Habitual Instinct

Jordan Shaw

A thesis exhibition presented to OCAD University
in partial fulfillment of the requirements for the degree of
MASTER of FINE ARTS (MFA) in DIGITAL FUTURES

OCAD University Open Gallery, April, 2017
Toronto, Ontario, Canada, April, 2017

You are free to:

- **Share** — copy and redistribute the material in any medium or format
- **Adapt** — remix, transform, and build upon the material

The licensor cannot revoke these freedoms as long as you follow the license terms.

Under the following terms:

- **Attribution** — You must give appropriate credit, provide a link to the license, and indicate if changes were made. You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use.
- **NonCommercial** — You may not use the material for commercial purposes.
- **ShareAlike** — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original.
- **No additional restrictions** — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits.

Notices:

You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation.

No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material.

Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I authorize OCAD University to lend this thesis to other institutions or individuals for the purpose of scholarly research.

I understand that my thesis may be made electronically available to the public.

I further authorize OCAD University to reproduce this thesis by photocopying or by other means, in total or in part, at the request of other institutions or individuals for the purpose of scholarly research.

Signature _____

Habitual Instinct

Jordan Shaw

OCAD University

MASTER of FINE ARTS (MFA) in DIGITAL FUTURES

2017

Abstract

Habitual Instinct challenges the predefined expectations participants hold with their relationship to technology and data by exposing anthropomorphic projections onto autonomous systems. The role *Habitual Instinct* has with its participants is to instigate continual reflection after participants leave the installation and interact with technology in their day-to-day activities. By creating a speculative scenario that is counter-intuitive to everyday experiences with interactive technology, the installation helps participants identify themes and behaviours that have become habitual by acknowledging the effect surrounding their experience and potential feelings. Recurring themes that materialize during interaction with the artwork include: challenging the status quo on how technology acknowledges and responds to interactions; autonomous systems and “alien agency”; digital data collection; connection between the self and digital representation through data visualizations; and data transparency and user privacy. These themes promote an open discussion surrounding their relationship with the power structure between society and corporate or governmental interest.

Keywords: installation, robotics, autonomous system, interaction, speculative design, alien agency, object-oriented-ontology, performance

I would like to acknowledge the ongoing encouragement and unconditional support I have received from both my family and friends. I am grateful to have each and every one of you. You have always challenged me and have been a source of inspiration throughout my life. Without all of you, my thesis would not have been possible. Thank you for believing in me.

Table of Contents

Table of Figures

Introduction

Figure 1.0. Habitual Instinct, 2017. OCAD U, Open Gallery.

Habitual Instinct explores and challenges the expectations and ideas that people hold in relation to technology and the ever increasing digital aspect of our lives. A certain dogma has developed regarding how users should interact with and use electronic devices, and how these connected objects should respond to those interactions. Why is there a particular expectation, or even any anticipated response expected, from an object that we're interacting with? *Habitual Instinct* requires users to participate and acknowledge their relationships with technology. The installation is intended to contradict what users may expect, through their interactions with 60 autonomous robots. These robots attempt to understand their surroundings by taking and interpreting measurement data collected through their ultrasonic sensors. Though they are interested in understanding their environment, they also endeavour to not directly engage with human viewers. *Habitual Instinct* also reveals the complexities of the infrastructure required to sustain the level of connectedness currently expected in our society. The project examines

the reasons organizations seek to gather and analyze user behaviour data and the positives and the negatives of this practice for the user. *Habitual Instinct* demonstrates the importance of knowing what information can be collected and stored through the physical surroundings, where the data may be stored, and who has access to it. Online behaviour analytics benefit corporate interests; this is why they can provide seemingly “free” services to users.

This topic opens the door to speculation about an alternative future where society's relationship with technology is different than it is in 2017. Much of the current digital economy is based on the advertising revenue generated by clicks. Similarly to clicking on links or directly providing personal information, data can be sourced from human movement, interactions, and behaviour in the physical world. Such data-sourcing objects might coerce humans to interact with them, but the system only consumes their interactions, and perhaps nothing of value or importance is returned to the human. An example of this unusual interaction with technology would be upon requesting directions from a map application the user received either unclear directions or no directions at all. Then, while the user is trying to navigate to their desired destination, the mapping application starts suggesting nearby restaurants for them to stop at for a meal. This sort of assumption would be completely based on, current location and past eating habits.

We can hypothesize what the emotional implications may be if the relationship becomes flipped, where the interactions are focused on benefiting the advancements of the technology rather than those of humans. What are the affective qualities of such an alien interaction? What would the users experience when exposed to this form of interaction? For example, would this type of interaction be perceived as “glitched”? The feeling of having lost control of our embodiment and presence might occur.

