Norman Doidge

The shaping of our environment and its reciprocal shaping of us is at the heart of neuroplasticity—the ability of the brain to change based on a person's life. The expression "neurons that fire together, wire together" describes how synapses that fire will strengthen a neural network, and inversely how the lack of synaptic connection will weaken other neural networks (Doidge, 2007). Catherine Malabou does not dispute this neuroscience, but questions the social and power structures within which it operates. Perhaps burdened by too many metaphors, one can easily get lost in her book, *What Should We Do with Our Brains?* Her book deals with neuroplasticity but extends it beyond science and applies critical lens to describe it in broader social, political, and economic contexts.

She looks critically at the term 'plasticity' as being one that is often confused with 'flexibility.' Plasticity is actually an important term in her philosophy in general, which she has discussed in depth in her other books. In this book, she aims to establish that plasticity and flexibility are distinct terms, and to delineate the social implications of both terms. She traces

how, when, and in what context each of these terms has been used. She goes on to tie this term of 'flexibility' with capitalistic goals. Yet her question really probes whether we in fact give form to our brain—is our brain plastic or flexible? Flexibility and plasticity are differing in this regard. "Flexibility is plasticity minus its genius" (Malabou, 2008). She footnotes genius: "In the strong sense of the word, genius: invention, form giving." Thus, she sees flexibility as not form giving. This aligns with her definition of plasticity as both form giving and destroying, even potentially explosive. Flexibility cannot be explosive and explode its own shape.

She describes the history of the term 'plasticity' but obviously in a much different way than Norman Doidge, who is a psychiatrist and psychoanalyst, in *The Brain that Changes Itself* (2007) and *The Brain's Way of Healing* (2015). He recounts many experiments and examples of people that have changed their own brains. In the latter, he describes a number of case studies of those using non-invasive methods of training to heal degenerative disorders. He describes John Pepper, who has kept his Parkinson's symptoms at bay through mindful walking (Doidge, 2015), and David Webber, who learned to see again through an alternative treatment developed by William Bates which involved neuroplastic exercises.

Malabou is interested in extending the neuronal to the political. Or simply, how these structures mirror or reflect each other, the neural network and political system—the transition relating more to the points at which the two cross. She asserts that the "principal transition point between the neuronal and the political, is also the principal transition point between neuroscientific discourse and the discourse of management, between the functioning of the brain and the functioning of a company" (Malabou, 2008). She describes the changes in perspectives on the brain, its structure and function, and how those perspectives reflect the political, economic, and cultural views at different points in time. For example, she notes that the brain has been viewed as a machine over the three ages of industrialization, and then in the second half of the 20th century and presently—with the introduction of computers and cybernetics—it is commonly described in terms of circuitry and networks. However, in this post-industrial world, capitalism persists, finding systems and circuitry hospitable to corporate ideologies. This is how Malabou connects corporatization of the brain with capitalism. In fact, she argues that capitalism infiltrates even the discipline of neuroscience:

> Awakening a consciousness of the brain, as we are trying to do, means awakening a consciousness of the self, a consciousness of consciousness, if you will, which is also to say a comprehension of the transition from the neuronal to the mental, a comprehension

> of cerebral change. The brain is our work and we do not know it. The brain is constituted by modifications of modifications, of "re-representations," and we do not know it. The brain owes its vitality to a perpetual change in plasticity (which is also to say a plasticity of change itself) and we do not know it. (Malabou, 2008)

Malabou understands that the shift from neuronal to mental is how to best understand brain change; it is bringing awareness to it. Otherwise, although we do the work of changing our brain, we are unaware that we do it. Our brain requires this constant changing to thrive and we do not often acknowledge that.

Why do we use the specific words that we use to describe our neuronal brain matter? If "flexibility" is highly sought as a tenet of capitalism, so too in our brain, flexibility is praised. The inflexible are then pathologized to their own peril.

> Mood medications, or "thymoregulators," thus seem to have the function of reducing vulnerability, chronic disturbance, and psychical precariousness by targeting the neuronal networks involved in initiative, stimulation, dynamism, and well-being. Medications should give back the appetite for mobility, the capacity to rid oneself of rigidity and of fixity in one's identity. (Malbou, 51-52)

We must acknowledge these subtle power structures embedded in even the way in which we speak about our own brains if we are to gain our own freedom. She probes Le Doux's "synaptic self" and how we create our own neural networks through our experiences that create our personality. This is the genius of plasticity—the form giving capacity for us to create our own form.

Malabou questions whether this plasticity and neuroscience have improved our lives. She describes the fluctuation between creation and destruction as inherent in plasticity, and answers her own question by saying:

> To cancel the fluxes, to lower our self-controlling guard, to accept exploding from time to time: this is what we should do with our brain. It is time to remember that some explosions are not in fact terrorist—explosions of rage, for example. Perhaps we ought to relearn how to enrage ourselves, to explode against a certain culture of docility, of amenity, of the effacement of all conflict even as we live in a state of permanent war. It is not because the struggle has changed form, it is not because it is no longer really possible to fight a boss, owner, or father that there is no struggle to wage against exploitation. To ask "What should we do with our brain?" is above all to visualize the possibility of saying no to an afflicting economic, political, and mediatic culture that celebrates only the triumph of flexibility, blessing obedient individuals who have no greater merit than that of knowing how to bow their heads with a smile. (Malabou, 2008)

She creates a call to action—and in some sense, a call to arms—for us to create our own vision or relation to our brain. That we should celebrate plasticity and not conform to flexibility.

In creating my own visualization, I am attempting to do just that. Through reading Doidge's book, *The Brain that Changes Itself*, I came to realize that I needed to, in fact, change my own brain. He included in his book an example of a patient who was raised by an alcoholic and then sought out relationships with alcoholics (Doidge, 2007). Doidge outlines Freud's critical period for sexual plasticity. He describes how Freud believed that the way in which we were loved determined how we will love. Doidge further extends sexual plasticity to neural plasticity, as you cannot have plasticity in isolation (Doidge, 2007). He emphasizes that neural plasticity is reinforced with our own chemistry through dopamine.

Doidge's interweaving of Freudian theory with modern neuroscience resonates with me. It was precisely because of this book that I sought out therapy. Cognitive Behaviour Therapy (CBT) has allowed me to construct new neuronal networks by simply questioning my own automatic thoughts. I found a new relation to my brain—I now consciously attempt to rewire or bury the destructive neuropathways by choosing not to follow this path of thought by willingly shifting attention to another. Over time, with less frequent use, these pathways lose their connections and eventually wither away. As such, this project is my way of playing with my own neurons.

3: Contextualization of the Project within Practice

In 2014, while working on my first project, *Mapping the Zone*, I researched artists using EEG technology and, specifically, in performance art. Artists working with EEG technology is not new, as there were some artists experimenting with EEG technology in the 1960s, such as the composer Karl Heinz Stockhausen and filmmaker Paul Sharits. In his art, Sharits used part of an educational film for medical students on seizures, showing a patient wearing an EEG during a seizure as part of his film installation, *1976 EPILECTIC SEIZURE COMPARISON* (Filmography, 2015). With the proliferation of consumer EEG products, artists are increasingly using this technology in their art.

In my research, I discovered Lisa Park's *Eunoia II* created in 2014. The work amplified the EEG recordings of artist's brain waves using pools of water on aluminum plates, which were arranged in a formation of a Buddhist symbol (Gan Gyil, meaning balance) and surrounded the artist. "During the performance," notes the artist, "the Emotiv brainwave sensor continuously transmitted emotional values (data) picked up by the headset. The collected data of emotional values (Frustration, Meditation, Boredom, Engagement and Excitement) was then able to modulate the speed, panning, and volume of sound" (Eunoia II., n.d.). I found the project compelling both in its technological complexity and visual simplicity.

Plate 2. Lisa Park's *Eunoia II* (2014)

At around the same time, the Baycrest Centre (an academic health sciences centre affiliated with the University of Toronto that investigates geriatric residential living, healthcare, research, innovation and education, with a special focus on brain health and aging) conducted "a large-scale experiment with EEG-based brain-computer interface (BCI) technology as part of an immersive multimedia science-art public art installation, *My Virtual Dream*, during Toronto's Nuit Blanche art festival on October 5, 2013" (Kovacevic et al., 2015). The art installation was designed by Baycrest, in partnership with the University of Toronto and industry partners. The researchers used Muse headbands on groups of twenty participants, who were shown a visualization to help train their brain to concentrate and relax. The collective EEG patterns were used to create visuals, a specific catalogue of artistic imagery that were projected on a dome enclosing the participants.

> A total of 523 adults (209 males, 314 females), ranging in age from 18 to 89, with an average age of 31, contributed their EEG brain data for the study. Each session involved 20 participants being seated in a semicircle in front of a stage and divided into four groups ("pods") of five. They played a collective neurofeedback computer game where they were required to manipulate their mental states of relaxation and concentration. The neurofeedback training lasted 6.5 minutes, which is much shorter than typical neurofeedback training experiments. (News - My Virtual Dream Website, 2015)

Plate 3. Bayview's *My Virtual Dream* (2015)

A simple Google search now yields an increasing number of artists working with EEG technologies, which have been simplified for use by regular consumers. The Muse is available for sale at Chapters and is a fraction of the cost of a traditional EEG used by neurologists. At its core, EEG art is connected to generative art and cybernetic arts. Philip Galanter sought to define generative art in his article, *What is Generative Art? Complexity Theory as a Context for Art Theory*. His definition encapsulates the breadth of artists working in the space: "Generative art refers to any art practice where the artist uses a system, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is set into motion with some degree of autonomy contributing to or resulting in a completed work of art" (Galanter, 2003).

Boden and Edmonds created an entire taxonomy of generative art in their article, "What Is Generative Art?" They note how the terms 'computer art' and 'generative art' have been used interchangeably.

> Today, the term 'generative art' is still current within the relevant artistic community. Since 1998 a series of conferences have been held in Milan with that title (Generativeart.com) and Brian Eno has been influential in promoting and using generative art methods (Eno 1996). Both in music and in visual art, the use of the term has now converged on work that has been produced by the activation of a set of rules and where the artist lets a computer system take over at least some of the decision-making (although, of course, the artist determines the rules). (Boden & Edmonds, 2009)

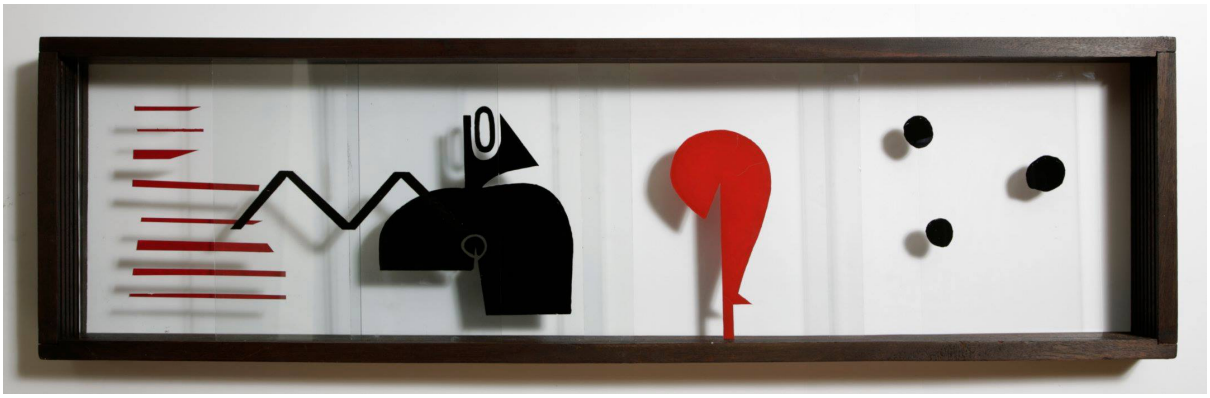
Generative artists, using their own personal data from consumer products—most often wearables—were another source of inspiration for my project. Some of these artists identify with the cultural phenomenon of the Quantified Self, self-tracking with technology in the hopes of understanding themselves through their numbers (Quantified Self, 2019). The *Big Bang Data* exhibition at the Somerset House in London, England featured such an artist, Nicholas Felton, who produced his own annual report called the *Felton Reports* (2016), which tracked his own sleep, alcohol consumption, and other data (Somerset House, n.d.). As with EEG art, the expansion of artists working in the area include those interested in data analytics tools for non-professionals (O'Neil, 2018). For example, in the same exhibition, there was *Debtris* (2016), created by David McCandless who hosts his own website on data visualization titled *Information Is Beautiful*. A play on the childhood digital game Tetris, McCandless scales blocks of the UK budget relative to one another and they fall into sequence. A response to UK's austerity policies,

the piece is impactful in its immediacy of the understanding of the data through the simple block visualization.

Generative art projects have origins in cybernetics. In one of the founding texts on the subject, *Cybernetics or Control and Communication in the Animal and Machine,* Norman Wiener concludes that "brain and the computing machine have much in common," and that this "may suggest new and valid approaches to psychopathology and psychiatrics" (Weiner, 1961). He defined cybernetics as "the scientific study of control and communication in the animal and the machine" (Weiner, 1961).

Weiner was also interested in the feedback loops for self-regulation, predictability, and operational equilibrium (Weiner, 1961). Whether in humans or machines, breaks in the feedback loop of a system result in dysregulation and dysfunction. The cybernetic art movement that followed was inspired by Weiner's writings; these artists were keenly interested in this information, feedback, and system. Edward A. Shanken reviewed the first group of artists, particularly Roy Ascott, who took great interest in cybernetics, as evident in the title of Shanken's article, "Cybernetics and Art: Cultural Convergence in the 1960s." "In 1968, Ascott rightly described himself as 'the artist responsible for first introducing cybernetic theory into art education [in Britain] and for having disseminated the concept of a cybernetic vision in art through various art and scientific journals'" (Ascott qtd. in Shanken, 2002). In the quote above, Shanken refers to Ascott's first interactive artwork, the *Change Paintings* (1959-1961, see Plate 4), which allowed participants to change the order of four small paintings made on Plexiglas by sliding them to create new painting composition.

Plate 4. Roy Ascott's *Change Paintings* (1959-1961)



Source: [Digital image]. (n.d.). Retrieved from https://www.facebook.com/EnglandGallery/photos/a.880518601966880/1221948721157198/?type=1&theater

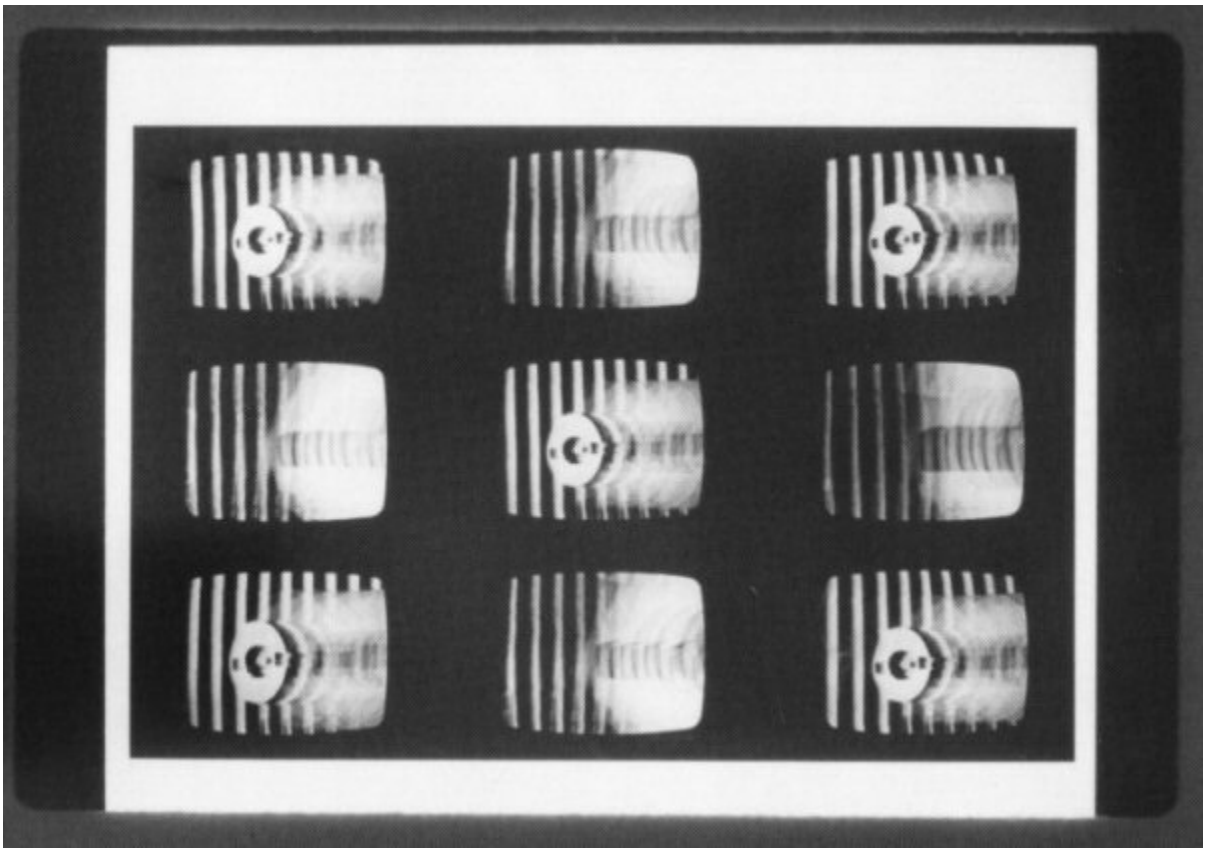
In outlining the history of cybernetics, Shanken astutely includes: composer John Cage, whose compositions included the sounds of the audience; and Les Levine's interactive video sculptures and experimentations with the video signal of Woody and Steina Vasulkas. Each contribute to this notion of setting out a system and letting the results reveal themselves through use. The key is the removal of the self or ego of the artist from the project—there is a turn to natural processes, systems theory, and cybernetics, which returns humans from the centre to their place amongst animals in the natural world. This is a precursor to posthumanism, which is often attributed to Donna Haraway's seminal text "A Cyborg Manifesto."

Plate 5. Les Levine's *Iris* (1969)

Les Levine's *Iris* consists of six monitors: three that show the viewer in close view, middle ground view, and in a wide angle; and three that distort the viewer.

Source: [Digital image]. (n.d.). Retrieved from http://ccca.concordia.ca/artists/image.html?languagePref=en&url=/c/images/big/l/levine/levi032.jpg&cright=Les Levine&mkey=49909&link_id=5442

Plate 6. Steina and Woody Vasulka's *Matrix* (1970-1972)



Steina and Woody Vasulka's *Matrix* is a multi-monitor artwork that interprets electronic signals into sound and visual images.

Source: Vasulka, W., & Vasulka, S. (n.d.). Matrix [Digital image]. Retrieved July 7, 2019, from http://www.fondation-langlois.org/media/activites/vasulka/matrix2.jpg

Cybernetics has continued to evolve, and many artists still explore principles of cybernetics in their art while moving between analog and digital media in their process of making. Rafael Lozano-Hemmer is an inspiring Mexican-born architect turned artist—I was first introduced to his work through my studies. His art is universally accessible despite its technological sophistication.

Lozano-Hemmer's work both engages the audience and plays with the use of biometric data, or an actual body, in a public performance. His work often has an element of playfulness in how it engages participants, and the media he uses in his work allows for this creativity.

Participants are necessary in Lozano-Hemmer's works; they bring the artwork to life. For example, in some of his projection works, participants must use their bodies to cast a shadow to reveal an important element of the art. How people interact—not only with the artwork but with each other—varies in each of Lozano-Hemmer's projects, which have also evolved over time.

Numerous writers have critically analyzed and written about Lozano-Hemmer's art, quite often identifying all types of communication and other related theories embedded within. In "Pulse on Pulse: Modulation and Signification in Rafael Lozano-Hemmer's *Pulse Room*," Carlson and Schmidt describe how the light installation set to the heart beat of the participants is both a signifier of heart rate and a material modulation referencing Deleuzian concept of "a signaletic material" (Carlson & Schmidt, 2012). In another example, "Between Infinity and Ubiquity: Perspectives in/on Rafael Lozano Hemmer's *Body Movies*," Hesselberth relies on concepts from media and film theory to analyze the *Body Movies* projection piece by Lozano-Hemmer (Carlson & Schmidt, 2012), hearkening back to Weiner's feedback loops.

University of Toronto hosted Lozano-Hemmer and Krzysztof Wodiczko in the Fall 2018 to facilitate a conversation between these two artists about their collaborative projects. They have a deep respect for one another, which was obvious to the audience, and their works complement each other. Most recently, University of Toronto screened a documentary about Lozano-Hemmer by filmmaker Benjamin Duffield, who recorded activities of this artist over 10 years. *MEGALODEMOCRAT: The Public Art of Rafael Lozano-Hemmer* (2018) is an homage to this artist and his work.

Plate 7. Rafael Lozano-Hemmer's *Pulse Room (2006)*

Source: Lozano-Hemmer, R. (n.d.). The Pulse Room [2006]. Retrieved from http://www.lozano-hemmer.com/pulse_room.php Photo by: David González

4: Substantive and Technical Decisions Involved in the Project's Production

My project includes a website which captures six performances as videos and includes an explanation of the project and my code. The six hour-long performances take place on the same day in six different locations. The video of each performance is a screen capture of the Processing visualization, which includes a point cloud image and an RGB video capture of myself as I go through my own yoga practice. In each performance, I am wearing the Neurosky which then tracks my EEG data and changes the Processing visualization by filling the screen with white colour when I am most meditative. White noise is playing and as I become more attentive, the white noise increases in volume. As well, based on the geolocation of my laptop, particle systems are displayed on screen relative to my position to cell towers in the area. The speed at which these particle systems flow is based on their relative height.

The composite parts of the project include:

4.1: Neurosky and its data
4.2: Kinect Sensor
4.3: Point Cloud
4.4: Cell Tower Data
4.5: Combain API
4.6: Particle system
4.7: Dial drawing
4.8: Noise generation
4.9: Website

I explain the creative and technical decisions in the sections below. Lastly, I discuss the temporal nature of projects that use emerging technologies and the difficulties I had experienced in maintenance of data and software during my studies.

4.1: Neurosky and Its Data

The first major decision in the project was the switch from the Muse EEG to Neurosky EEG technology. While both products are aimed at consumers and are designed for use by developers, the technical support team for Muse refused to share the algorithm used for meditation and concentration. Countless forum conversations revealed this algorithm is deemed

proprietary by the founders of Muse, yet without it, software developers and artists cannot use the device to its full potential. The makers of Neurosky chose to go the opposite direction: they provide a data stream for both concentration and meditation, and have marketed their EEG device to artists. Interestingly, Muse's original software development kit (SDK) did have an experimental concentration and meditation stream, which was subsequently unsupported and removed from their site. Muse's stance on withholding the personal data of the individual commercial user, and to not reveal the most crucial algorithms, are at odds with the maker and open-source movements. Neurosky's ease in installation and access to the needed meditation and concentration algorithms made it a simple transition from Muse.

It was Muse's decision to lock out the raw data from the user that initially required me to use the SDK in the first place. I am not a programmer, but when I contacted Muse to see if I could access my raw data, I was told that I could only have the interpreted data as provided through the app, unless I myself started using the development software. These decisions by developers are problematic to say the least. If I cannot see the algorithm or the raw data, there is no way to confirm their interpretation is accurate. If I am to train my brain, how can I know the training is on track without knowing if the training tool is correct?

For example, if a heartbeat tool only interpreted your heart rate as high or low, how would you know how to train your cardiovascular system? The technology itself is not overly precise as compared to a traditional EEG used by neurologists, which has markedly more sensors or leads. It is marketed not as a precise tool but as a training tool. With physical training tools, you are given the baseline measurements and then allowed to track your progress yourself. Minna Ruckenstein argues that the creation of our own data doubles as a means of sousveillance,

bringing visibility to the invisible functions of the body such as the heartbeat, and bringing meaning to our own physiological functions:

> Monitoring and tracking technologies create a "techno-gaze" that can be directed towards the user: measuring devices offer insights into personal data flows by making them comprehensible and actionable in terms of individual and biopolitical aims. In other words, tracking devices offer and arrange physical and metaphysical information by encouraging and persuading the measured to engage with it (Ruckenstein, 2014).

Further, she describes how Haggerty and Ericson in surveillance studies "refer to operations that first abstract human bodies by separating them into various data flows or streams and then reassemble them into data doubles to be analyzed and targeted for intervention" (Ruckenstein, 2014).

The interpretation of data by the developer without oversight by the user presents a data double created by the developer rather than through the interpretation of the user. If it were a simple mapping of user values, this may not be problematic; however, interpretation of EEG is not straightforward and requires knowledge and experience in interpretation of EEG waveforms. Unlike your heartbeat, you do not immediately know what each waveform is doing or what it means without prior training or some understanding of EEG data. Whereas the biopolitical aim of the technology may be to track and subtly control the users, the individual aim is often to better understand and potentially optimize their lives. Inherent within the use of the product is full faith that the algorithm is correct, or at least correct enough to track progress. Yet even with heartbeat monitors, the accuracy of wearables is questionable at best. A recent study found:

> Fitness trackers are devices or applications for monitoring and tracking fitness-related metrics such as distance walked or run, calorie consumption, quality of sleep and heart rate. Since accurate heart rate monitoring is essential in fitness training, the objective of this study was to assess the accuracy and precision of the Fitbit Charge 2 for measuring heart rate with respect to a gold standard electrocardiograph. Fifteen healthy participants were asked to ride a stationary bike for 10 minutes and their heart rate was simultaneously recorded from each device. Results showed that the Fitbit Charge 2 underestimates the heart rate. Although the mean bias in measuring heart rate was a

> modest -5.9 bpm (95% CI: -6.1 to -5.6 bpm), the limits of agreement, which indicate the precision of individual measurements, between the Fitbit Charge 2 and criterion measure were wide (+16.8 to -28.5 bpm) indicating that an individual heart rate measure could plausibly be underestimated by almost 30 bpm. (Benedetto et al., 2018)

The use, access, and storage of our own personal data is an ongoing debate, particularly in the Quantified Self movement, which seeks out knowledge of self through measurement and numbers. "The Quantified Self movement was founded by Gary Wolf and Kevin Kelly in 2007. From the start it has been a movement that aims to explore 'what new tools of self-tracking are good for' and 'to create an environment where this question can be explored on a human level.'" (Quantified Self Institute, n.d.). The Quantified Self movement seeks to optimize human performance through this data. At the core of the movement is the sharing of one's data with others for comparison. Our data doubles are "decorporealized and decontextualized bodies" that loop back information, which modifies behaviour through its new self-knowledge (Ruckenstein, 2014). The heightened awareness evokes and rewards modification toward a normalized positive—which presumes this normalized positive as true, without full critical understanding of the creation of this presupposition. Further, when we use these predetermined algorithms, although it can be efficient, there is no certainty whether they are truly accurate except for the word of the marketer. Perhaps as these tools are used more by scientific communities, there may be more stringent validation and perhaps collaborations between medical science researchers and citizen scientists.[5] I suggest that we can foster more collaboration between users, or us "citizen scientists," in our own right and the scientific community. Increasingly, there is more collaboration with scientists and the wearable manufacturers but again, their goals may not be aligned.

[5] 'Citizen science' is research conducted by non-scientists (Citizen science, 2019).

In designing the visualization, I decided to fill the screen with white colour, based on the numerical value reading of EEG that I wore while doing meditation. A complete or 100% numeric value for meditation would correspond with being in the full meditative state, and this value would be visualized by completely filling the screen with white colour, obliterating other visualizations beneath. This choice of colour was intentional; it was inspired by yogic teachings of the chakras and their corresponding colours. The chakra colours include: "Root Chakra (Red Color); Sacral Chakra (Orange Color); Solar Plexus Chakra (Yellow Color); Heart Chakra (Green Color); Throat Chakra (Blue Color); Third Eye Chakra (Indigo Color) and the Crown Chakra (Violet or White Color)" (Olesen, 2014).

> In chakra study, white is associated with the seventh or crown chakra. It energizes the spiritual side of our subtle anatomy by reaching beyond our earthly bodies and toward the celestial oneness that some call god/goddess. When we ask ourselves about the meaning of life, what happens when we die, what is our purpose, etc., we are focused on the energy which lies within the crown chakra. This is the highest form of human experience and opens great possibilities toward a higher understanding of ourselves and the universe, otherwise known as enlightenment. (Cook, 2014)

In Appendix A1, you can see the Neurosky connected through ThinkGear Connector, which runs as a background process. The ThinkGear Connector takes the livestream data from the Neurosky from the serial port and pushes it to an open network socket (ThinkGear Connector, 2015). This was less cumbersome than connecting to the serial port through Processing, which is possible but slow. Neurosky transmits the following data: an interpreted value for meditation (using their proprietary algorithm); an interpreted value for attention (again, with their proprietary algorithm); a poor signal level; delta waves; theta waves; low alpha waves, high alpha waves; low beta waves; low gamma waves; and high gamma waves. Neurosky explains the different waves on their website as follows:

Gamma Waves

- Too much: Anxiety, high arousal, stress
- Too little: ADHD, depression, learning disabilities

- Optimal: Binding senses, cognition, information processing, learning, perception, REM sleep

Beta Waves
- Too much: Adrenaline, anxiety, high arousal, inability to relax, stress
- Too little: ADHD, daydreaming, depression, poor cognition
- Optimal: Conscious focus, memory, problem solving

Alpha Waves
- Too much: Daydreaming, inability to focus, too relaxed
- Too little: Anxiety, high stress, insomnia, OCD
- Optimal: Relaxation

Theta Waves
- Too much: ADHD, depression, hyperactivity, impulsivity, inattentiveness
- Too little: Anxiety, poor emotional awareness, stress
- Optimal: Creativity, emotional connection, intuition, relaxation

Delta Waves
- Too much: Brain injuries, learning problems, inability to think, severe ADHD
- Too little: Inability to rejuvenate body, inability to revitalize the brain, poor sleep
- Optimal: Immune system, natural healing, restorative / deep sleep

From the live stream coming through the network (127.0.0.1), the data is organized as JSON or JavaScript Object Notation. JSON is "a lightweight data-interchange format. It is easy for humans to read and write. It is easy for machines to parse and generate" (Introducing JSON, n.d.). In the draw section of Processing, the JSON packet of information is read and looks for the value associated with attention and meditation. The ThinkGear Connector website has details on the network socket protocol, where meditation and attention are nested under 'eSense.'[6] Therefore, if it finds the 'eSense' object, it looks for the value after the string or word 'attention.'

4.2: The Kinect Sensor

[6] Neurosky's meter based on their algorithm for meditation or attentiveness.

The decision to incorporate the Kinect sensor arose from the need for documentation of the project. The sensor allows recording in several different ways, both as a video camera and as an infrared sensor. The infrared sensor allows for depth manipulation and various modes of representation including video, point clouds, or any drawing made in Processing that uses the data from the sensor. In our earlier studies, as we learned about Processing, we saw how data was used in the Radiohead *House of Cards* music video (Radiohead, 2008). In this particular video, a point cloud was used and was driven by the live data feed. I decided to use the same technique for my own project, creating the point cloud from live data feed from the Kinect sensor.

4.3: Point Cloud

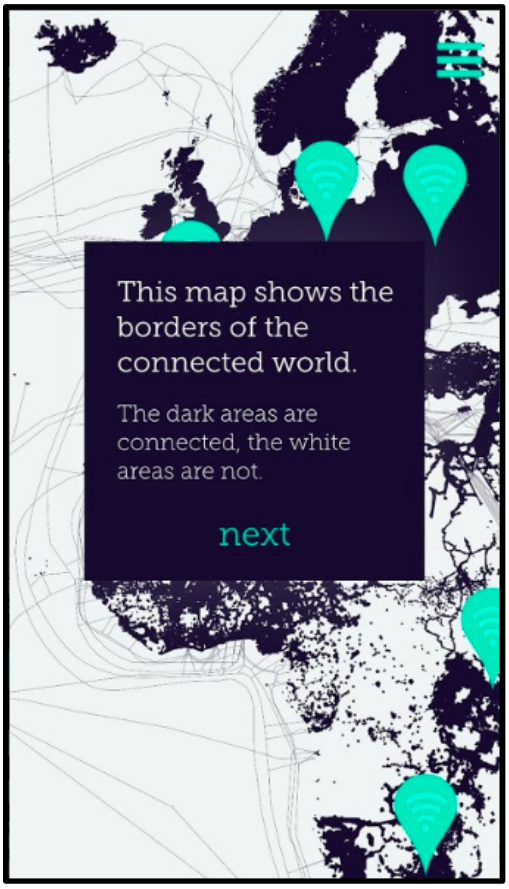
Coding for the Kinect sensor came from Daniel Shiffman, the guru of Processing, who makes coding examples for Processing widely available and explains how they work in a series of online tutorials. I used the tutorials and learned how to incorporate the Kinect sensor to create only the point cloud.

The Kinect sensor has an RGB colour VGA video camera, a depth sensor, and a multi-array microphone. The depth sensor contains a monochrome Complementary Metal Oxide Semiconductor (CMOS) sensor and infrared projector, which defines the 3D space within the room. It also measures the distance of each point of the person or object by transmitting invisible near-infrared light and measuring the time it takes to return to the sensor (Cong & Winters, n.d.). Light waves being sent by the sensor and the resulting visualization using the data from the sensor fit well with the overall objectives of my project, as this is a way of tracking the unseen. Some of the coding below is unexplained as it was unexplored—used "as is."

4.4: Cell Tower Data

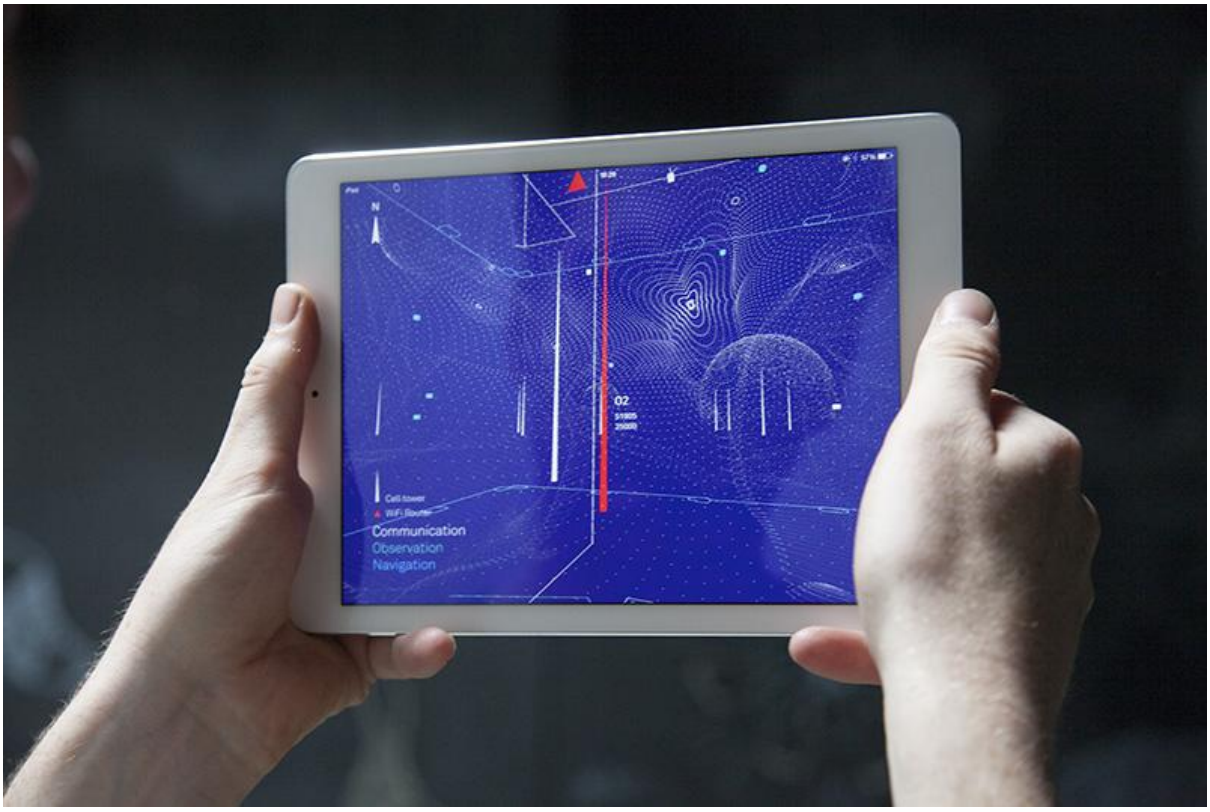
The use of the cell tower data arose from discussions with my supervisor and was inspired by the *White Spots* (2015) project. In a world of unrelenting digital connectedness—with constant connection to Wi-Fi and the internet through smartphones—there is a resurgence of an instinct for retreat, not just physically but also now digitally. 'Digital detoxification' is a new term for taking a break from these technologies and this constant digital connection. The app White Spots is designed to assist the user to find 'white spots,' the areas on Earth where one can escape the world that is overwhelmingly connected through technology.

Figure 1. Screenshot of White Spots App



The radio and Wi-Fi waves that are all around us are undoubtedly affecting us in ways we cannot yet know. The choice to reveal these waves was similar to my decision to use my brain data—a way of collecting information about the self and the invisible forces that affect the self. All electromagnetic waves, including radio, cell tower, and brain, can be measurable and made visible. In researching *White Spots* and Richard Vijgen's earlier project—*the Architecture of Radio* (Vijgen, n.d.), see Plate 8—I discovered that although the app presented imagery that looked like live data, the information was in fact being pulled from a database of cell information. This was a breakthrough in my project because connecting to live feed data was far too complicated to achieve within the constraints of time and budget. Plus, live feed data was also not necessary to achieve the goals of my project, as the database information was sufficient.

Plate 8. Architecture of Radio (2015*)* App Screenshot



I then set about to find the Canadian source of cell tower data by emailing government agencies. I found the resource through Spectrum Management System Data, which contains broadcasting

database files (Sector, 2019). In order to make the information manageable, I only took the data of the wave type, longitude, latitude, and height of the cell towers.

Even with the reduced data, when I began visualizing it in my program, the resulting visualization was very slow. Through conversations with colleagues at the Digital Media Lab, I came to realize there was redundancy in longitude and latitude, which meant the drawing was being redrawn multiple times, resulting in a slow animation. I manually removed the duplications, resulting in a much faster processing of data and, therefore, better visualization. However, after seeing the final results of the visualizations, I realized that the waves were the same throughout, as I did not set the sensitivity of the data to the visualization correctly; the waves correlated to the same towers, as I set the proximity to the towers as too large, causing the system to map to the same location on screen at every location. In other words, if I am already setting up within ~5 km block in the downtown, setting the proximity to the towers within the nearest 100 km would result in the same towers repeatedly being mapped. So, to adjust this looped process, I either needed to set the proximity closer to my desired tower, or move further away from certain towers for each performance (see Appendix B for the data table).

4.5: Combain API

In order to geolocate myself (longitude and latitude) and compare my geolocation to the cell tower data, I researched a variety of application program interfaces (APIs). Combain API emerged as the best option, as it uses a database and compares the http request Cell ID (CID) to "return the latitude and longitude parameters for the actual position" (Combain, n.d.).

Using the API required that I write an execution code in Python (programming language). I worked with the staff at the Digital Media Lab on writing this code. The setup.py code (see Appendix A5) uses my CID to return information about the longitude and latitude of my location as a text file titled "location." I discovered that Combain has limits with respect to the number of

requests for searching for a location, and near the end of the project I had to purchase another 25,000 searches[7] at the cost of €100 to address this issue.

In Processing, the runpython code (see Appendix A6) is initiated through an exec command (see Appendix A5). Println commands were added for troubleshooting, to see when the command had been completed in Processing. The maximum and minimum longitude and latitudes are then converted and mapped to the screen size to give a simulation of where they would exist within the space created by the drawing. Later, I added the height of the cell towers data as a percentage (dividing the cell tower height by the maximum height) to affect the visualization of the cell towers.

4.6: Particle System

I chose a particle system effect to represent the cell towers. "Since the early 1980s, particle systems have been used in countless video games, animations, digital art pieces, and installations to model various irregular types of natural phenomena, such as fire, smoke, waterfalls, fog, grass, bubbles, and so on" (THE NATURE OF CODE, n.d.). This seemed particularly appropriate for something like radio waves transmission and reception by a cell tower and cell signals. Again, Daniel Shiffman provided the necessary code online, which I used in my project with some slight modifications to have the particle system flow in a more wave-like manner, and horizontally. I also used the percentage of the height of the cell tower to impact the velocity of the particle system movement. I translated the height of the tower into a percentage based on the highest tower. This was then applied to velocity; so the higher the tower, the faster the velocity.

4.7: Dial

I wanted to add a dial to show that attention could be measured and monitored like any other activity that becomes data on a Fitbit or another wearable. I modified existing code and used the attention data stream from the EEG. For clarity's sake, this data stream is created by

[7] Every time I run the code, which sends a request to the server for a geolocation, it qualifies as a search. Therefore with testing, I used all the free searches available and had to purchase a minimum of 25,000 more.

Neurosky using their proprietary algorithm. I did not use the raw EEG data, as I am not a neuroscientist and to create the algorithm is well beyond the scope of this project.

In Processing, the order of commands in the code within the program is important, because when the program is running it reads every line of code in the program from top to bottom in a loop, while continuously re-drawing (providing sound or graphic representations on a screen of codes running in the program). Therefore, if code is not set in proper order—for example, one code is underneath another—the image could be lost. It took some time for me to figure out the appropriate order of code and of layering pushMatrix and popMatrix, which essentially layers elements in a matrix stack. Each pushMatrix must be matched to a popMatrix, or it causes an error.

4.8: Noise Generation

"White noise is a random signal having equal intensity at different frequencies, giving it a constant power spectral density… White noise draws its name from white light, although light that appears white generally does not have a flat power spectral density over the visible band" (White Noise, 2019).