Using technology, *Habitual Instinct* looks at how an unsettling feeling about the current state of technology might help us become wiser, and demonstrate the importance of having a continual open dialogue about how we see technology fit into our future. A part of this conversation is to learn and

accept the adoption of Artificial Intelligence (AI) in a smart and sustainable way. The intention of creating a piece of work that attempts to provoke a feeling of uncertainty is to focus on the value, both socially and monetarily, that users generate when they participate, share and interact with the digitally connected world.

To try and demonstrate the intangibility and abstractness of digital interactions, *Habitual Instinct* aims to concretize the physical interactions that users perform with the installation and communicate this data in real time to them in a conceptually provocative way. By offering an experience of a potential future where human interactions are taken for granted by technology, *Habitual Instinct* prompts the participant to question their own understanding of their behaviour online and in the physically connected present, their digital and monetary value as an individual, the idea of permanent information, and their assumptions about data analysis and research. All of this is to try to instigate a re-evaluation of our online and physical use of technology from the point of view of security and privacy.

Thesis Background Information

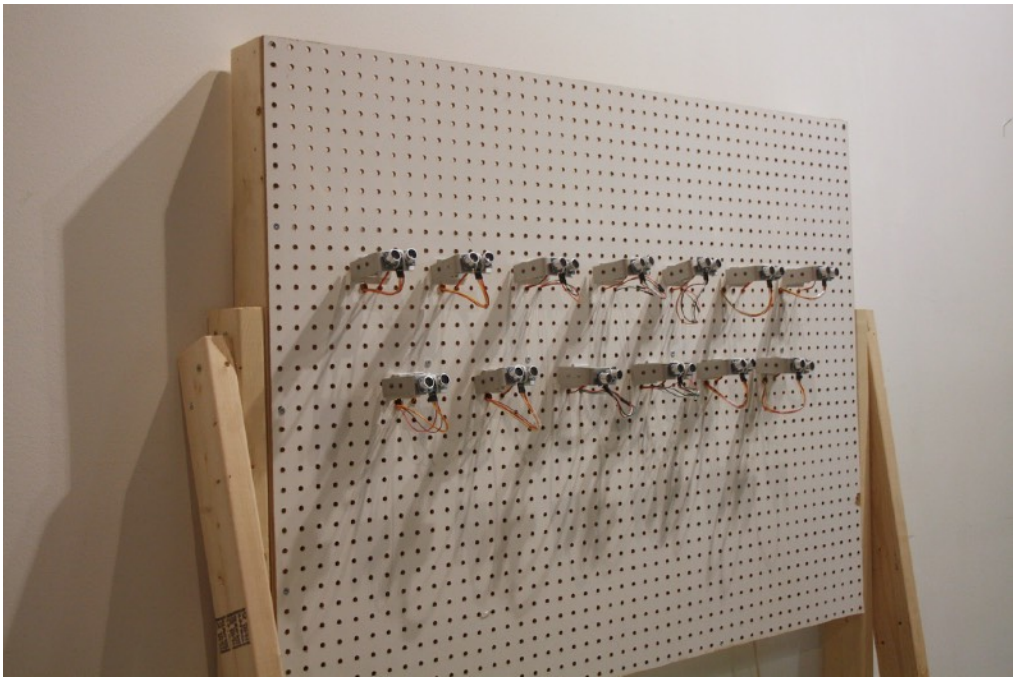

Figure 1.1. Habitual Instinct, Study 3.

Habitual Instinct was developed through a series of reflexive prototypes. This allowed for the refinement of the interaction, behaviour, technology selection and the physical presence of the piece. Starting with a strong conceptual idea of what the piece needed to accomplish in the areas of aesthetics and the desired emotion evoked by the user helped with determining the effectiveness of each study. The project evolved through continuous studies that focused on a specific set of themes. This evolution is apparent by observing the first study in Figure 1.2 with the most recent study of *Habitual Instinct* seen in Figure 1.0. The final form was confirmed during Study 3. During this study, 13 sensors were tested, mounted to a panel that was used as a false wall. The confirmation of controlling 13+ sensors allowed for the focus to shift back to the individual sensor. The purpose of the shift was to improve the interaction and behaviour of the sensor with participants and improve the communication between the robot, the data storage service and the visualization. This study used a single embodied robot mounted to a self-supported stand. This form factor allowed for more technical and efficient testing and development of the robot. The study ended up being called *Creation By Error* and was shown at OCAD University's Digital Futures OPEN Show, March 2017.