Sound was always an element in this project, throughout its various iterations. The choice for noise generation was inspired by uses of white noise for sleep. Living in an urban setting, I had to seek out ways to drown out ambient noise and use it regularly. Could white noise be also used as a means of cancelling noise of the mind? I chose to have the sound volume increase with attention.

Research results have been mixed in terms of the effect of white noise on concentration and memory. The body and brain's response to noise is also chemical, e.g., cortisol, the stress hormone, is commonly released by the body in response to loud noise. A study in 2007 found that white noise improved cognitive performance for Attention Deficit Hyperactivity Disorder (ADHD) in children as a result of increased dopamine, a neural modulator (Göran et al., 2007). "Noise exerted a positive effect on cognitive performance for the ADHD group and deteriorated performance for the control group, indicating that ADHD subjects need more noise than controls for optimal cognitive performance" (Göran et al., 2007). A subsequent study in 2014 confirmed this result for ADHD children, and also found the inverse effect in attentive children (Helps et

al., 2014). The study suggested that white noise may offer an alternative therapy for those who do not respond to traditional medications (Helps et al., 2014).

4.9: Website (https://mind-and-matter.ca)

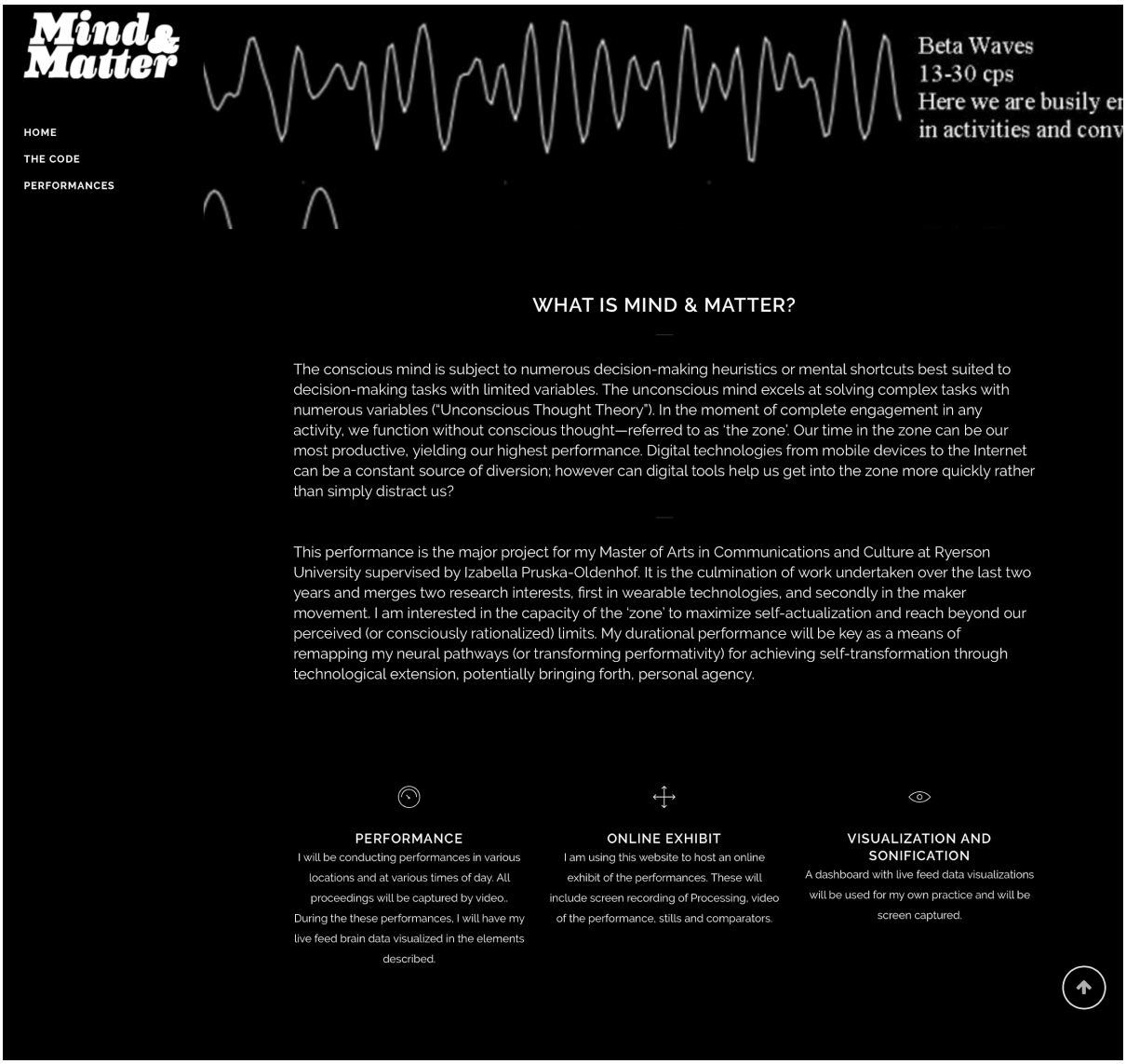
Throughout the process of working on this project, I recorded its making and shared the information, code, and data as much as possible, thereby celebrating the maker movement.[8] The project website was created with this purpose in mind. I used WordPress (an opensource software[9]) to create the website, and I selected one of its readymade templates of site set-up at the outset of the project. In selecting the template for the website, I followed a similar aesthetic as the performance visualization—a black screen with white text and minimalist graphics. I also used other websites; GitHub to host the coding data, and YouTube to host the performance videos.

Websites require constant upgrades to continue functioning. Each upgrade of the software caused new issues in my website, for which I needed to find solutions. Currently, the website cannot be updated to the latest version WordPress due to the limitations of the template, which is no longer being updated by the developer; therefore, this website will likely not be viewable within the next year. I will further discuss the longevity of this project at the end of this section.

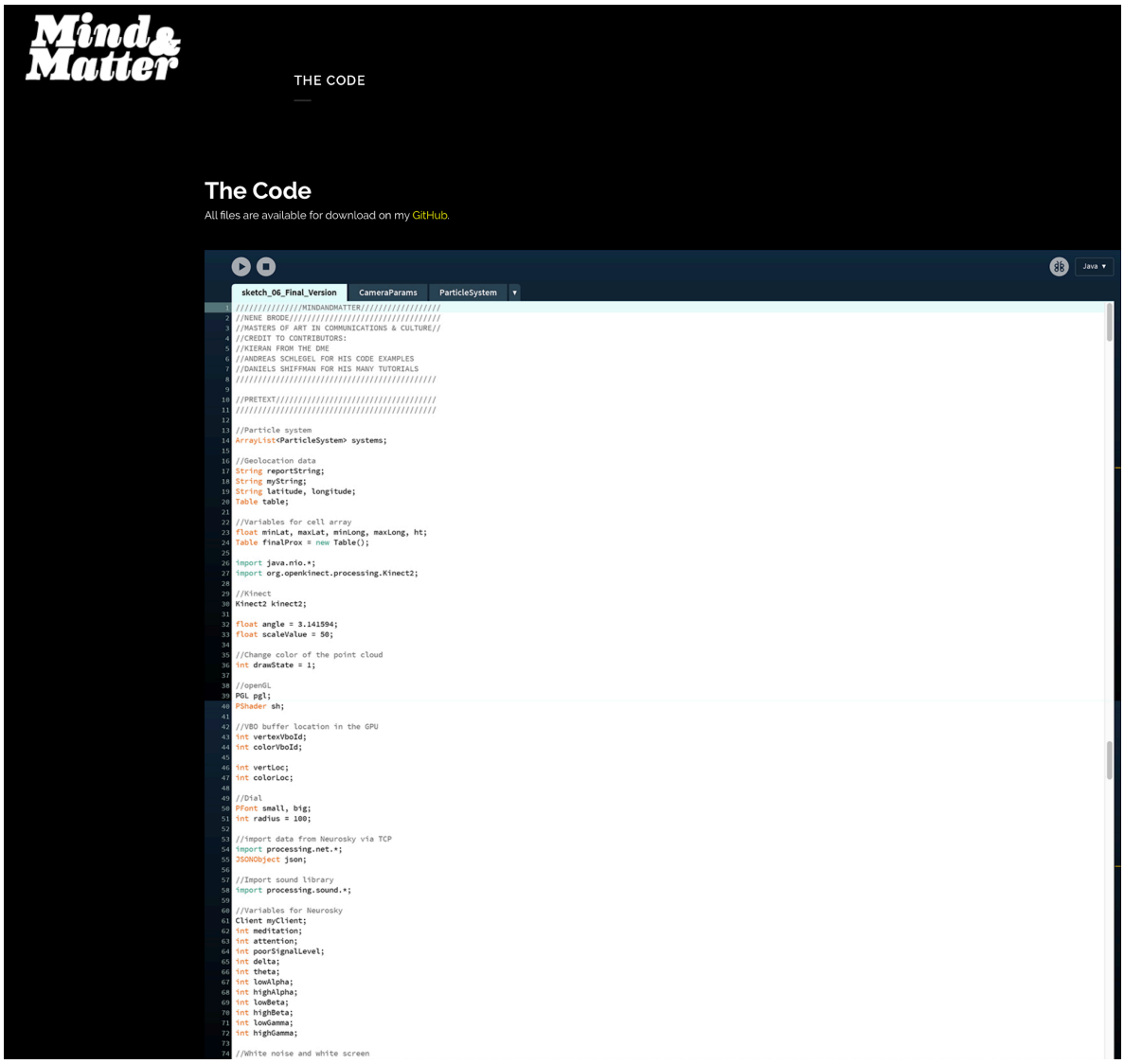
[8]This is discussed in section 4, explaining how the project relates to my academic program.
[9] Open source and the maker movement are aligned in their intention to share resources and information. Maker cultures support open source (Maker Culture, 2019).

Figure 2. Screenshots of the *Mind & Matter* Website

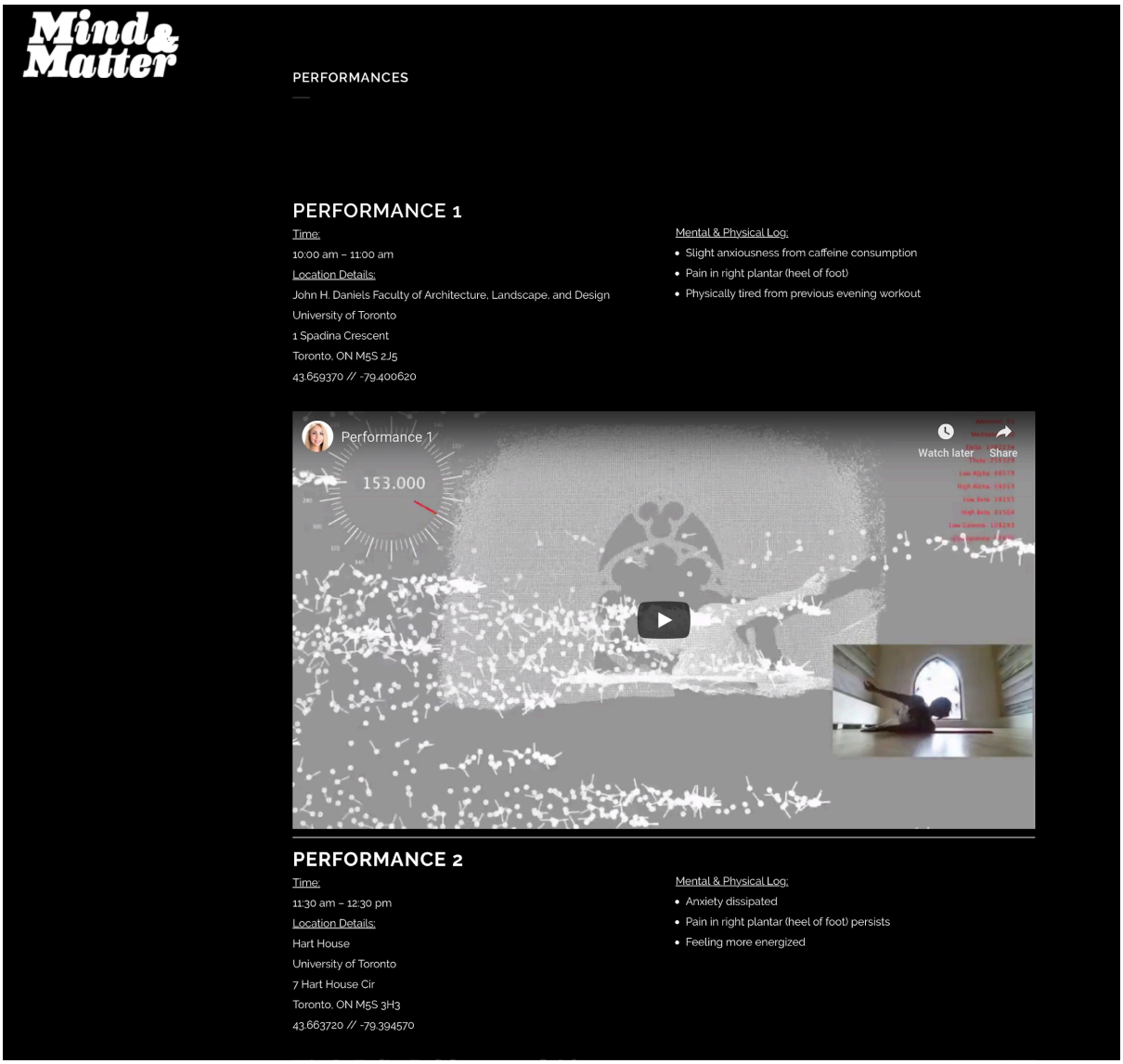
2A. Landing Page



2B. Coding Page



2C. Performance Page



The Coding Process

The process of coding without prior training involved a lot of learning by trial and error, copying sections of code and then making changes to observe what happens. Every element of the project was a research project unto itself. For every piece of code used in the final project, there were countless pieces of code tried and discarded. When running the code, more often than not sudden errors would come up and lead to a complete stop of the project. A script that worked previously would suddenly stop working, which I then had to troubleshoot. For every error, there were a series of steps taken to resolve it: starting with a Google search, then reading forum

discussions, eventually leading to online tutorials and, if still not resolved, asking for help at the Digital Media Lab. Often, people at the Lab could not actually answer my questions, but it was still extremely valuable, as the process of discussing the issue with them often led to solutions.

Stumbling Blocks and Limitations

Using open source means that one is reliant on the independent developer of items such as Processing libraries to issue a new release. Updates may not be continually created by the developer, or those updates can subsequently not be compliant with the current version, causing code not to work. Each delay in working on the project, due to personal or workload issues, would often necessitate a revamp of the code after installing the latest updates. The life span of this project is thus constrained by several technologies that it uses, which are ever-evolving and sometimes obsolesced by others. Unless the project is regularly updated and, if necessary, migrated to new platforms, its functionality and access to it will cease—it will become obsolete, just like many other digital projects over the last half a century.

5: Project's Relationship to My Academic Program

This project is a culmination of my experience and learning in the Communications and Culture program. The main technology used in my project stemmed directly from two projects I did in my courses, as previously noted. The two streams of focus for my degree have been Technology in Practice and Media and Culture. Technology in Practice concentrates on the development, application, and influence of historical, current, and emerging communication technologies in cultural production—both personal and professionally. In my project, I am working with the emerging wearable EEG technology, which until recently was only available in neuroscience and medical fields for tracking brainwave activity. My project therefore explores the possible uses of this new consumer-oriented EEG technology but focused on cultural production; that is, in the production of my artwork. The Media and Culture stream explores the confluence of media (mass media) and culture and their relationships within social systems. The key differences between Technology in Practice and Media and Culture is the practice element as a mode of learning and thinking through direct experience—making as a way of thinking, rather than solely language-based learning and thinking through writing.

Other courses I took, including my field placement, focused on maker and DIY cultures and movements. These have been critical in learning more about the maker movement, which ultimately aided me in executing this project.

The project itself is a demonstration of technology in practice. In the course, Advanced Communication Technology, I was first introduced to project-based work when I created *Mapping the Zone*, my first project with an EEG technology, which I used for creative purpose. This foundational course explored cultural and critical issues around emerging technologies. This was discussed through communications theorists and also artists such as experimental filmmakers, music composers, and visual artists.

In the course The Body and the Culture of Modernity, we looked at how the body is used as a medium by a variety of artists. Artists investigated included performance artist Marina Abramovic, Jozef Robakowski, and Aimee Mullins, among others. All use the body as a site of experimentation in completely different ways. We explored the phenomenological body and how we experience the world through our bodies. We examined media ecology and how technology creates its own environment—and in that process, the profound effects enacted on the body, modes of thinking, society, political structures, architecture, etc. The course provided

opportunities to reflect on how the body is transformed through social and cultural experience and even power structures. The body was shown to be a site of resistance, often fighting against the capitalist and techno-scientific control over our senses, bodies, and experience. We traced how the body has been medicalized, technologized, and sexualized. This course is where I collaborated with a group of other students on *Performetrics*, the dance performance layered with technology, facilitating my second foray into an artistic project using EEG and other wearable technologies.

In the course Making and Doing, we learned about the maker culture and the maker movement. This area of inquiry led to a deeper understanding of hacker culture, tinkering and maker spaces. I continued learning about maker spaces in my research methods course and in a field study I created with the Digital Media Experience Lab. My connection with this particular space was critical for my master's project. It was the only place I could go to get timely technical assistance with my project.

In the course The Popular, we took a critical look at "popular" as a phenomenon and its history. My final paper explored the history of crypto-anarchism and the darknet, a subset of the deep web. This media and culture course provided a wide range of philosophers and communications theorists; perhaps the most influential on me were the Frankfurt School philosophers, Max Horkheimer and Theodor Adorno. I was also introduced in this course to philosophy of Catherine Malabou, a student and collaborator of Jacques Derrida. Malabou's philosophy is core to the conceptual underpinnings of my project.

I would never have expected to pursue this project at the outset of my degree; however, through all my coursework, I feel I was led to this culminating project. Each course fine-tuned my direction. This project is technology in practice that probes further into the critical thought of media and culture, understanding that plasticity of neuropathways in our brains are shaped by and, in turn, are shaping social and political power structures, as I explained in the earlier section of this paper.

6: Contributions to Theory and/or Professional Practice

During my studies, I began a parallel journey into fitness and yoga instruction. I became a Canfitpro-certified group fitness instructor, a Schwinn-certified spin instructor, and a yoga teacher. I currently teach at three different fitness clubs in Toronto, across wide range of ages and variety of classes. I also went through perhaps the most challenging work experience, which completely shook my identity and affected my mental health. As a path to recovery and healing, I began both group and individual therapy. From my early childhood trauma to my recent cognitive behavioural therapy, I discovered along the way new tools for coping with my personal history and toxic work environments I had to endure. Although these personal reflections may all seem tangential, they are intricately woven into my personal narrative that I learned to craft through my studies, and which has informed my project.

I would situate my project between several areas of art and social practice: new media and performance art, Quantified Self practices, Maker Culture, and data visualizations. I first became interested in data visualizations prior to my studies through books such as the series *Data Flow*. During my studies, I became even more immersed in this practice of data visualization. I believe my unique contribution to the creative practices of new media and performance is the combination of eastern yoga philosophy and yoga practice with exploration of neuroplasticity and neurofeedback using consumer EEG technology, and bringing these together as a creative project rather than only through a text. Additionally, I believe my unique contribution to theory is the at the crossroads of neuroplasticity theory and Malabou's theory of plasticity through plastic arts, technology, and yoga practice.

I call upon media ecology's understanding of the reciprocal relationship between media and ourselves. "We shape our tools and thereafter they shape us. These extensions of our senses begin to interact with our senses" (Culkin, 1967). Furthermore, I believe my work falls under new digital materialism. Birringer outlines this 'new digital materialism' in his review of the Kinetica Art Fair. He states that "Kinetica is less interested in the relation of immateriality and language, but revels in the uncanny valley, the disconcerting stage of a continuing process of materialization, which is always technological and perplexes us with unexpected twists" (Birringer, 2015). He also links this new digital materialism with the maker culture when he invites his students:

> to ponder the scene, tap into the electronic magic, and experience the "tinkering" ethos, the "fixing, connecting, and converting of devices for artistic or non-artistic purposes," as Mike Stubbs notes in the introduction to the 2014 catalogue, emphasizing the "maker culture" underlying all the science and technology and its close relation to eccentric hobbyism. (Birringer, 2015)

This project contributes to this new digital materialism with the use of yoga practice along with the visualization; the combination of bringing in materiality during performance.

As well, I align myself within this maker culture; I even used the maker space on campus to execute my project. I contributed my code and explanation of the project online and on GitHub for others to use to draw from for their own project. GitHub is the online platform to share open source projects (Github, 2019). I used GitHub to figure out how to code my own project and am sharing mine so others can do the same.

Further, the paper draws on new French philosophy of Catherine Malabou to shed light on this wearable EEG technology. It is a rethinking of how to conceptualize consciousness, subjectivity, and self. The project uses consumer technology with non-consumer visualizations to play with our plasticity and not conform to flexibility. It intends to bring awareness to our ability to change our brains.

Lastly, I believe that my project, in my interpretation of the relevant literature, is unique. In this paper, I bring together the philosophy of Malabou with McLuhan's explorations of media to reflect on embodiment, technology, (neuro)plasticity, and culture. To my knowledge, this is the first time these two figures have been brought together and my paper illustrates significant overlaps in their thought, which makes possible discussions of neuroplasticity and media ecology together to shed more light on the effects of new technologies on our lives.

Conclusion

I set out to play with my own EEG data through different technologies for the purpose of mental and physical training. I believe this is an initial exploration and much more could be done to advance this research by setting out the framework for others and continuing both qualitative and quantitative studies. Additionally, further explorations and playing could continue: I plan to work on another creative 'play' project using a sleep tracking wearable and Processing to create a 'sleep performance' within individual and group settings. In this case, quantitative assessment of sleep would help me process something I personally struggle with by exploring the question: could we take numbers out of the assessment, and thus see the process differently?

This project was my first foray into the world of digital arts, working with self-monitoring tools. Yet it is not only what I did during my master's degree but also the extracurricular activities during that time that made this project possible. These extracurricular activities, outlined below, ultimately are my greatest contribution to the profession; my deep involvement in post-secondary outreach programming. I cannot conclude this paper without referring to the passion project I took on during my time at Ryerson, which has led to my current academic and career trajectory. It is often the activities we take on that are inspired from our studies that become more important than the studies themselves. It is also a major reason why my studies have taken longer than expected.

My Field Study at the DME yielded a collaboration in the creation of a program called V4Lab. I created the proposal with Vincent Hui, the Ryerson Summer Camps, and the DME for the Provost and received $25,000 seed funding to start the program. The program was designed to spark curiosity in technology in youth with no prior background in technology. From 2016 to 2018, the program expanded in size and scope. By the final year, we had two 2-week sessions with full registration of 50 participants. It was a steep learning curve for me and an enormous amount of work done mostly outside of formal work and school hours. Creating everything from the curriculum to the website to advertising, I worked with colleagues across the University to execute the vision. My work resulted in my nomination and receipt of the Julia Hanigsberg Make Your Mark Staff Awards for Community Engagement in 2018.

I was recruited to the John H. Daniels Faculty of Architecture, Landscape, and Design at the University of Toronto by my former director, Dean Richard Sommer, this past fall in large part because of the work I had done at the V4Lab. I have created similar programming this year

with two programs targeting two different ages: Bits & Bytes (9-11-year olds) and DigiFab (12-14-year olds). The programs were recently featured in an article in the *Globe and Mail*, "University of Toronto's Tech Summer Camp for Budding Architects" (LeBlanc, 2019).

All the programs are designed with STEAM (science, technology, engineering, art and math) activities. Participants are introduced to digital art along with the science, and the program is inspired by the open-source movements I learned in my studies. We use open-source software and share our creations. We talk about some of the philosophy along with the technology, and try to reflect on our relationship with it. It was important to me to allow students to bring technology to the program and negotiate its use; to self-regulate by understanding when it is distracting and when it is useful. We talk about the dark web, deep web, and all types of hacking—from white to black. The final projects all have an artistic component and aspects are designed collectively.

My master's project is situated somewhere among new emerging digital artists—certainly not of the scale of Rafael Lozano-Hemmer, but with other, newer references. Yet this is not where I believe I have or will make my greatest contribution. I am now looking to situate myself in the space between Lozano-Hemmer and youth learning technology. I will use my position within the University to open up possibilities of inspiring young people by creating a safe place for them to experiment and to meet artists such as Lozano-Hemmer. The summer youth programs piloted this past summer will continue to expand to programming throughout the year. Collaborating with colleagues in engineering and math, I will continue to create new cross-disciplinary programming that allows young people to start to discover how they think and find their own career path through discovery. Some will immediately be drawn to testing the limits of a technology whereas some will seek to change the aesthetic natures. This is telling for a participant to find their own path and, eventually, "their people."

Upon completing my master's in Communications and Culture, I plan to pursue my PhD in Education in the Curriculum & Pedagogy Program at the University of Toronto's Ontario Institute for Studies in Education (OISE). I will continue to build and study the STEAM-based youth outreach programming with critical discussions with youth on our use of technology. Engaging McLuhan-inspired conversations about how the medium molds us are an important aspect of STEAM learning, which can often be overlooked, even dismissed, in pursuit of the latest gadget. This is where I hope to truly make my impact on professional practice. I believe my own master's project was critical in helping me find my path and I am truly grateful.

Appendices

Appendix A. Processing Code

A1. Neurosky Coding

In pretext:

```
//import data from Neurosky via TCP
import processing.net.*;
JSONObject json;

//Variables for Neurosky
Client myClient;
int meditation;
int attention;
int poorSignalLevel;
int delta;
int theta;
int lowAlpha;
int highAlpha;
int lowBeta;
int highBeta;
int lowGamma;
int highGamma;
```

In set-up:

```
//Neurosky TCP
  myClient = new Client(this, "127.0.0.1", 13854);
  myClient.write("{\"appName\": \"helloWorld\", \"appKey\":
\"0123456789012345678901234567890123456789\", \"enableRawOutput\": false,
\"format\":\"Json\"}");
```

In draw:

```
//Neurosky
  pushMatrix();
  JSONObject packet;
  if (myClient.available() > 0 && myClient.active()) {
    String test = myClient.readString();
    packet = parseJSONObject(test);
    if (!packet.isNull("eSense")) {
      if (!packet.getJSONObject("eSense").isNull("attention"))
        attention = packet.getJSONObject("eSense").getInt("attention");
      if (!packet.getJSONObject("eSense").isNull("meditation"));
      meditation = packet.getJSONObject("eSense").getInt("meditation");
    }
```

```
    if (!packet.isNull("poorSignalLevel")) {
      poorSignalLevel = packet.getInt("poorSignalLevel");
    }
    if (!packet.isNull("eegPower")) {
      if (!packet.getJSONObject("eegPower").isNull("delta"))
        delta = packet.getJSONObject("eegPower").getInt("delta");
      if (!packet.getJSONObject("eegPower").isNull("theta"));
      theta = packet.getJSONObject("eegPower").getInt("theta");
      if (!packet.getJSONObject("eegPower").isNull("lowAlpha"))
        lowAlpha = packet.getJSONObject("eegPower").getInt("lowAlpha");
      if (!packet.getJSONObject("eegPower").isNull("highAlpha"))
        highAlpha = packet.getJSONObject("eegPower").getInt("highAlpha");
      if (!packet.getJSONObject("eegPower").isNull("lowBeta"))
        lowBeta = packet.getJSONObject("eegPower").getInt("lowBeta");
      if (!packet.getJSONObject("eegPower").isNull("highBeta"))
        highBeta = packet.getJSONObject("eegPower").getInt("highBeta");
      if (!packet.getJSONObject("eegPower").isNull("lowGamma"))
        lowGamma = packet.getJSONObject("eegPower").getInt("lowGamma");
      if (!packet.getJSONObject("eegPower").isNull("highGamma"))
        highGamma = packet.getJSONObject("eegPower").getInt("highGamma");
    }
  }

//Map white screen
  a = map(meditation, 0, 100, 0, 255);

//White screen
  fill(255, a);
  rect(0, 0, 1440, 900);
```

A2. Kinect Sensor Coding

In pretext:

```
import java.nio.*;
import org.openkinect.processing.Kinect2;

//Kinect
Kinect2 kinect2;
```

In set-up:

```
//Kinect
  kinect2 = new Kinect2(this);
  // Start all data
  kinect2.initDepth();
  kinect2.initIR();
  kinect2.initVideo();
  kinect2.initRegistered();
```

```
  kinect2.initDevice();
```

In draw:

```
 //IR image
  pushMatrix();
  translate(width/2, height/2, scaleValue);
  rotateY(angle);
  stroke(255);

///Get camera image
  pushMatrix();
  kinect2.getIrImage();
  image(kinect2.getVideoImage(), 1050, 500, kinect2.colorWidth*0.2,
kinect2.colorHeight*0.2);
  popMatrix();
```

A3. Point Cloud Coding

In pretext:

```
//Change color of the point cloud
int drawState = 1;

//openGL
PGL pgl;
PShader sh;

//VBO buffer location in the GPU
int vertexVboId;
int colorVboId;

int vertLoc;
int colorLoc;
```

In set-up:

```
  //start shader
  //shader usefull to add post-render effects to the point cloud
  sh = loadShader("frag.glsl", "vert.glsl");
  //smooth(16);

  //create VBO
  PGL pgl = beginPGL();

  // allocate buffer big enough to get all VBO ids back
  IntBuffer intBuffer = IntBuffer.allocate(2);
  pgl.genBuffers(2, intBuffer);
```

```
  //memory location of the VBO
  vertexVboId = intBuffer.get(0);
  colorVboId = intBuffer.get(1);

  endPGL();
```

In draw:

```
//obtain the XYZ camera positions based on the depth data
  FloatBuffer depthPositions = kinect2.getDepthBufferPositions();

  //obtain the color information as IntBuffers
  IntBuffer irData         = kinect2.getIrColorBuffer();
  IntBuffer registeredData = kinect2.getRegisteredColorBuffer();
  IntBuffer depthData      = kinect2.getDepthColorBuffer();

  pgl = beginPGL();
  sh.bind();

  //send the the vertex positions (point cloud) and color down the render pipeline
  //positions are render in the vertex shader, and color in the fragment shader
  vertLoc = pgl.getAttribLocation(sh.glProgram, "vertex");
  pgl.enableVertexAttribArray(vertLoc);

  //enable drawing to the vertex and color buffer
  colorLoc = pgl.getAttribLocation(sh.glProgram, "color");
  pgl.enableVertexAttribArray(colorLoc);

  int vertData = kinect2.depthWidth * kinect2.depthHeight;

  //vertex
  {
    pgl.bindBuffer(PGL.ARRAY_BUFFER, vertexVboId);
    // fill VBO with data
    pgl.bufferData(PGL.ARRAY_BUFFER, Float.BYTES * vertData * 3, depthPositions,
PGL.DYNAMIC_DRAW);
    // associate currently bound VBO with shader attribute
    pgl.vertexAttribPointer(vertLoc, 3, PGL.FLOAT, false, Float.BYTES * 3, 0);
  }

  //color
  //change color of the point cloud depending on the depth, ir and color+depth
information.
  switch(drawState) {
  case 0:
    pgl.bindBuffer(PGL.ARRAY_BUFFER, colorVboId);
    // fill VBO with data
```

```
    pgl.bufferData(PGL.ARRAY_BUFFER, Integer.BYTES * vertData, depthData,
PGL.DYNAMIC_DRAW);
    // associate currently bound VBO with shader attribute
    pgl.vertexAttribPointer(colorLoc, 4, PGL.UNSIGNED_BYTE, false, Byte.BYTES, 0);
    break;
  case 1:
    pgl.bindBuffer(PGL.ARRAY_BUFFER, colorVboId);
    // fill VBO with data
    pgl.bufferData(PGL.ARRAY_BUFFER, Integer.BYTES * vertData, irData,
PGL.DYNAMIC_DRAW);
    // associate currently bound VBO with shader attribute
    pgl.vertexAttribPointer(colorLoc, 4, PGL.UNSIGNED_BYTE, false, Byte.BYTES, 0);
    break;
  case 2:
    pgl.bindBuffer(PGL.ARRAY_BUFFER, colorVboId);
    // fill VBO with data
    pgl.bufferData(PGL.ARRAY_BUFFER, Integer.BYTES * vertData, registeredData,
PGL.DYNAMIC_DRAW);
    // associate currently bound VBO with shader attribute
    pgl.vertexAttribPointer(colorLoc, 4, PGL.UNSIGNED_BYTE, false, Byte.BYTES,
0);//Byte.SIZE, 0);
    break;
  }

  // unbind VBOs
  pgl.bindBuffer(PGL.ARRAY_BUFFER, 0);

  //draw the point cloud as a set of points
  pgl.drawArrays(PGL.POINTS, 0, vertData);

  //disable drawing
  pgl.disableVertexAttribArray(vertexVboId);
  pgl.disableVertexAttribArray(colorVboId);

  sh.unbind();
  endPGL();
  popMatrix();
```

In CameraParams file:

```
//camera information based on the Kinect v2 hardware
static class CameraParams {
  static float cx = 254.878f;
  static float cy = 205.395f;
  static float fx = 365.456f;
  static float fy = 365.456f;
```

```
  static float k1 = 0.0905474;
  static float k2 = -0.26819;
  static float k3 = 0.0950862;
  static float p1 = 0.0;
  static float p2 = 0.0;
}
```

A4. Cell Tower Coding

In pretext:

```
//Geolocation data
String reportString;
String myString;
String latitude, longitude;
Table table;

//Variables for cell array
float minLat, maxLat, minLong, maxLong, ht;
Table finalProx = new Table();
```

In set-up:

```
String[] tempLoc = loadStrings("/Users/nenebrode/Desktop/python/location");
  tempLoc = split(tempLoc[0], ",");
  latitude = tempLoc[0];
  longitude = tempLoc[1];

  print(latitude, longitude, "\n");

  // import cell tower, antenna, and wifi information

  Table table = new Table();
  table = loadTable("Site_Data_GTA.csv", "header");
  table.setColumnType(1, "float");
  table.sort (1);

  // compare latitude
  Table proxTable = new Table();
  proxTable.setColumnTitles(table.getColumnTitles());
  for (TableRow row : table.rows ()) {
    if ((row.getFloat(1)>float(latitude)-0.2) && (row.getFloat(1)<float(latitude)+0.2)) {
      proxTable.addRow(row);
    }
  }
  println("done latitude");
  proxTable.setColumnType(2, "float");
```

```
  finalProx.setColumnTitles(table.getColumnTitles());
  finalProx.setColumnType(3, "float");

  // compare longitude
  for (TableRow row : proxTable.rows ()) {
    if ((row.getFloat(2)>float(longitude)-0.23) &&
(row.getFloat(2)<float(longitude)+0.23)) {
      println("added");
      finalProx.addRow(row);
    }
  }
  print("done longitude");
  saveTable(finalProx, "finalProx.csv");

  finalProx.sort (1);
  minLat = finalProx.getFloat(0, 1);
  maxLat = finalProx.getFloat(finalProx.getRowCount()-1, 1);
  finalProx.sort (2);
  maxLong = finalProx.getFloat(0, 2);
  minLong = finalProx.getFloat(finalProx.getRowCount()-1, 2);

  systems = new ArrayList<ParticleSystem>();
  for (TableRow row : finalProx.rows()) {
    float x = map(row.getFloat(2), minLong, maxLong, 0, width);
    float y = map(row.getFloat(1), minLat, maxLat, 0, height);
    float ht = map(row.getFloat(4), 0, .1, -2, 2);
    systems.add(new ParticleSystem(1, new PVector(x, y)));
    println("ht");
  }
```

A5. Setup.py Code

```
from httplib import HTTPSConnection
import json

apiKey = "lm29vkgmwo1c2oe7r6gy"

data = {
   "radioType": "gsm",
   "cellTowers": [{
      "mobileCountryCode": 302,
      "mobileNetworkCode": 610,
      "locationAreaCode": 10500,
      "cellId": 138818919
   }]
}
```

```
headers = { "Content-Type" : "text/json" }
conn = HTTPSConnection("cps.combain.com",443)
conn.request("POST", "/?key="+apiKey, json.dumps(data), headers)
response = conn.getresponse()
result = json.load(response)

if ("location" in result):
   print("Returned location: "+str(result['location']['lat'])+", "+str(result['location']['lng']))
   f=open('/Users/nenebrode/Desktop/python/location','w+')
   f.write(str(result['location']['lat'])+","+str(result['location']['lng'])+'\n')
   f.close()
else:
   print("The following error occurred: "+result['error']['message']
```

A6. Runpython Code

```
#!/bin/bash
python ~/Desktop/python\ test/setup.]
```

A7. Particle System Code

In pretext:

```
//Particle system
ArrayList<ParticleSystem> systems;
```

In set-up:

```
systems = new ArrayList<ParticleSystem>();
```

In draw:

```
//Draw Particles
 pushMatrix();
 for (ParticleSystem ps : systems) {
   ps.run();
   ps.addParticle();
 }
 popMatrix();
```

In ParticleSystem file:

```
// An ArrayList is used to manage the list of Particles

class ParticleSystem {

  ArrayList<Particle> particles;    // An arraylist for all the particles
  PVector origin;                   // An origin point for where particles are birthed

  ParticleSystem(int num, PVector v) {
    particles = new ArrayList<Particle>();   // Initialize the arraylist
```

```
  origin = v.copy();                      // Store the origin point
  for (int i = 0; i < num; i++) {
    particles.add(new Particle(origin));    // Add "num" amount of particles to the arraylist
  }
 }

 void run() {
  // Cycle through the ArrayList backwards, because we are deleting while iterating
  for (int i = particles.size()-1; i >= 0; i--) {
    Particle p = particles.get(i);
    p.run();
    if (p.isDead()) {
      particles.remove(i);
    }
  }
 }

 void addParticle() {
  Particle p;
  // Add either a Particle or CrazyParticle to the system
  if (int(random(0, 2)) == 0) {
    p = new Particle(origin);
  }
  else {
    p = new CrazyParticle(origin);
  }
  particles.add(p);
 }

 void addParticle(Particle p) {
  particles.add(p);
 }

 // A method to test if the particle system still has particles
 boolean dead() {
  return particles.isEmpty();
 }
}

// A subclass of Particle

class CrazyParticle extends Particle {

 // Just adding one new variable to a CrazyParticle
 // It inherits all other fields from "Particle", and we don't have to retype them!
 float theta;
```

```
  // The CrazyParticle constructor can call the parent class (super class) constructor
  CrazyParticle(PVector l) {
    // "super" means do everything from the constructor in Particle
    super(l);
    // One more line of code to deal with the new variable, theta
    theta = 0.0;
  }

  // Notice we don't have the method run() here; it is inherited from Particle

  // This update() method overrides the parent class update() method
  void update() {
    super.update();
    // Increment rotation based on horizontal velocity
    float theta_vel = (velocity.x * velocity.mag()) / 10.0f;
    theta += theta_vel;
  }

  // This display() method overrides the parent class display() method
  void display() {
    // Render the ellipse just like in a regular particle
    super.display();
    // Then add a rotating line
    pushMatrix();
    translate(position.x, position.y);
    rotate(theta);
    stroke(255, lifespan);
    line(0, 0, 25, 0);
    popMatrix();
  }
}

// A simple Particle class

class Particle {
  PVector position;
  PVector velocity;
  PVector acceleration;
  float lifespan;

  Particle(PVector l) {
    acceleration = new PVector(-0.5, 0.05);
    velocity = new PVector(random(ht, 1), random(ht-2, 0));
    position = l.copy();
    lifespan = 255.0;
```

```
  }

  void run() {
    update();
    display();
  }

  // Method to update position
  void update() {
    velocity.add(acceleration);
    position.add(velocity);
    lifespan -= 2.0;
  }

  // Method to display
  void display() {
    stroke(255, lifespan);
    fill(255, lifespan);
    ellipse(position.x, position.y, 8, 8);
  }

  // Is the particle still useful?
  boolean isDead() {
    return (lifespan < 0.0);
  }
}
```

A8. Dial Code

In pretext:

```
//Dial
PFont small, big;
int radius = 100;
```

In set-up:

```
  //Dial
  small = createFont("sansSerif", 10);
  big = createFont("sansSerif", 30);
  fill(0);
  textAlign(CENTER, CENTER);
```

In draw:

```
//Dial
  pushMatrix();
  fill(255);
  translate(200, 200);
  stroke(0);
```

```
 textFont(small);
 for (int i=0; i<360; i+=5) {
  if (i % 20 == 0) {
    stroke(255);
    strokeWeight(2);
    float radi = radians(i);
    line(sin(radi)*radius, cos(radi)*radius, sin(radi)*radius*1.4, cos(radi)*radius*1.4);
    text(i, sin(radi)*radius*1.55, cos(radi)*radius*1.55);
  } else {
    strokeWeight(1);
    float radi = radians(i);
    line(sin(radi)*radius, cos(radi)*radius, sin(radi)*radius*1.2, cos(radi)*radius*1.2);
  }
 }

 stroke(255, 0, 0);
 strokeWeight(3);
 float dial = radians(attention);
 line(sin(dial)*radius*0.5, cos(dial)*radius*0.5, sin(dial)*radius, cos(dial)*radius);
 textFont(big);
 textAlign(CENTER);
 text(a, 0, 0);
 popMatrix();
```

A9. Noise Generation Code

In pretext:

```
//White noise and white screen
WhiteNoise noise;
float amp=0.0;
float a;
float b;
```

In set-up:

```
// Create a noise generator and filters
  noise = new WhiteNoise(this);
  //smooth();
  frameRate(25);
  noStroke();
```

In draw:

```
 //Map white noise
  b = map(attention, 0, 100, 0.0, 1.0);
  //Play noise
  noise.play();
  noise.amp(b);
  popMatrix();
```

A10. Full Code for all Files

File1: sketch_06_Final_Version 1

```
///////////////MINDANDMATTER/////////////////
//NENE BRODE//////////////////////////////
//MASTERS OF ART IN COMMUNICATIONS & CULTURE//
//CREDIT TO CONTRIBUTORS:
//KIERAN FROM THE DME
//ANDREAS SCHLEGEL FOR HIS CODE EXAMPLES
//DANIELS SHIFFMAN FOR HIS MANY TUTORIALS
//////////////////////////////////////////

//PRETEXT////////////////////////////////////
//////////////////////////////////////////

//Particle system
ArrayList<ParticleSystem> systems;

//Geolocation data
String reportString;
String myString;
String latitude, longitude;
Table table;

//Variables for cell array
float minLat, maxLat, minLong, maxLong, ht;
Table finalProx = new Table();

import java.nio.*;
import org.openkinect.processing.Kinect2;

//Kinect
Kinect2 kinect2;

float angle = 3.141594;
float scaleValue = 50;

//Change color of the point cloud
int drawState = 1;

//openGL
PGL pgl;
PShader sh;

//VBO buffer location in the GPU
int vertexVboId;
int colorVboId;

int vertLoc;
int colorLoc;
```

```
//Dial
PFont small, big;
int radius = 100;

//import data from Neurosky via TCP
import processing.net.*;
JSONObject json;

//Import sound library
import processing.sound.*;

//Variables for Neurosky
Client myClient;
int meditation;
int attention;
int poorSignalLevel;
int delta;
int theta;
int lowAlpha;
int highAlpha;
int lowBeta;
int highBeta;
int lowGamma;
int highGamma;

//White noise and white screen
WhiteNoise noise;
float amp=0.0;
float a;
float b;

////////////////////////////////////////////
//SET UP////////////////////////////
////////////////////////////////////////////

void setup() {
  size(1440, 900, P3D);

  //Dial
  small = createFont("sansSerif", 10);
  big = createFont("sansSerif", 30);
  fill(0);
  textAlign(CENTER, CENTER);

  //Neurosky TCP
  myClient = new Client(this, "127.0.0.1", 13854);
  myClient.write("{\"appName\": \"helloWorld\", \"appKey\":
\"0123456789012345678901234567890123456789\", \"enableRawOutput\": false, \"format\":\"Json\"}");

  // Create a noise generator and filters
  noise = new WhiteNoise(this);
  //smooth();
  frameRate(25);
  noStroke();

  //run external program to get cell location from combain api and wait for it to finish
```

```
Process p = exec("/Users/nenebrode/Desktop/python/runpython.txt");

try {

  int result = p.waitFor();
  println("the process returned"+result);
}
catch (InterruptedException e) {
}

String[] tempLoc = loadStrings("/Users/nenebrode/Desktop/python/location");
tempLoc = split(tempLoc[0], ",");
latitude = tempLoc[0];
longitude = tempLoc[1];

print(latitude, longitude, "\n");

// import cell tower, antenna, and wifi information

Table table = new Table();
table = loadTable("Site_Data_GTA.csv", "header");
table.setColumnType(1, "float");
table.sort (1);

// compare latitude
Table proxTable = new Table();
proxTable.setColumnTitles(table.getColumnTitles());
for (TableRow row : table.rows ()) {
  if ((row.getFloat(1)>float(latitude)-0.2) && (row.getFloat(1)<float(latitude)+0.2)) {
    proxTable.addRow(row);
  }
}
println("done latitude");
proxTable.setColumnType(2, "float");

finalProx.setColumnTitles(table.getColumnTitles());
finalProx.setColumnType(3, "float");

// compare longitude
for (TableRow row : proxTable.rows ()) {
  if ((row.getFloat(2)>float(longitude)-0.23) && (row.getFloat(2)<float(longitude)+0.23)) {
    println("added");
    finalProx.addRow(row);
  }
}
print("done longitude");
saveTable(finalProx, "finalProx.csv");

finalProx.sort (1);
minLat = finalProx.getFloat(0, 1);
maxLat = finalProx.getFloat(finalProx.getRowCount()-1, 1);
finalProx.sort (2);
maxLong = finalProx.getFloat(0, 2);
minLong = finalProx.getFloat(finalProx.getRowCount()-1, 2);

systems = new ArrayList<ParticleSystem>();
```

```
  for (TableRow row : finalProx.rows()) {
    float x = map(row.getFloat(2), minLong, maxLong, 0, width);
    float y = map(row.getFloat(1), minLat, maxLat, 0, height);
    float ht = map(row.getFloat(4), 0, .1, -2, 2);
    systems.add(new ParticleSystem(1, new PVector(x, y)));
    println("ht");
  }

  //Kinect
  kinect2 = new Kinect2(this);
  // Start all data
  kinect2.initDepth();
  kinect2.initIR();
  kinect2.initVideo();
  kinect2.initRegistered();
  kinect2.initDevice();

  //start shader
  //shader usefull to add post-render effects to the point cloud
  sh = loadShader("frag.glsl", "vert.glsl");
  //smooth(16);

  //create VBO
  PGL pgl = beginPGL();

  // allocate buffer big enough to get all VBO ids back
  IntBuffer intBuffer = IntBuffer.allocate(2);
  pgl.genBuffers(2, intBuffer);

  //memory location of the VBO
  vertexVboId = intBuffer.get(0);
  colorVboId = intBuffer.get(1);

  endPGL();
}

////////////////////////////////////////////
//DRAWING///////////////////////////////////
////////////////////////////////////////////

void draw() {

  background(0);

  //IR image
  pushMatrix();
  translate(width/2, height/2, scaleValue);
  rotateY(angle);
  stroke(255);

  //obtain the XYZ camera positions based on the depth data
  FloatBuffer depthPositions = kinect2.getDepthBufferPositions();

  //obtain the color information as IntBuffers
  IntBuffer irData         = kinect2.getIrColorBuffer();
  IntBuffer registeredData = kinect2.getRegisteredColorBuffer();
```

```
  IntBuffer depthData      = kinect2.getDepthColorBuffer();

  pgl = beginPGL();
  sh.bind();

  //send the the vertex positions (point cloud) and color down the render pipeline
  //positions are render in the vertex shader, and color in the fragment shader
  vertLoc = pgl.getAttribLocation(sh.glProgram, "vertex");
  pgl.enableVertexAttribArray(vertLoc);

  //enable drawing to the vertex and color buffer
  colorLoc = pgl.getAttribLocation(sh.glProgram, "color");
  pgl.enableVertexAttribArray(colorLoc);

  int vertData = kinect2.depthWidth * kinect2.depthHeight;

  //vertex
  {
    pgl.bindBuffer(PGL.ARRAY_BUFFER, vertexVboId);
    // fill VBO with data
    pgl.bufferData(PGL.ARRAY_BUFFER, Float.BYTES * vertData * 3, depthPositions,
PGL.DYNAMIC_DRAW);
    // associate currently bound VBO with shader attribute
    pgl.vertexAttribPointer(vertLoc, 3, PGL.FLOAT, false, Float.BYTES * 3, 0);
  }

  //color
  //change color of the point cloud depending on the depth, ir and color+depth information.
  switch(drawState) {
  case 0:
    pgl.bindBuffer(PGL.ARRAY_BUFFER, colorVboId);
    // fill VBO with data
    pgl.bufferData(PGL.ARRAY_BUFFER, Integer.BYTES * vertData, depthData,
PGL.DYNAMIC_DRAW);
    // associate currently bound VBO with shader attribute
    pgl.vertexAttribPointer(colorLoc, 4, PGL.UNSIGNED_BYTE, false, Byte.BYTES, 0);
    break;
  case 1:
    pgl.bindBuffer(PGL.ARRAY_BUFFER, colorVboId);
    // fill VBO with data
    pgl.bufferData(PGL.ARRAY_BUFFER, Integer.BYTES * vertData, irData, PGL.DYNAMIC_DRAW);
    // associate currently bound VBO with shader attribute
    pgl.vertexAttribPointer(colorLoc, 4, PGL.UNSIGNED_BYTE, false, Byte.BYTES, 0);
    break;
  case 2:
    pgl.bindBuffer(PGL.ARRAY_BUFFER, colorVboId);
    // fill VBO with data
    pgl.bufferData(PGL.ARRAY_BUFFER, Integer.BYTES * vertData, registeredData,
PGL.DYNAMIC_DRAW);
    // associate currently bound VBO with shader attribute
    pgl.vertexAttribPointer(colorLoc, 4, PGL.UNSIGNED_BYTE, false, Byte.BYTES, 0);//Byte.SIZE, 0);
    break;
  }

  // unbind VBOs
  pgl.bindBuffer(PGL.ARRAY_BUFFER, 0);
```

```
//draw the point cloud as a set of points
pgl.drawArrays(PGL.POINTS, 0, vertData);

//disable drawing
pgl.disableVertexAttribArray(vertexVboId);
pgl.disableVertexAttribArray(colorVboId);

sh.unbind();
endPGL();
popMatrix();

//Neurosky
pushMatrix();
JSONObject packet;
if (myClient.available() > 0 && myClient.active()) {
  String test = myClient.readString();
  packet = parseJSONObject(test);
  if (!packet.isNull("eSense")) {
    if (!packet.getJSONObject("eSense").isNull("attention"))
      attention = packet.getJSONObject("eSense").getInt("attention");
    if (!packet.getJSONObject("eSense").isNull("meditation"));
    meditation = packet.getJSONObject("eSense").getInt("meditation");
  }
  if (!packet.isNull("poorSignalLevel")) {
    poorSignalLevel = packet.getInt("poorSignalLevel");
  }
  if (!packet.isNull("eegPower")) {
    if (!packet.getJSONObject("eegPower").isNull("delta"))
      delta = packet.getJSONObject("eegPower").getInt("delta");
    if (!packet.getJSONObject("eegPower").isNull("theta"));
    theta = packet.getJSONObject("eegPower").getInt("theta");
    if (!packet.getJSONObject("eegPower").isNull("lowAlpha"))
      lowAlpha = packet.getJSONObject("eegPower").getInt("lowAlpha");
    if (!packet.getJSONObject("eegPower").isNull("highAlpha"))
      highAlpha = packet.getJSONObject("eegPower").getInt("highAlpha");
    if (!packet.getJSONObject("eegPower").isNull("lowBeta"))
      lowBeta = packet.getJSONObject("eegPower").getInt("lowBeta");
    if (!packet.getJSONObject("eegPower").isNull("highBeta"))
      highBeta = packet.getJSONObject("eegPower").getInt("highBeta");
    if (!packet.getJSONObject("eegPower").isNull("lowGamma"))
      lowGamma = packet.getJSONObject("eegPower").getInt("lowGamma");
    if (!packet.getJSONObject("eegPower").isNull("highGamma"))
      highGamma = packet.getJSONObject("eegPower").getInt("highGamma");
  }
}

//Map white screen
a = map(meditation, 0, 100, 0, 255);

//White screen
fill(255, a);
rect(0, 0, 1440, 900);

//Map white noise
b = map(attention, 0, 100, 0.0, 1.0);
```

```
//Play noise
noise.play();
noise.amp(b);
popMatrix();

//Draw Particles
pushMatrix();
for (ParticleSystem ps : systems) {
  ps.run();
  ps.addParticle();
}
popMatrix();

//Dial
pushMatrix();
fill(255);
translate(200, 200);
stroke(0);
textFont(small);
for (int i=0; i<360; i+=5) {
  if (i % 20 == 0) {
    stroke(255);
    strokeWeight(2);
    float radi = radians(i);
    line(sin(radi)*radius, cos(radi)*radius, sin(radi)*radius*1.4, cos(radi)*radius*1.4);
    text(i, sin(radi)*radius*1.55, cos(radi)*radius*1.55);
  } else {
    strokeWeight(1);
    float radi = radians(i);
    line(sin(radi)*radius, cos(radi)*radius, sin(radi)*radius*1.2, cos(radi)*radius*1.2);
  }
}

stroke(255, 0, 0);
strokeWeight(3);
float dial = radians(attention);
line(sin(dial)*radius*0.5, cos(dial)*radius*0.5, sin(dial)*radius, cos(dial)*radius);
textFont(big);
textAlign(CENTER);
text(a, 0, 0);
popMatrix();

//Print Values
pushMatrix();
textAlign(RIGHT);
textSize(12);
fill(255, 0, 0);
text("Poor Signal Level: " + poorSignalLevel, 1400, 50);
text("Attention: " + attention, 1400, 75);
text("Meditation: " + meditation, 1400, 100);
text("Delta: " + delta, 1400, 125);
text("Theta: " + theta, 1400, 150);
text("Low Alpha: " + lowAlpha, 1400, 175);
text("High Alpha: " + highAlpha, 1400, 200);
text("Low Beta: " + lowBeta, 1400, 225);
```

```
  text("High Beta: " + highBeta, 1400, 250);
  text("Low Gamma: " + lowGamma, 1400, 275);
  text("High Gamma: " + highGamma, 1400, 300);

  popMatrix();

  ///Get camera image
  pushMatrix();
  kinect2.getIrImage();
  image(kinect2.getVideoImage(), 1050, 500, kinect2.colorWidth*0.2, kinect2.colorHeight*0.2);
  popMatrix();
}

///////////////MINDANDMATTER///////////////
```

File: CameraParams

```
//camera information based on the Kinect v2 hardware
static class CameraParams {
  static float cx = 254.878f;
  static float cy = 205.395f;
  static float fx = 365.456f;
  static float fy = 365.456f;
  static float k1 = 0.0905474;
  static float k2 = -0.26819;
  static float k3 = 0.0950862;
  static float p1 = 0.0;
  static float p2 = 0.0;
}
```

File: ParticleSystem:

```
// An ArrayList is used to manage the list of Particles

class ParticleSystem {

  ArrayList<Particle> particles;    // An arraylist for all the particles
  PVector origin;                   // An origin point for where particles are birthed

  ParticleSystem(int num, PVector v) {
    particles = new ArrayList<Particle>();   // Initialize the arraylist
    origin = v.copy();                       // Store the origin point
    for (int i = 0; i < num; i++) {
      particles.add(new Particle(origin));    // Add "num" amount of particles to the arraylist
    }
  }


  void run() {
    // Cycle through the ArrayList backwards, because we are deleting while iterating
    for (int i = particles.size()-1; i >= 0; i--) {
      Particle p = particles.get(i);
      p.run();
      if (p.isDead()) {
        particles.remove(i);
```

```
    }
   }
  }

  void addParticle() {
   Particle p;
   // Add either a Particle or CrazyParticle to the system
   if (int(random(0, 2)) == 0) {
    p = new Particle(origin);
   }
   else {
    p = new CrazyParticle(origin);
   }
   particles.add(p);
  }

  void addParticle(Particle p) {
   particles.add(p);
  }

  // A method to test if the particle system still has particles
  boolean dead() {
   return particles.isEmpty();
  }
}

// A subclass of Particle

class CrazyParticle extends Particle {

  // Just adding one new variable to a CrazyParticle
  // It inherits all other fields from "Particle", and we don't have to retype them!
  float theta;

  // The CrazyParticle constructor can call the parent class (super class) constructor
  CrazyParticle(PVector l) {
   // "super" means do everything from the constructor in Particle
   super(l);
   // One more line of code to deal with the new variable, theta
   theta = 0.0;
  }

  // Notice we don't have the method run() here; it is inherited from Particle

  // This update() method overrides the parent class update() method
  void update() {
   super.update();
   // Increment rotation based on horizontal velocity
   float theta_vel = (velocity.x * velocity.mag()) / 10.0f;
   theta += theta_vel;
  }

  // This display() method overrides the parent class display() method
  void display() {
   // Render the ellipse just like in a regular particle
   super.display();
```

```
    // Then add a rotating line
    pushMatrix();
    translate(position.x, position.y);
    rotate(theta);
    stroke(255, lifespan);
    line(0, 0, 25, 0);
    popMatrix();
  }
}

// A simple Particle class

class Particle {
  PVector position;
  PVector velocity;
  PVector acceleration;
  float lifespan;

  Particle(PVector l) {
    acceleration = new PVector(-0.5, 0.05);
    velocity = new PVector(random(ht, 1), random(ht-2, 0));
    position = l.copy();
    lifespan = 255.0;
  }

  void run() {
    update();
    display();
  }

  // Method to update position
  void update() {
    velocity.add(acceleration);
    position.add(velocity);
    lifespan -= 2.0;
  }

  // Method to display
  void display() {
    stroke(255, lifespan);
    fill(255, lifespan);
    ellipse(position.x, position.y, 8, 8);
  }

  // Is the particle still useful?
  boolean isDead() {
    return (lifespan < 0.0);
  }
}
```

Appendix B. Cell Tower Data

SERVICE	LATITUDE	LONGITUDE	STUCT_HT_T	PERCENT
PCS	43.654	-79.4062	106	0.19
CELL	43.6541	-79.3803	119	0.22
AWS	43.6542	-79.38	91	0.17
AWS	43.6544	-79.4236	120	0.22
AWS	43.6544	-79.4228	124	0.23
AWS	43.6544	-79.3806	94	0.17
AWS	43.6544	-79.3758	110.6	0.2
MBS	43.6544	-79.3589	93	0.17
FCFS38	43.6545	-79.4235	119	0.22
PCS	43.6546	-79.3787	86	0.16
PCS	43.6547	-79.3828	94	0.17
AWS	43.6547	-79.3469	97	0.18
MBS	43.655	-79.4147	127.7	0.23
FCFS38	43.655	-79.388	136	0.25
AWS	43.655	-79.3856	141	0.26
PCS	43.6551	-79.388	125	0.23
MBS	43.6551	-79.388	133	0.24
MBS	43.6551	-79.388	135	0.25
AWS	43.6552	-79.3586	90	0.17
AWS	43.6553	-79.4147	131	0.24
PCS	43.6553	-79.4147	133	0.24
AWS	43.6553	-79.3878	148	0.27
FCFS38	43.6555	-79.4556	128	0.23
AWS	43.6556	-79.4583	130	0.24
AWS	43.6556	-79.415	136	0.25
AWS	43.6556	-79.4092	129	0.24
AWS	43.6556	-79.3881	137	0.25
BWA24	43.6556	-79.37	139	0.26
PCS	43.6557	-79.4585	134	0.25
PCS	43.6557	-79.3846	98	0.18
PCS	43.6557	-79.3809	96	0.18
FCFS38	43.6557	-79.3695	133	0.24
AWS	43.6558	-79.3919	135.1	0.25

AWS	43.6558	-79.3839	110.9	0.2
AWS	43.6558	-79.3792	143	0.26
AWS	43.6558	-79.3783	153	0.28
PCS	43.6558	-79.3783	155	0.28
AWS	43.6559	-79.4093	129	0.24
PCS	43.6559	-79.4093	131	0.24
AWS	43.6559	-79.3841	115	0.21
MBS	43.6559	-79.3841	116	0.21
MBS	43.6559	-79.3841	117	0.21
PCS	43.6559	-79.3841	165	0.3
PCS	43.6559	-79.3841	165	0.3
CELL	43.6559	-79.3841	171	0.31
PCS	43.656	-79.3849	98	0.18
AWS	43.6561	-79.3914	144	0.26
BWA24	43.6561	-79.3589	62	0.11
AWS	43.6561	-79.3361	86.9	0.16
PCS	43.6562	-79.3803	111	0.2
AWS	43.6563	-79.3807	98	0.18
PCS	43.6564	-79.3826	106	0.19
BWA24	43.6564	-79.3819	102	0.19
AWS	43.6564	-79.3758	139	0.26
AWS	43.6564	-79.3744	128.5	0.24
FWA	43.6564	-79.3656	137	0.25
WCS	43.6564	-79.3656	137.1	0.25
AWS	43.6564	-79.3656	138.8	0.25
AWS	43.6564	-79.3654	130	0.24
CELL	43.6564	-79.3654	130	0.24
MBS	43.6564	-79.3654	131	0.24
MBS	43.6566	-79.4672	176	0.32
AWS	43.6566	-79.4672	178	0.33
PCS	43.6566	-79.3806	96	0.18
FCFS38	43.6566	-79.3805	141	0.26
AWS	43.6567	-79.4672	178	0.33
AWS	43.6567	-79.3811	119	0.22
AWS	43.6567	-79.3656	130	0.24
BWA24	43.6569	-79.4031	96	0.18

AWS	43.6569	-79.4017	126	0.23
AWS	43.6569	-79.3591	163	0.3
FCFS38	43.6569	-79.3469	98	0.18
AWS	43.6569	-79.3468	100	0.18
PCS	43.657	-79.3811	107	0.2
AWS	43.657	-79.3811	109	0.2
PCS	43.6571	-79.4352	112	0.21
AWS	43.6572	-79.4642	185	0.34
AWS	43.6572	-79.4494	134.7	0.25
AWS	43.6572	-79.3903	174	0.32
CELL	43.6572	-79.3872	274	0.5
BWA24	43.6572	-79.345	52	0.1
AWS	43.6573	-79.3905	101	0.19
AWS	43.6575	-79.4033	126.3	0.23
AWS	43.6575	-79.3833	188	0.34
AWS	43.6578	-79.4881	143	0.26
PCS	43.6578	-79.4461	138	0.25
AWS	43.6578	-79.4461	140	0.26
MBS	43.6578	-79.4461	147	0.27
AWS	43.6578	-79.3889	99	0.18
AWS	43.6578	-79.3756	93	0.17
AWS	43.6578	-79.37	153	0.28
FCFS38	43.6579	-79.4883	145	0.27
AWS	43.6581	-79.4881	139	0.26
AWS	43.6581	-79.4461	145	0.27
AWS	43.6581	-79.3906	385	0.71
AWS	43.6581	-79.3889	149.5	0.27
PCS	43.6581	-79.3497	88	0.16
AWS	43.6583	-79.3989	155.7	0.29
FCFS38	43.6584	-79.399	152	0.28
AWS	43.6584	-79.3901	103	0.19
AWS	43.6585	-79.372	122	0.22
PCS	43.6585	-79.372	124	0.23
PCS	43.6586	-79.399	153	0.28
MBS	43.6586	-79.399	155	0.28
PCS	43.6586	-79.399	157	0.29

AWS	43.6586	-79.3986	150	0.28
AWS	43.6589	-79.4297	165	0.3
AWS	43.6589	-79.3783	126.5	0.23
AWS	43.6591	-79.3821	93	0.17
AWS	43.6592	-79.3897	104	0.19
AWS	43.6592	-79.3764	138	0.25
AWS	43.6592	-79.3717	131.1	0.24
BWA24	43.6594	-79.3536	70	0.13
AWS	43.6597	-79.4361	154	0.28
AWS	43.6597	-79.4361	155.3	0.28
AWS	43.6599	-79.3887	106	0.19
PCS	43.66	-79.4302	151	0.28
AWS	43.66	-79.3953	130	0.24
AWS	43.66	-79.3831	205.2	0.38
PCS	43.66	-79.3792	133	0.24
PCS	43.6601	-79.4363	150	0.28
PCS	43.6601	-79.4363	162	0.3
PCS	43.6601	-79.393	148	0.27
MBS	43.6601	-79.393	175	0.32
AWS	43.6603	-79.3861	136.5	0.25
AWS	43.6603	-79.3292	91.3	0.17
PCS	43.6603	-79.3291	94	0.17
AWS	43.6603	-79.3291	95	0.17
MBS	43.6603	-79.3291	97	0.18
CELL	43.6603	-79.3291	97	0.18
BWA24	43.6606	-79.3856	224	0.41
AWS	43.6606	-79.3825	157	0.29
MBS	43.6612	-79.3869	147	0.27
RAC	43.6614	-79.5128	111	0.2
AWS	43.6614	-79.3867	106	0.19
MBS	43.6614	-79.3835	118	0.22
PCS	43.6614	-79.3835	120	0.22
AWS	43.6617	-79.3874	212	0.39
AWS	43.6617	-79.3861	142	0.26
BWA24	43.6617	-79.3828	10	0.02
AWS	43.6617	-79.3828	156.4	0.29

MBS	43.6617	-79.3397	102	0.19
PCS	43.6617	-79.3397	104	0.19
AWS	43.6617	-79.3397	106	0.19
WCS	43.6618	-79.3828	162	0.3
PCS	43.662	-79.3216	94	0.17
CELL	43.6622	-79.3831	107	0.2
AWS	43.6622	-79.3786	128	0.23
PCS	43.6623	-79.4814	142	0.26
PCS	43.6623	-79.4814	144	0.26
AWS	43.6623	-79.4814	145	0.27
AWS	43.6623	-79.3788	135	0.25
MBS	43.6623	-79.3788	138	0.25
PCS	43.6623	-79.3653	119	0.22
AWS	43.6623	-79.3653	121	0.22
AWS	43.6625	-79.4214	125	0.23
CELL	43.6625	-79.3889	139	0.26
AWS	43.6625	-79.3769	127	0.23
AWS	43.6625	-79.3653	110.8	0.2
AWS	43.6625	-79.3329	84	0.15
FCFS38	43.6625	-79.3329	99	0.18
FCFS38	43.6627	-79.4215	127	0.23
PCS	43.6628	-79.4214	129	0.24
AWS	43.6628	-79.4214	130	0.24
AWS	43.6628	-79.3886	154.6	0.28
WBS	43.6628	-79.3575	166	0.3
FCFS38	43.663	-79.3577	165	0.3
AWS	43.6631	-79.3989	140.9	0.26
PCS	43.6631	-79.3581	160	0.29
AWS	43.6631	-79.3581	162	0.3
PCS	43.6631	-79.3581	164	0.3
AWS	43.6631	-79.3578	119	0.22
AWS	43.6631	-79.3575	163	0.3
AWS	43.6631	-79.3406	112	0.21
AWS	43.6633	-79.3738	132	0.24
MBS	43.6633	-79.3738	134	0.25
AWS	43.6633	-79.3403	113	0.21

AWS	43.6636	-79.4106	135.2	0.25
RAC	43.6639	-79.5103	113	0.21
RAC	43.6639	-79.4569	122	0.22
BRS	43.6642	-79.4561	133.6	0.25
PCS	43.6644	-79.3995	162	0.3
MBS	43.6644	-79.3995	167	0.31
AWS	43.6644	-79.3875	177.4	0.33
AWS	43.6644	-79.3722	146	0.27
AWS	43.6645	-79.3993	113	0.21
AWS	43.6646	-79.3876	170	0.31
PCS	43.6646	-79.3876	172	0.32
AWS	43.6647	-79.3878	183	0.34
BWA24	43.6647	-79.3772	113	0.21
AWS	43.6649	-79.3552	170	0.31
AWS	43.665	-79.4992	147	0.27
FCFS38	43.665	-79.4991	141	0.26
PCS	43.665	-79.4986	146	0.27
AWS	43.665	-79.4986	148	0.27
AWS	43.665	-79.4983	144.2	0.26
AWS	43.665	-79.3986	162	0.3
AWS	43.665	-79.3842	153.6	0.28
FCFS38	43.6653	-79.4788	142	0.26
AWS	43.6653	-79.4786	139	0.26
PCS	43.6653	-79.3986	223	0.41
BWA24	43.6653	-79.3447	148	0.27
AWS	43.6653	-79.3175	98.6	0.18
AWS	43.6655	-79.4116	136	0.25
MBS	43.6655	-79.4116	138	0.25
RAC	43.6656	-79.5019	122	0.22
RAC	43.6656	-79.4492	123	0.23
MBS	43.6656	-79.3181	105	0.19
PCS	43.6656	-79.3181	106	0.19
CELL	43.6656	-79.3181	107	0.2
AWS	43.6656	-79.3181	109	0.2
MBS	43.6656	-79.3181	110	0.2
AWS	43.6658	-79.3839	176	0.32

AWS	43.6658	-79.38	149.8	0.27
FCFS38	43.6658	-79.3787	153	0.28
AWS	43.6658	-79.3786	157	0.29
AWS	43.6658	-79.3783	151	0.28
MBS	43.6658	-79.3783	153	0.28
PCS	43.6658	-79.3783	156	0.29
AWS	43.6658	-79.3158	101	0.19
FCFS38	43.666	-79.3787	159	0.29
AWS	43.6664	-79.4856	150	0.28
RAC	43.6667	-79.4644	122	0.22
RAC	43.6667	-79.4558	123	0.23
AWS	43.6667	-79.405	167	0.31
PCS	43.6667	-79.405	169	0.31
PCS	43.6667	-79.405	171	0.31
RAC	43.6669	-79.4603	123	0.23
AWS	43.6669	-79.4061	170	0.31
AWS	43.6669	-79.3742	134	0.25
WCS	43.667	-79.4063	172.5	0.32
FWA	43.667	-79.4063	173	0.32
FCFS38	43.667	-79.4062	164	0.3
FCFS38	43.667	-79.4062	169	0.31
RAC	43.6672	-79.4839	129	0.24
RAC	43.6672	-79.4839	136	0.25
RAC	43.6672	-79.4839	195	0.36
RAC	43.6672	-79.4836	163	0.3
AWS	43.6672	-79.4464	179	0.33
AWS	43.6672	-79.4456	175	0.32
AWS	43.6672	-79.4011	165	0.3
AWS	43.6672	-79.3906	134.5	0.25
FCFS38	43.6672	-79.3841	157	0.29
FCFS38	43.6673	-79.4457	170	0.31
MBS	43.6674	-79.4468	182	0.33
AWS	43.6674	-79.4468	184	0.34
PCS	43.6674	-79.4468	190	0.35
MBS	43.6674	-79.3728	148	0.27
PCS	43.6674	-79.3728	150	0.28

RAC	43.6675	-79.4836	165.7	0.3
MBS	43.6675	-79.4658	155	0.28
PCS	43.6675	-79.4658	156	0.29
RAC	43.6675	-79.4658	160	0.29
AWS	43.6675	-79.3944	144	0.26
PCS	43.6675	-79.3855	127	0.23
PCS	43.6676	-79.3945	144	0.26
PCS	43.6678	-79.4844	128	0.23
AWS	43.6678	-79.4658	168	0.31
BWA24	43.6678	-79.4008	179	0.33
AWS	43.6678	-79.3962	220	0.4
FCFS38	43.668	-79.4633	135	0.25
AWS	43.668	-79.395	113	0.21
AWS	43.6681	-79.4125	154	0.28
AWS	43.6683	-79.4678	142	0.26
AWS	43.6683	-79.4128	141	0.26
BWA24	43.6683	-79.3997	121	0.22
BWA24	43.6683	-79.39	10	0.02
AWS	43.6683	-79.3806	144.5	0.27
AWS	43.6685	-79.3705	195	0.36
MBS	43.6685	-79.3705	196	0.36
PCS	43.6685	-79.3705	197	0.36
AWS	43.6686	-79.3958	149	0.27
AWS	43.6686	-79.3894	180	0.33
AWS	43.6686	-79.3894	183	0.34
AWS	43.6686	-79.3853	149	0.27
AWS	43.6689	-79.3736	180	0.33
AWS	43.6689	-79.3717	195.6	0.36
AWS	43.6689	-79.3431	116	0.21
AWS	43.6692	-79.4372	149	0.27
AWS	43.6694	-79.3986	168.6	0.31
CELL	43.6694	-79.3883	111	0.2
AWS	43.6694	-79.3406	122	0.22
PCS	43.6694	-79.3406	123	0.23
PCS	43.6694	-79.3406	134	0.25
PCS	43.6695	-79.3012	96	0.18

AWS	43.6695	-79.3012	97	0.18
PCS	43.6695	-79.3012	98	0.18
AWS	43.6697	-79.3897	168	0.31
PCS	43.6697	-79.3883	113	0.21
AWS	43.6697	-79.3792	165	0.3
AWS	43.6697	-79.3742	178.2	0.33
FCFS38	43.6698	-79.3902	167	0.31
AWS	43.6698	-79.3887	120	0.22
RAC	43.67	-79.4617	113	0.21
AWS	43.67	-79.4006	139.2	0.26
PCS	43.67	-79.39	148	0.27
PCS	43.67	-79.39	157	0.29
MBS	43.67	-79.39	159	0.29
AWS	43.67	-79.3889	110	0.2
AWS	43.67	-79.3792	115	0.21
PCS	43.67	-79.2864	91	0.17
AWS	43.6703	-79.4286	135.6	0.25
AWS	43.6703	-79.3878	132	0.24
AWS	43.6703	-79.3839	168	0.31
PCS	43.6703	-79.36	92.5	0.17
AWS	43.6703	-79.2989	93	0.17
AWS	43.6705	-79.3745	176	0.32
PCS	43.6705	-79.3745	178	0.33
AWS	43.6706	-79.4539	155	0.28
AWS	43.6706	-79.4539	155	0.28
AWS	43.6706	-79.3864	202	0.37
AWS	43.6706	-79.3863	127	0.23
CELL	43.6706	-79.3792	146	0.27
AWS	43.6706	-79.2975	105	0.19
AWS	43.6708	-79.4536	157.2	0.29
MBS	43.6708	-79.3866	143	0.26
BRS	43.6708	-79.3866	144	0.26
PCS	43.6708	-79.3866	146	0.27
CELL	43.6708	-79.3842	110	0.2
AWS	43.6708	-79.3827	109	0.2
FWA	43.6709	-79.4538	159	0.29

WCS	43.6709	-79.4538	159.1	0.29
PCS	43.6709	-79.3826	234	0.43
PCS	43.671	-79.3931	121	0.22
PCS	43.671	-79.3839	123	0.23
AWS	43.6711	-79.3808	184	0.34
PCS	43.6711	-79.3807	195	0.36
AWS	43.6711	-79.3797	118	0.22
AWS	43.6711	-79.3797	132	0.24
AWS	43.6711	-79.3714	153	0.28
PCS	43.6713	-79.2935	25	0.05
CELL	43.6714	-79.38	111	0.2
AWS	43.6714	-79.3261	101.2	0.19
AWS	43.6715	-79.3853	111	0.2
MBS	43.6715	-79.3786	197	0.36
AWS	43.6715	-79.3786	199	0.37
AWS	43.6717	-79.395	170	0.31
PCS	43.6717	-79.3946	120	0.22
AWS	43.6717	-79.385	166.7	0.31
BWA24	43.6717	-79.3778	545	1
PCS	43.6718	-79.3779	189	0.35
FCFS38	43.6719	-79.4268	137	0.25
AWS	43.6719	-79.3853	162	0.3
AWS	43.6719	-79.3812	3	0.01
AWS	43.6722	-79.4142	140	0.26
MBS	43.6722	-79.4142	142	0.26
AWS	43.6722	-79.3826	3	0.01
WCS	43.6722	-79.3789	138.5	0.25
FWA	43.6722	-79.3789	139	0.26
AWS	43.6722	-79.3786	144.9	0.27
MBS	43.6724	-79.2878	106	0.19
PCS	43.6724	-79.2878	107	0.2
AWS	43.6725	-79.3544	117.7	0.22
AWS	43.6725	-79.3222	106	0.19
AWS	43.6725	-79.3222	109	0.2
AWS	43.6725	-79.2875	104.3	0.19
AWS	43.6728	-79.4228	151	0.28

AWS	43.6731	-79.4231	153	0.28
AWS	43.6731	-79.4025	152	0.28
AWS	43.6731	-79.3953	147	0.27
PCS	43.6731	-79.3885	139	0.26
CELL	43.6731	-79.3885	139	0.26
MBS	43.6733	-79.4223	153	0.28
BRS	43.6733	-79.4223	155	0.28
PCS	43.6733	-79.4223	158	0.29
AWS	43.6733	-79.402	69	0.13
MBS	43.6733	-79.402	70	0.13
PCS	43.6733	-79.402	71	0.13
AWS	43.6736	-79.4631	136	0.25
AWS	43.6736	-79.4028	144.5	0.27
AWS	43.6739	-79.4942	154.3	0.28
PCS	43.6739	-79.3199	118	0.22
AWS	43.6739	-79.3199	120	0.22
AWS	43.6742	-79.3397	140	0.26
AWS	43.6742	-79.3397	150.3	0.28
RAC	43.6742	-79.3236	99	0.18
FCFS38	43.6743	-79.3395	128	0.23
RAC	43.6744	-79.4125	123	0.23
BWA24	43.6744	-79.3817	110	0.2
AWS	43.6744	-79.3083	113.5	0.21
AWS	43.6746	-79.3086	111	0.2
PCS	43.6746	-79.3086	113	0.21
AWS	43.6747	-79.4311	136.4	0.25
CELL	43.6747	-79.3961	136	0.25
RAC	43.6747	-79.33	115	0.21
RAC	43.6747	-79.3297	106	0.19
AWS	43.6748	-79.3982	183	0.34
PCS	43.6748	-79.3982	186	0.34
PCS	43.6748	-79.3982	195	0.36
AWS	43.675	-79.2783	126	0.23
PCS	43.675	-79.2783	128	0.23
AWS	43.675	-79.2783	132.9	0.24
AWS	43.6753	-79.4331	165	0.3

AWS	43.6753	-79.3883	138.5	0.25
AWS	43.6753	-79.2786	131	0.24
FCFS38	43.6754	-79.3885	148	0.27
AWS	43.6755	-79.4333	160	0.29
MBS	43.6755	-79.4333	162	0.3
PCS	43.6755	-79.4333	167	0.31
BWA24	43.6756	-79.4017	129	0.24
MBS	43.6757	-79.4106	153	0.28
AWS	43.6757	-79.3928	170	0.31
PCS	43.6757	-79.3928	172	0.32
PCS	43.6757	-79.3928	173	0.32
AWS	43.6758	-79.3936	179	0.33
AWS	43.676	-79.4109	133	0.24
AWS	43.6761	-79.4106	150	0.28
AWS	43.6763	-79.3595	135	0.25
PCS	43.6763	-79.3595	136	0.25
PCS	43.6763	-79.3595	137	0.25
FCFS38	43.6764	-79.3595	136	0.25
AWS	43.6764	-79.3594	139	0.26
AWS	43.6772	-79.445	166	0.3
BWA24	43.6772	-79.3889	51	0.09
AWS	43.6772	-79.3606	173.9	0.32
FCFS38	43.6775	-79.4449	162	0.3
AWS	43.6775	-79.4431	157	0.29
AWS	43.6775	-79.4156	164.9	0.3
AWS	43.6778	-79.4458	167	0.31
PCS	43.6778	-79.4458	171	0.31
MBS	43.6778	-79.4458	173	0.32
PCS	43.6778	-79.3498	124	0.23
PCS	43.6778	-79.3298	49	0.09
MBS	43.678	-79.3608	140	0.26
AWS	43.678	-79.3608	144	0.26
AWS	43.6781	-79.3608	176.1	0.32
AWS	43.6783	-79.4961	156	0.29
MBS	43.6783	-79.4961	158	0.29
AWS	43.6783	-79.4961	162	0.3

AWS	43.6783	-79.4817	146	0.27
AWS	43.6783	-79.2989	152	0.28
PCS	43.6784	-79.4819	155	0.28
MBS	43.6784	-79.4819	157	0.29
FCFS38	43.6785	-79.299	146	0.27
AWS	43.6786	-79.2994	140.5	0.26
AWS	43.6789	-79.3447	129	0.24
AWS	43.6789	-79.3447	129	0.24
AWS	43.6792	-79.3426	135	0.25
MBS	43.6792	-79.3426	136	0.25
PCS	43.6792	-79.3426	137	0.25
PCS	43.6792	-79.3426	140	0.26
AWS	43.6794	-79.4347	166.8	0.31
AWS	43.6794	-79.3219	136	0.25
AWS	43.6794	-79.3217	135.5	0.25
FCFS38	43.6796	-79.3217	132	0.24
FCFS38	43.6796	-79.3217	133	0.24
CELL	43.6799	-79.2975	125	0.23
PCS	43.6799	-79.2975	127	0.23
PCS	43.6803	-79.4355	205	0.38
CELL	43.6803	-79.4355	205	0.38
MBS	43.6803	-79.4355	207	0.38
PCS	43.6803	-79.4355	223	0.41
AWS	43.6803	-79.31	143	0.26
PCS	43.6805	-79.3103	141	0.26
AWS	43.6808	-79.4281	176.2	0.32
AWS	43.6808	-79.4281	186	0.34
AWS	43.6811	-79.2834	176	0.32
PCS	43.6811	-79.2834	178	0.33
PCS	43.6811	-79.2834	180	0.33
AWS	43.6814	-79.2831	175.4	0.32
AWS	43.6817	-79.3908	148	0.27
PCS	43.6817	-79.3341	158	0.29
CELL	43.6817	-79.3341	159	0.29
PCS	43.6817	-79.3341	160	0.29
AWS	43.6817	-79.3341	161	0.3

AWS	43.6817	-79.3339	154.2	0.28
PCS	43.6819	-79.4725	148	0.27
CELL	43.6819	-79.4725	149	0.27
AWS	43.6819	-79.4725	150	0.28
AWS	43.6819	-79.4725	151	0.28
AWS	43.6819	-79.3997	161.1	0.3
AWS	43.6819	-79.3917	141	0.26
MBS	43.6819	-79.3917	143	0.26
AWS	43.6819	-79.3342	159	0.29
AWS	43.6822	-79.4717	150	0.28
AWS	43.6822	-79.4183	219	0.4
PCS	43.6822	-79.4183	221	0.41
FCFS38	43.6824	-79.4727	154	0.28
WBS	43.6825	-79.4992	237	0.43
AWS	43.6831	-79.4372	172	0.32
AWS	43.6831	-79.3228	134.7	0.25
RAC	43.6831	-79.3089	145	0.27
AWS	43.6833	-79.3228	124	0.23
PCS	43.6833	-79.3228	142	0.26
MBS	43.6834	-79.3996	162	0.3
AWS	43.6839	-79.4125	218.3	0.4
PCS	43.6842	-79.4533	165	0.3
AWS	43.6842	-79.3839	150.4	0.28
PCS	43.6842	-79.3724	138	0.25
PCS	43.6844	-79.3844	125	0.23
MBS	43.6844	-79.3844	127	0.23
MBS	43.6844	-79.3844	127	0.23
AWS	43.6844	-79.3495	124	0.23
AWS	43.6844	-79.2953	148.6	0.27
AWS	43.6845	-79.2993	124	0.23
AWS	43.6847	-79.5128	175.9	0.32
AWS	43.6847	-79.2956	155	0.28
FCFS38	43.6849	-79.4108	183	0.34
CELL	43.685	-79.5131	170	0.31
PCS	43.685	-79.5131	173	0.32
PCS	43.685	-79.5131	176	0.32

AWS	43.6853	-79.4456	163.7	0.3
PCS	43.6854	-79.3145	131	0.24
AWS	43.6856	-79.4917	169.1	0.31
AWS	43.6856	-79.4039	185.5	0.34
AWS	43.6857	-79.4041	185	0.34
PCS	43.6857	-79.4041	187	0.34
AWS	43.6858	-79.3925	163.4	0.3
PCS	43.6861	-79.4014	438	0.8
AWS	43.6861	-79.3931	165	0.3
FCFS38	43.6861	-79.3926	170	0.31
AWS	43.6864	-79.4464	180	0.33
AWS	43.6864	-79.4206	221.8	0.41
AWS	43.6864	-79.4136	212	0.39
AWS	43.6864	-79.375	139	0.26
AWS	43.6864	-79.3744	143.5	0.26
PCS	43.6867	-79.3103	18	0.03
PCS	43.6869	-79.4135	209	0.38
MBS	43.6869	-79.4135	211	0.39
PCS	43.6869	-79.3611	117	0.21
AWS	43.6869	-79.3611	119	0.22
AWS	43.6869	-79.3133	145	0.27
AWS	43.6872	-79.2719	139.9	0.26
BRS	43.6874	-79.272	134	0.25
PCS	43.6874	-79.272	136	0.25
RAC	43.6875	-79.3872	202	0.37
WBS	43.6876	-79.3008	241	0.44
AWS	43.6878	-79.425	181	0.33
AWS	43.6881	-79.3978	198.9	0.36
BWA24	43.6881	-79.3953	152	0.28
AWS	43.6881	-79.3944	232	0.43
BWA24	43.6881	-79.3931	149	0.27
AWS	43.6881	-79.3508	169.6	0.31
WCS	43.6881	-79.3016	188	0.34
PCS	43.6881	-79.3016	208	0.38
PCS	43.6881	-79.3016	210	0.39
AWS	43.6881	-79.3003	253	0.46

AWS	43.6883	-79.5033	184	0.34
AWS	43.6883	-79.3136	151.4	0.28
PCS	43.6884	-79.3935	198	0.36
AWS	43.6884	-79.3935	200	0.37
AWS	43.6885	-79.4124	163	0.3
PCS	43.6889	-79.4911	154	0.28
MBS	43.6889	-79.4911	156	0.29
AWS	43.6889	-79.3544	163	0.3
AWS	43.6889	-79.3544	163	0.3
PCS	43.6889	-79.3544	166	0.3
PCS	43.6891	-79.4358	187	0.34
AWS	43.6891	-79.4358	190	0.35
AWS	43.6894	-79.4919	160	0.29
AWS	43.6894	-79.4131	176.1	0.32
AWS	43.6894	-79.3858	154.8	0.28
AWS	43.6894	-79.3417	148.5	0.27
AWS	43.6894	-79.3242	151.5	0.28
FCFS38	43.6895	-79.386	168	0.31
FCFS38	43.6896	-79.3419	155	0.28
AWS	43.6897	-79.3419	147	0.27
PCS	43.6898	-79.3258	32	0.06
PCS	43.69	-79.4642	198	0.36
BRS	43.69	-79.4642	199	0.37
MBS	43.69	-79.4642	201	0.37
FCFS38	43.69	-79.4353	177	0.32
AWS	43.69	-79.4353	186	0.34
AWS	43.69	-79.4353	187	0.34
FCFS38	43.6901	-79.325	156	0.29
MBS	43.6902	-79.3463	152	0.28
PCS	43.6902	-79.3463	153	0.28
PCS	43.6902	-79.3463	155	0.28
PCS	43.6903	-79.4022	151	0.28
AWS	43.6903	-79.383	170	0.31
PCS	43.6903	-79.383	172	0.32
PCS	43.6903	-79.383	175	0.32
AWS	43.6903	-79.3828	163.3	0.3

CELL	43.6903	-79.325	127	0.23
FCFS38	43.6904	-79.3506	151	0.28
AWS	43.6906	-79.4092	179.8	0.33
AWS	43.6906	-79.4019	217	0.4
AWS	43.6906	-79.3503	157	0.29
AWS	43.6906	-79.3253	161	0.3
BWA24	43.6919	-79.4878	131	0.24
AWS	43.6919	-79.4686	215	0.39
AWS	43.6919	-79.4681	214.5	0.39
AWS	43.6926	-79.3164	133	0.24
PCS	43.6926	-79.3164	135	0.25
PCS	43.6928	-79.3342	20	0.04
CELL	43.6933	-79.4033	312	0.57
AWS	43.6936	-79.2786	157.9	0.29
AWS	43.6936	-79.2747	163	0.3
RAC	43.6942	-79.3492	118	0.22
PCS	43.6942	-79.2778	160	0.29
AWS	43.6942	-79.2778	162	0.3
AWS	43.6944	-79.4231	192.7	0.35
BWA24	43.695	-79.4894	131	0.24
RAC	43.695	-79.3594	85	0.16
AWS	43.695	-79.2906	146.2	0.27
PCS	43.6956	-79.4507	218	0.4
PCS	43.6956	-79.4507	221	0.41
AWS	43.6956	-79.4483	224	0.41
FCFS38	43.6956	-79.3985	199	0.37
FCFS38	43.6956	-79.3985	201	0.37
AWS	43.6956	-79.3983	202	0.37
AWS	43.6956	-79.3972	197	0.36
AWS	43.6958	-79.4486	219	0.4
AWS	43.6958	-79.3028	172	0.32
PCS	43.6964	-79.3941	159	0.29
MBS	43.6964	-79.372	165	0.3
AWS	43.6964	-79.372	167	0.31
AWS	43.6964	-79.3719	163.9	0.3
AWS	43.6964	-79.2747	149.6	0.27

AWS	43.6967	-79.2878	189	0.35
BRS	43.6968	-79.287	185	0.34
PCS	43.6968	-79.287	187	0.34
AWS	43.6969	-79.4031	182.7	0.34
RAC	43.6969	-79.3619	132	0.24
BWA24	43.6972	-79.4608	177	0.32
AWS	43.6975	-79.4247	199	0.37
AWS	43.6975	-79.3717	164	0.3
AWS	43.6976	-79.4245	195	0.36
PCS	43.6976	-79.4245	197	0.36
AWS	43.6978	-79.4764	172.5	0.32
FCFS38	43.6978	-79.3856	177	0.32
AWS	43.6978	-79.3856	178.6	0.33
BRS	43.6979	-79.4997	178	0.33
PCS	43.6979	-79.4997	179	0.33
CELL	43.698	-79.4764	163	0.3
MBS	43.698	-79.4764	165	0.3
MBS	43.6981	-79.5008	173.2	0.32
AWS	43.6981	-79.5008	178	0.33
AWS	43.6983	-79.4889	180	0.33
AWS	43.6983	-79.3869	179	0.33
CELL	43.6983	-79.3867	174	0.32
PCS	43.6983	-79.3867	175	0.32
BRS	43.6983	-79.3867	176	0.32
AWS	43.6983	-79.3114	139	0.26
MBS	43.6986	-79.3919	218.5	0.4
PCS	43.6989	-79.3969	172	0.32
CELL	43.6989	-79.3969	176	0.32
MBS	43.6989	-79.3969	178	0.33
AWS	43.6989	-79.2556	189	0.35
AWS	43.6992	-79.2547	183.7	0.34
CELL	43.6994	-79.277	208	0.38
PCS	43.6994	-79.277	217	0.4
PCS	43.6994	-79.2544	179	0.33
AWS	43.6994	-79.2544	191	0.35
PCS	43.6994	-79.2544	193	0.35

PCS	43.6998	-79.3191	138	0.25
PCS	43.6998	-79.3191	140	0.26
BRS	43.6998	-79.3191	142	0.26
FCFS38	43.7002	-79.2978	160	0.29
AWS	43.7003	-79.2978	161	0.3
AWS	43.7006	-79.3428	194	0.36
PCS	43.7008	-79.4597	253	0.46
BRS	43.7008	-79.4596	214	0.39
CELL	43.7008	-79.4596	216	0.4
AWS	43.7008	-79.4596	219	0.4
AWS	43.7008	-79.3428	198	0.36
BWA24	43.7011	-79.5083	131	0.24
FCFS38	43.7011	-79.4507	190	0.35
AWS	43.7011	-79.3975	167.1	0.31
RAC	43.7014	-79.3592	126	0.23
RAC	43.7018	-79.3591	139	0.26
AWS	43.7019	-79.4417	218	0.4
MBS	43.7019	-79.4194	188.8	0.35
AWS	43.7019	-79.3558	212.4	0.39
BRS	43.7019	-79.3358	112	0.21
FCFS38	43.7021	-79.4193	201	0.37
PCS	43.7022	-79.3565	195	0.36
AWS	43.7022	-79.3565	197	0.36
BRS	43.7022	-79.3565	200	0.37
AWS	43.7024	-79.3875	166	0.3
FCFS38	43.7025	-79.4383	195	0.36
AWS	43.7025	-79.4381	196	0.36
BRS	43.7025	-79.4381	197	0.36
PCS	43.7025	-79.4381	198	0.36
CELL	43.7025	-79.4381	199	0.37
PCS	43.7025	-79.3744	170	0.31
MBS	43.7025	-79.3742	172	0.32
PCS	43.7025	-79.3424	185	0.34
BRS	43.7025	-79.3424	187	0.34
PCS	43.7025	-79.3424	192	0.35
AWS	43.7028	-79.3742	169	0.31

AWS	43.7031	-79.2981	163.9	0.3
PCS	43.7031	-79.2981	168	0.31
CELL	43.7031	-79.2981	170	0.31
AWS	43.7033	-79.4128	214	0.39
CELL	43.7033	-79.4125	207	0.38
MBS	43.7033	-79.4125	209	0.38
PCS	43.7033	-79.4125	214	0.39
AWS	43.7036	-79.345	143.1	0.26
AWS	43.7036	-79.2794	186	0.34
AWS	43.7036	-79.2775	106	0.19
MBS	43.7042	-79.4536	198	0.36
BWA24	43.7044	-79.3983	232	0.43
PCS	43.7044	-79.34	182	0.33
AWS	43.7044	-79.34	183	0.34
CELL	43.7044	-79.34	185	0.34
PCS	43.7047	-79.4933	203.6	0.37
AWS	43.7047	-79.3981	187	0.34
AWS	43.7047	-79.3483	162	0.3
PCS	43.7049	-79.4392	192	0.35
AWS	43.705	-79.3606	260	0.48
AWS	43.7053	-79.5036	169	0.31
AWS	43.7054	-79.3122	123	0.23
AWS	43.7055	-79.4028	183	0.34
PCS	43.7055	-79.4028	185	0.34
AWS	43.7056	-79.4897	171	0.31
CELL	43.7056	-79.4897	173	0.32
PCS	43.7056	-79.4897	174	0.32
AWS	43.7056	-79.4267	213	0.39
WBS	43.7056	-79.3977	337	0.62
PCS	43.7057	-79.4268	216	0.4
BRS	43.7057	-79.4268	217	0.4
BWA24	43.7058	-79.47	177	0.32
BWA24	43.7058	-79.4008	159	0.29
MBS	43.7058	-79.3983	225.8	0.41
PCS	43.7062	-79.4183	182	0.33
AWS	43.7067	-79.3956	208	0.38

AWS	43.7069	-79.3919	203.3	0.37
AWS	43.7069	-79.2947	160	0.29
AWS	43.7071	-79.3987	167	0.31
AWS	43.7071	-79.3968	206	0.38
PCS	43.7071	-79.3968	207	0.38
MBS	43.7072	-79.4803	222.9	0.41
AWS	43.7072	-79.3966	164	0.3
MBS	43.7075	-79.4003	234.3	0.43
AWS	43.7078	-79.3444	229	0.42
AWS	43.7081	-79.5044	168	0.31
AWS	43.7083	-79.4106	195	0.36
BRS	43.7083	-79.4106	196	0.36
PCS	43.7083	-79.4106	198	0.36
CELL	43.7083	-79.3108	145	0.27
AWS	43.7083	-79.3108	145.3	0.27
BRS	43.7083	-79.3108	147	0.27
PCS	43.7086	-79.4783	193	0.35
CELL	43.7086	-79.4783	200	0.37
AWS	43.7086	-79.39	193	0.35
CELL	43.7086	-79.39	195	0.36
PCS	43.7086	-79.39	196	0.36
BRS	43.7086	-79.3225	118	0.22
FCFS38	43.7086	-79.3111	148	0.27
FCFS38	43.7088	-79.4794	200	0.37
AWS	43.7089	-79.4794	199	0.37
MBS	43.7089	-79.3978	198	0.36
AWS	43.7089	-79.39	192	0.35
MBS	43.7089	-79.3883	202.2	0.37
MBS	43.7102	-79.5119	159	0.29
CELL	43.7102	-79.5119	161	0.3
FCFS38	43.7102	-79.3799	187	0.34
AWS	43.7103	-79.3983	188	0.34
AWS	43.7103	-79.38	192	0.35
AWS	43.7103	-79.3783	176.5	0.32
MBS	43.7103	-79.3783	176.5	0.32
PCS	43.7105	-79.3786	28	0.05

FWA	43.7105	-79.3786	180.9	0.33
FWA	43.7105	-79.3786	181	0.33
BRS	43.7106	-79.2967	158	0.29
AWS	43.7107	-79.5057	157	0.29
CELL	43.7107	-79.5057	163	0.3
PCS	43.7108	-79.3983	205	0.38
CELL	43.7108	-79.3983	207	0.38
MBS	43.7108	-79.3983	209	0.38
PCS	43.7108	-79.3983	212	0.39
PCS	43.7111	-79.4661	161.5	0.3
AWS	43.7111	-79.3975	191.1	0.35
MBS	43.7111	-79.2706	190	0.35
RAC	43.7114	-79.3497	202	0.37
AWS	43.7118	-79.3578	136	0.25
AWS	43.7119	-79.3931	192.8	0.35
CELL	43.7122	-79.2844	173	0.32
AWS	43.7122	-79.2844	175	0.32
BRS	43.7123	-79.2709	189	0.35
CELL	43.7123	-79.2709	191	0.35
BRS	43.7125	-79.4433	198.2	0.36
BWA24	43.7125	-79.3494	131	0.24
AWS	43.7125	-79.2711	172	0.32
RAC	43.7125	-79.2581	166	0.3
RAC	43.7125	-79.2578	181	0.33
AWS	43.7125	-79.2481	198	0.36
CELL	43.7125	-79.2475	214	0.39
PCS	43.7125	-79.2475	216	0.4
PCS	43.7125	-79.2475	223	0.41
AWS	43.7128	-79.3942	253	0.46
BWA24	43.7128	-79.3514	131	0.24
BWA24	43.7128	-79.3136	106	0.19
MBS	43.7128	-79.2472	209.5	0.38
FCFS38	43.713	-79.3662	156	0.29
BWA24	43.7131	-79.4578	185	0.34
MBS	43.7131	-79.455	215.5	0.4
MBS	43.7131	-79.455	221	0.41

CELL	43.7131	-79.455	222	0.41
PCS	43.7131	-79.455	225	0.41
MBS	43.7131	-79.3661	156.2	0.29
AWS	43.7131	-79.3661	162	0.3
PCS	43.7131	-79.3248	150	0.28
BRS	43.7131	-79.3248	153	0.28
AWS	43.7133	-79.4553	218	0.4
FCFS38	43.7133	-79.455	214	0.39
AWS	43.7133	-79.3661	164	0.3
PCS	43.7133	-79.3661	166	0.3
RAC	43.7133	-79.2578	145	0.27
PCS	43.7135	-79.3921	191	0.35
RAC	43.7139	-79.3486	124	0.23
BRS	43.7139	-79.3156	106	0.19
PCS	43.7148	-79.4509	358	0.66
MBS	43.715	-79.3306	200.2	0.37
RAC	43.715	-79.2556	178	0.33
RAC	43.715	-79.2556	204	0.37
MBS	43.7153	-79.3578	142.6	0.26
AWS	43.7154	-79.3579	135	0.25
FCFS38	43.7155	-79.3046	174	0.32
AWS	43.7156	-79.3047	176	0.32
AWS	43.7158	-79.5097	167	0.31
AWS	43.7158	-79.3361	168	0.31
AWS	43.7158	-79.3361	179	0.33
BWA24	43.7158	-79.3306	210	0.39
AWS	43.7161	-79.3306	197	0.36
AWS	43.7164	-79.5061	154	0.28
BRS	43.7164	-79.3933	173.7	0.32
AWS	43.7164	-79.3389	131	0.24
AWS	43.7165	-79.3389	246	0.45
RAC	43.7167	-79.3872	202	0.37
AWS	43.7169	-79.4297	229	0.42
AWS	43.7169	-79.3094	162	0.3
CELL	43.717	-79.4441	195	0.36
BWA24	43.7172	-79.4672	186	0.34

AWS	43.7175	-79.3772	168	0.31
PCS	43.718	-79.5104	157	0.29
PCS	43.718	-79.5104	160	0.29
BRS	43.718	-79.5104	162	0.3
PCS	43.718	-79.5104	165	0.3
AWS	43.7181	-79.4011	192	0.35
PCS	43.7181	-79.3286	144	0.26
AWS	43.7181	-79.3286	148	0.27
BWA24	43.7183	-79.4692	150	0.28
FCFS38	43.7183	-79.3298	149	0.27
PCS	43.7185	-79.4456	183	0.34
CELL	43.7186	-79.43	202	0.37
AWS	43.7186	-79.43	205	0.38
MBS	43.7189	-79.4289	207	0.38
PCS	43.7189	-79.3019	197	0.36
MBS	43.7189	-79.3019	198	0.36
PCS	43.7189	-79.3019	199	0.37
CELL	43.7195	-79.3374	196	0.36
AWS	43.7195	-79.3374	198	0.36
MBS	43.7203	-79.2389	209.7	0.38
PCS	43.7204	-79.339	145	0.27
MBS	43.7205	-79.4825	190	0.35
CELL	43.7205	-79.4825	192	0.35
FCFS38	43.7205	-79.2391	209	0.38
AWS	43.7206	-79.2392	205	0.38
PCS	43.7209	-79.5125	6	0.01
PCS	43.7211	-79.2392	206	0.38
MBS	43.7214	-79.3747	172.3	0.32
PCS	43.7214	-79.3747	176	0.32
AWS	43.7217	-79.375	187	0.34
MBS	43.7219	-79.5078	163	0.3
MBS	43.7219	-79.3356	162.5	0.3
FCFS38	43.722	-79.4309	211	0.39
PCS	43.7221	-79.3015	168	0.31
MBS	43.7222	-79.4861	186.7	0.34
AWS	43.7222	-79.4314	212	0.39

AWS	43.7222	-79.4136	194	0.36
MBS	43.7222	-79.4136	196.8	0.36
FCFS38	43.7223	-79.4137	196	0.36
CELL	43.7223	-79.4136	26	0.05
AWS	43.7223	-79.4136	28	0.05
PCS	43.7225	-79.4814	187	0.34
PCS	43.7225	-79.3411	141	0.26
RAC	43.7225	-79.3222	85	0.16
AWS	43.723	-79.4665	207	0.38
CELL	43.723	-79.4665	210	0.39
FWA	43.723	-79.4665	216.7	0.4
FWA	43.723	-79.4665	217	0.4
PCS	43.723	-79.4665	218	0.4
PCS	43.7231	-79.4956	183	0.34
BRS	43.7231	-79.4956	186	0.34
CELL	43.7231	-79.4956	188	0.34
MBS	43.7231	-79.2894	175.5	0.32
BWA24	43.7233	-79.3478	122	0.22
MBS	43.7236	-79.4022	204	0.37
FCFS38	43.7237	-79.4023	198	0.36
FCFS38	43.7237	-79.4023	203	0.37
AWS	43.7238	-79.2997	3	0.01
CELL	43.7239	-79.2549	191	0.35
PCS	43.7239	-79.2549	193	0.35
AWS	43.7242	-79.5122	183	0.34
WBS	43.7242	-79.5108	222	0.41
PCS	43.7242	-79.4883	232	0.43
PCS	43.7245	-79.4864	176	0.32
AWS	43.7247	-79.4939	190	0.35
MBS	43.7247	-79.4303	203.1	0.37
MBS	43.7247	-79.275	199.2	0.37
BRS	43.7248	-79.2753	181	0.33
CELL	43.7248	-79.2753	183	0.34
MBS	43.7248	-79.2753	184	0.34
CELL	43.725	-79.4489	205	0.38
PCS	43.725	-79.4489	209	0.38

MBS	43.725	-79.4489	215.1	0.39
PCS	43.7253	-79.4528	187	0.34
AWS	43.7256	-79.4028	191	0.35
PCS	43.7256	-79.4025	183	0.34
CELL	43.7256	-79.4025	192	0.35
MBS	43.7256	-79.4025	194	0.36
BWA24	43.7256	-79.3486	127	0.23
BWA24	43.7256	-79.3411	117	0.21
AWS	43.7258	-79.4811	210	0.39
MBS	43.7258	-79.4589	225	0.41
BWA24	43.7258	-79.3489	144	0.26
MBS	43.7258	-79.3489	147.8	0.27
BWA24	43.7258	-79.3489	195	0.36
BWA24	43.7258	-79.2925	165	0.3
PCS	43.7261	-79.4543	191	0.35
MBS	43.7261	-79.3125	175.4	0.32
AWS	43.7261	-79.3036	177	0.32
BWA24	43.7261	-79.28	165	0.3
BWA24	43.7261	-79.2783	10	0.02
CELL	43.7262	-79.2318	201	0.37
PCS	43.7262	-79.2318	205	0.38
CELL	43.7264	-79.4862	224	0.41
BRS	43.7264	-79.4862	227	0.42
AWS	43.7265	-79.3128	148	0.27
BRS	43.7266	-79.4553	214	0.39
CELL	43.7266	-79.4553	215	0.39
PCS	43.7266	-79.4553	216	0.4
AWS	43.7266	-79.4553	223	0.41
AWS	43.7266	-79.3312	3	0.01
BRS	43.7266	-79.2877	193	0.35
CELL	43.7266	-79.2877	196	0.36
WBS	43.727	-79.3249	269	0.49
CELL	43.7272	-79.3318	164	0.3
MBS	43.7275	-79.3808	179	0.33
CELL	43.7275	-79.2975	163	0.3
MBS	43.7275	-79.2514	218.6	0.4

AWS	43.7275	-79.2511	232	0.43
CELL	43.7278	-79.2969	196	0.36
BRS	43.7278	-79.2969	198	0.36
PCS	43.7278	-79.2969	200	0.37
PCS	43.7278	-79.2969	212	0.39
AWS	43.7281	-79.4178	195	0.36
MBS	43.7281	-79.2969	311.7	0.57
AWS	43.7283	-79.3238	190	0.35
CELL	43.7283	-79.3238	192	0.35
CELL	43.7283	-79.3238	192	0.35
PCS	43.7283	-79.3238	193	0.35
AWS	43.7286	-79.3811	179	0.33
PCS	43.7286	-79.3286	139	0.26
PCS	43.729	-79.3388	135	0.25
AWS	43.7294	-79.4586	215	0.39
MBS	43.73	-79.3322	166	0.3
CELL	43.7301	-79.5098	203	0.37
BRS	43.7301	-79.5098	205	0.38
CELL	43.7301	-79.4191	180	0.33
CELL	43.7302	-79.3411	157	0.29
BRS	43.7302	-79.3411	159	0.29
FCFS38	43.7302	-79.3321	162	0.3
MBS	43.7303	-79.4833	197	0.36
MBS	43.7303	-79.4189	187.2	0.34
MBS	43.7303	-79.4036	178.5	0.33
AWS	43.7303	-79.3322	173	0.32
CELL	43.7304	-79.4333	220	0.4
BRS	43.7304	-79.4333	222	0.41
AWS	43.7308	-79.4397	234	0.43
PCS	43.7308	-79.355	168	0.31
BRS	43.7308	-79.355	170	0.31
CELL	43.7308	-79.355	172	0.32
MBS	43.7314	-79.5111	162.5	0.3
CELL	43.7317	-79.2781	191	0.35
PCS	43.7317	-79.2781	193	0.35
PCS	43.7317	-79.2781	194	0.36

FCFS38	43.7317	-79.2779	191	0.35
MBS	43.7317	-79.2778	185.3	0.34
AWS	43.7317	-79.2778	196	0.36
BWA24	43.7319	-79.4525	10	0.02
CELL	43.7322	-79.4603	206	0.38
MBS	43.7322	-79.4431	204.5	0.38
BRS	43.7325	-79.3683	166	0.3
AWS	43.7333	-79.4039	185	0.34
CELL	43.7334	-79.4039	188	0.34
AWS	43.7339	-79.3492	175	0.32
FCFS38	43.7339	-79.3489	168	0.31
AWS	43.7344	-79.3978	161	0.3
MBS	43.7344	-79.3803	158	0.29
MBS	43.7345	-79.3811	177	0.32
PCS	43.7345	-79.3811	178	0.33
CELL	43.7345	-79.3811	179	0.33
MBS	43.7345	-79.3811	180	0.33
BRS	43.7345	-79.3811	182	0.33
FCFS38	43.7345	-79.3806	175	0.32
FCFS38	43.7346	-79.4452	206	0.38
CELL	43.7347	-79.4452	210	0.39
MBS	43.7353	-79.4331	200	0.37
MBS	43.7353	-79.2686	191.9	0.35
AWS	43.7356	-79.2686	196	0.36
MBS	43.7358	-79.2561	226.5	0.42
MBS	43.736	-79.2852	190	0.35
CELL	43.736	-79.2852	192	0.35
BRS	43.736	-79.2852	194	0.36
PCS	43.736	-79.2852	196	0.36
AWS	43.7361	-79.2564	218	0.4
MBS	43.7364	-79.3442	166.9	0.31
MBS	43.7367	-79.4719	207	0.38
AWS	43.7367	-79.4356	215	0.39
CELL	43.7369	-79.2583	206	0.38
MBS	43.7369	-79.2583	208	0.38
BRS	43.7369	-79.2583	209	0.38

CELL	43.7372	-79.3431	178	0.33
PCS	43.7372	-79.3431	180	0.33
AWS	43.7375	-79.5114	190	0.35
AWS	43.7376	-79.4346	199	0.37
PCS	43.7386	-79.3558	182.5	0.33
CELL	43.7392	-79.4269	213	0.39
AWS	43.7392	-79.4269	216	0.4
BRS	43.7392	-79.4269	218	0.4
PCS	43.7392	-79.4269	219	0.4
PCS	43.7394	-79.4739	212	0.39
BWA24	43.7397	-79.4192	178	0.33
PCS	43.7397	-79.2394	199.8	0.37
MBS	43.7399	-79.2394	204	0.37
CELL	43.7399	-79.2394	206	0.38
PCS	43.7399	-79.2394	212	0.39
FCFS38	43.7403	-79.4227	225	0.41
MBS	43.7403	-79.4225	223.9	0.41
AWS	43.7403	-79.4225	229	0.42
BRS	43.7403	-79.3098	193	0.35
CELL	43.7403	-79.3098	196	0.36
AWS	43.7404	-79.4797	210	0.39
CELL	43.7404	-79.4797	212	0.39
PCS	43.7404	-79.4797	214	0.39
CELL	43.7404	-79.4226	230	0.42
PCS	43.7404	-79.4226	232	0.43
MBS	43.7406	-79.3283	161.1	0.3
AWS	43.7406	-79.31	197	0.36
CELL	43.7407	-79.4055	92	0.17
BRS	43.7407	-79.4055	94	0.17
BWA24	43.7408	-79.315	160	0.29
BRS	43.7409	-79.3278	162	0.3
CELL	43.7409	-79.3278	164	0.3
PCS	43.7409	-79.3278	165	0.3
PCS	43.7411	-79.4797	215	0.39
MBS	43.7411	-79.3106	200	0.37
AWS	43.7411	-79.2417	195	0.36

AWS	43.7414	-79.3292	166	0.3
MBS	43.7417	-79.4536	208.5	0.38
RAC	43.7417	-79.3731	202	0.37
CELL	43.7422	-79.3058	187	0.34
PCS	43.7422	-79.3058	189	0.35
PCS	43.7422	-79.3058	195	0.36
PCS	43.7433	-79.4719	207	0.38
MBS	43.7444	-79.4864	194.5	0.36
PCS	43.7444	-79.4044	160	0.29
AWS	43.7447	-79.49	198	0.36
AWS	43.7447	-79.4062	141	0.26
PCS	43.7448	-79.4063	166	0.3
BWA24	43.7453	-79.2861	177	0.32
CELL	43.7454	-79.2904	182	0.33
PCS	43.7454	-79.2904	184	0.34
BRS	43.7454	-79.2904	188	0.34
BRS	43.7454	-79.2904	188	0.34
CELL	43.7455	-79.4785	208	0.38
PCS	43.7457	-79.4067	145	0.27
MBS	43.7461	-79.4078	155.5	0.29
MBS	43.7467	-79.3464	148.6	0.27
FCFS38	43.7468	-79.4885	207	0.38
AWS	43.7469	-79.5131	214	0.39
AWS	43.7469	-79.4881	209	0.38
CELL	43.7469	-79.4881	210	0.39
PCS	43.7469	-79.4881	212	0.39
PCS	43.7469	-79.4881	218	0.4
AWS	43.7469	-79.3528	164	0.3
AWS	43.7469	-79.2856	219	0.4
MBS	43.7469	-79.285	205	0.38
FCFS38	43.7471	-79.3528	177	0.32
FCFS38	43.7471	-79.2852	203	0.37
FCFS38	43.7471	-79.2852	204	0.37
CELL	43.7476	-79.3541	174	0.32
BRS	43.7476	-79.3541	180	0.33
CELL	43.7477	-79.3841	172	0.32

RAC	43.7478	-79.4772	195	0.36
RAC	43.7478	-79.4772	208	0.38
MBS	43.7478	-79.3839	175	0.32
PCS	43.7481	-79.2739	214	0.39
PCS	43.7481	-79.2739	217	0.4
FCFS38	43.7486	-79.4372	207	0.38
BRS	43.7489	-79.2489	180	0.33
MBS	43.7494	-79.4375	202.7	0.37
BRS	43.7494	-79.3264	210	0.39
BRS	43.7497	-79.4997	168	0.31
AWS	43.7497	-79.2639	199	0.37
FCFS38	43.7507	-79.264	192	0.35
MBS	43.7511	-79.5114	216.2	0.4
BRS	43.7517	-79.3961	182	0.33
PCS	43.7521	-79.3557	18	0.03
AWS	43.7525	-79.4539	216	0.4
CELL	43.7525	-79.3154	207	0.38
MBS	43.7525	-79.315	222	0.41
AWS	43.7528	-79.4381	218	0.4
CELL	43.7528	-79.4103	196	0.36
PCS	43.7528	-79.4103	199	0.37
PCS	43.753	-79.2608	179	0.33
CELL	43.753	-79.2608	181	0.33
BRS	43.7531	-79.4836	212	0.39
CELL	43.7531	-79.4606	217	0.4
AWS	43.7531	-79.4606	219	0.4
BRS	43.7531	-79.4606	221	0.41
MBS	43.7531	-79.4606	223.4	0.41
PCS	43.7531	-79.4606	225	0.41
CELL	43.7535	-79.3612	191	0.35
PCS	43.7535	-79.3612	193	0.35
PCS	43.7535	-79.3612	198	0.36
MBS	43.7536	-79.3619	210	0.39
MBS	43.7536	-79.3618	195	0.36
CELL	43.7536	-79.3618	197	0.36
BRS	43.7536	-79.3618	199	0.37

MBS	43.7536	-79.3608	193.4	0.35
BWA24	43.7536	-79.2722	130	0.24
FCFS38	43.7537	-79.362	194	0.36
MBS	43.7539	-79.265	181.3	0.33
PCS	43.7542	-79.4375	215	0.39
BRS	43.7542	-79.4375	218	0.4
MBS	43.7542	-79.4078	201.5	0.37
PCS	43.7542	-79.3894	136	0.25
CELL	43.7542	-79.3339	168	0.31
PCS	43.7542	-79.3339	171	0.31
MBS	43.7544	-79.3333	226.3	0.42
AWS	43.7544	-79.3331	200	0.37
BWA24	43.7544	-79.2883	159	0.29
FCFS38	43.7545	-79.3333	238	0.44
BWA24	43.7547	-79.4847	10	0.02
AWS	43.7547	-79.3614	201	0.37
BWA24	43.7547	-79.3469	183	0.34
AWS	43.7549	-79.2899	194	0.36
CELL	43.7549	-79.2899	196	0.36
PCS	43.755	-79.2436	175	0.32
AWS	43.7553	-79.2439	178	0.33
CELL	43.7556	-79.3471	157	0.29
PCS	43.7556	-79.3471	159	0.29
PCS	43.7556	-79.3471	161	0.3
AWS	43.7556	-79.3471	162	0.3
MBS	43.7558	-79.2497	195.3	0.36
PCS	43.7558	-79.2469	185	0.34
CELL	43.7558	-79.2408	188	0.34
BRS	43.7558	-79.2408	190	0.35
PCS	43.7558	-79.2408	191	0.35
PCS	43.756	-79.2467	155	0.28
MBS	43.7561	-79.4739	209	0.38
AWS	43.7561	-79.41	205	0.38
CELL	43.7562	-79.2501	187	0.34
AWS	43.7564	-79.4894	221	0.41
CELL	43.7564	-79.2469	84	0.15

BWA24	43.7567	-79.2697	175	0.32
MBS	43.7569	-79.4908	217.4	0.4
PCS	43.7572	-79.3117	48	0.09
PCS	43.7574	-79.4752	93	0.17
BWA24	43.7581	-79.3597	127	0.23
MBS	43.7583	-79.4386	220	0.4
BWA24	43.7583	-79.3008	132	0.24
FCFS38	43.7586	-79.4388	212	0.39
PCS	43.7586	-79.4225	189.9	0.35
BWA24	43.7592	-79.41	243	0.45
PCS	43.7594	-79.41	265	0.49
MBS	43.7594	-79.3497	167	0.31
FCFS38	43.7599	-79.4645	211	0.39
MBS	43.76	-79.4644	210.2	0.39
AWS	43.76	-79.4644	211	0.39
PCS	43.7608	-79.4132	181	0.33
MBS	43.7608	-79.3883	188.5	0.35
MBS	43.7611	-79.5097	211.8	0.39
AWS	43.7611	-79.3914	201	0.37
PCS	43.7611	-79.3628	165	0.3
CELL	43.7611	-79.3628	167	0.31
BRS	43.7611	-79.3628	169	0.31
AWS	43.7612	-79.3918	30	0.06
PCS	43.7612	-79.3918	33	0.06
CELL	43.7612	-79.3918	40	0.07
CELL	43.7613	-79.5104	201	0.37
BRS	43.7613	-79.5104	203	0.37
CELL	43.7614	-79.4131	217	0.4
MBS	43.7614	-79.4128	214.5	0.39
PCS	43.7614	-79.3906	206	0.38
CELL	43.7614	-79.3906	211	0.39
BRS	43.7614	-79.3906	213	0.39
AWS	43.7614	-79.3631	165	0.3
AWS	43.7614	-79.3011	183	0.34
MBS	43.7614	-79.3011	194	0.36
CELL	43.7614	-79.3011	204	0.37

PCS	43.7614	-79.3011	206	0.38
BRS	43.7614	-79.3011	208	0.38
MBS	43.7614	-79.3011	209.6	0.38
PCS	43.7616	-79.466	193	0.35
PCS	43.7616	-79.4108	178	0.33
PCS	43.7616	-79.4108	263	0.48
AWS	43.7617	-79.4131	216	0.4
PCS	43.7617	-79.4081	173	0.32
BWA24	43.7619	-79.4817	204	0.37
BWA24	43.7622	-79.4844	207	0.38
CELL	43.7625	-79.4768	220	0.4
PCS	43.7625	-79.4768	222	0.41
MBS	43.7625	-79.4768	224	0.41
BRS	43.7625	-79.4768	226	0.41
AWS	43.7625	-79.3378	214	0.39
CELL	43.7627	-79.4081	204	0.37
BRS	43.7627	-79.2707	190	0.35
CELL	43.7627	-79.2707	192	0.35
MBS	43.7628	-79.3378	219.4	0.4
FCFS38	43.7629	-79.3379	227	0.42
PCS	43.763	-79.3176	231	0.42
AWS	43.763	-79.3176	235	0.43
CELL	43.763	-79.3176	237	0.43
MBS	43.7631	-79.3192	230.6	0.42
BRS	43.7633	-79.4031	185.9	0.34
PCS	43.7635	-79.4078	173	0.32
AWS	43.7639	-79.4978	228	0.42
PCS	43.7644	-79.4917	230.3	0.42
CELL	43.7644	-79.4917	232	0.43
BRS	43.7644	-79.4917	233	0.43
PCS	43.7644	-79.4917	238	0.44
BWA24	43.7644	-79.2944	177	0.32
CELL	43.7655	-79.4138	262	0.48
PCS	43.7655	-79.4138	265	0.49
AWS	43.7658	-79.5108	226	0.41
PCS	43.7658	-79.3756	206	0.38

AWS	43.7661	-79.4117	257	0.47
CELL	43.7669	-79.3649	174	0.32
PCS	43.7669	-79.3649	176	0.32
PCS	43.7675	-79.3689	92	0.17
MBS	43.7675	-79.2828	221	0.41
PCS	43.7676	-79.4127	171	0.31
MBS	43.7678	-79.4742	219	0.4
BWA24	43.7678	-79.4742	244	0.45
MBS	43.7678	-79.4119	217	0.4
CELL	43.7681	-79.4111	247	0.45
PCS	43.7681	-79.4111	249	0.46
AWS	43.7681	-79.2844	207	0.38
MBS	43.7683	-79.3825	243	0.45
AWS	43.7683	-79.3483	201	0.37
MBS	43.7683	-79.3456	228	0.42
AWS	43.7683	-79.2672	181	0.33
PCS	43.7685	-79.3863	179	0.33
CELL	43.7685	-79.3828	222	0.41
AWS	43.7686	-79.3828	223	0.41
PCS	43.7689	-79.3419	200	0.37
CELL	43.7689	-79.3419	217	0.4
PCS	43.7689	-79.3217	204	0.37
PCS	43.7689	-79.3217	205	0.38
CELL	43.7689	-79.3217	207	0.38
CELL	43.7692	-79.4621	218	0.4
MBS	43.7694	-79.3831	229.8	0.42
MBS	43.7694	-79.3625	173.1	0.32
RAC	43.7694	-79.2939	179	0.33
PCS	43.7695	-79.2848	206	0.38
CELL	43.7695	-79.2848	208	0.38
PCS	43.7696	-79.3331	123	0.23
MBS	43.7696	-79.3028	174	0.32
MBS	43.7696	-79.3028	176	0.32
BRS	43.7696	-79.3028	178	0.33
CELL	43.7696	-79.3028	180	0.33
CELL	43.7697	-79.3831	105	0.19

PCS	43.7697	-79.333	124	0.23
PCS	43.7697	-79.3319	173	0.32
PCS	43.7697	-79.3305	123	0.23
RAC	43.7697	-79.2939	179	0.33
BWA24	43.77	-79.29	171	0.31
CELL	43.7703	-79.2644	194	0.36
BRS	43.7703	-79.2644	199	0.37
PCS	43.7703	-79.2644	308	0.57
MBS	43.7706	-79.2606	202	0.37
MBS	43.7708	-79.4492	225.5	0.41
BWA24	43.7711	-79.3236	181	0.33
CELL	43.7714	-79.5014	228	0.42
PCS	43.7714	-79.5014	229	0.42
BRS	43.7714	-79.5014	230	0.42
MBS	43.7717	-79.3375	215.1	0.39
MBS	43.7719	-79.4142	236.8	0.43
MBS	43.7722	-79.2992	195	0.36
MBS	43.7725	-79.5086	230.5	0.42
MBS	43.7725	-79.5039	237.2	0.44
PCS	43.7725	-79.4519	249	0.46
PCS	43.7725	-79.4519	250	0.46
BWA24	43.7725	-79.3289	248	0.46
WBS	43.7725	-79.3278	253	0.46
AWS	43.7726	-79.3289	116	0.21
MBS	43.7728	-79.4994	214.2	0.39
CELL	43.7728	-79.4431	212	0.39
PCS	43.7728	-79.4431	213	0.39
MBS	43.7728	-79.3311	207.6	0.38
CELL	43.7733	-79.5044	233	0.43
MBS	43.7733	-79.4422	201.6	0.37
BWA24	43.7733	-79.3675	179	0.33
AWS	43.7733	-79.3419	226	0.41
PCS	43.7734	-79.2595	3	0.01
BWA24	43.7736	-79.3358	10	0.02
MBS	43.7736	-79.2542	207.5	0.38
FCFS38	43.7738	-79.2543	205	0.38

CELL	43.774	-79.2543	203	0.37
BRS	43.774	-79.2543	205	0.38
BRS	43.774	-79.2543	291	0.53
MBS	43.7742	-79.4756	245.8	0.45
AWS	43.7742	-79.25	242	0.44
BRS	43.775	-79.3111	194	0.36
AWS	43.7753	-79.5028	230	0.42
MBS	43.7753	-79.2444	190	0.35
AWS	43.7756	-79.4153	227	0.42
CELL	43.7756	-79.2447	183	0.34
PCS	43.7756	-79.2447	189	0.35
MBS	43.7758	-79.415	219	0.4
CELL	43.7758	-79.415	225	0.41
BRS	43.7758	-79.415	226	0.41
PCS	43.7758	-79.415	228	0.42
FWA	43.7759	-79.4151	230	0.42
MBS	43.7761	-79.4919	220.7	0.4
AWS	43.7761	-79.4919	227	0.42
AWS	43.7761	-79.4431	216	0.4
MBS	43.7761	-79.3483	224.3	0.41
MBS	43.7761	-79.3211	235	0.43
CELL	43.7761	-79.2578	171	0.31
AWS	43.7761	-79.2578	183	0.34
BWA24	43.7764	-79.4756	207	0.38
AWS	43.7764	-79.2747	196	0.36

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