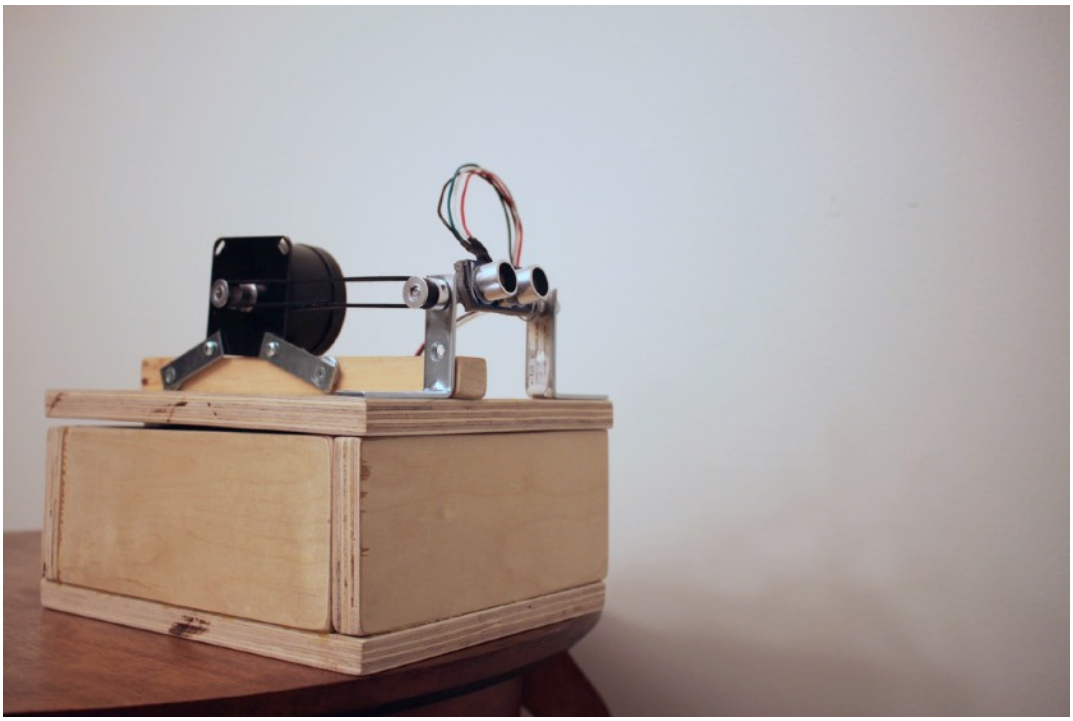

Figure 1.2. Habitual Instinct, Study 1.

Research Motivation

Over the last 10 years, the importance of online user behaviour analytics has become pronounced in its significance for large corporations such as Amazon, Facebook, and Google to help them understand their user demographics and for strategists to better target online advertising to these users. There are extensive online advertising networks that specialize in making online targeted advertising more effective through better personalization. This has become even more relevant as the traditionally non-technology based companies have started to depend on online demographics for flyers, emails, and other analogue customer outreach. There are many benefits for collecting and analyzing massive data sets gathered from million of online users, but there are also negative aspects to this large-scale data collection and statistical analysis. My background is in the technology industry, in both start-ups and advertising. My previous work included proof-of-concepts for GPS targeted advertising. These included phone apps utilizing the geolocation of the user. My work included research into the possibilities of using GPS as a geo-fence, RFID, NFC, or Bluetooth to activate interactive targeted signage, billboards or custom streamed radio or video ads to the user, based on the user's location and proximity to said signage. In tandem to these signage project inquiries, The clients were also interested in custom location-based targeted coupons and special offers being pushed to a user’s device or emailed to the user when they enter a geo-fence or come within a set proximity to certain store displays.

During these project proposals and discussions, a connection between traditional online advertising and analytics and the future of smart spaces and targeted physical consumer environments became apparent; inevitably, this is where the future of retail is headed. Starting with retail, it is also simple to speculate the expansion of this technology into other physical environments like schools, malls, amusement parks, public spaces, cities and whole geographic zones. Creating a system that is consistently aware of where its users are in the physical world is one thing; a larger question is how would this impact larger communities? How would the system like this be implemented? Who has access to this, not just digital and online user behaviour data set, but user's physical movement and the

content they view online, and where? These ethical questions really hit home — “The unintended side effects of technology dictate our future” [Basar et. al.].

By this point, internet users have more-or-less accepted that their online behaviour is being tracked. One’s physical, traditionally-offline presence is felt to be the last of an individual's private and personal space; a sense of solitude, removed from distractions and observation. The diminishing public or private spaces that offer the ability to be an individual and not a commodity that generates marketable data is a crucial factor in understanding oneself as an individual and accepting the world for what it is. This topic evolved into my research question about data privacy and the digital perception of reality. This is done through the research questions: How can an artwork reveal the complexities and aspects of data collection through an interactive environment? How can visually communicating the data collected by an artwork prompt awareness of surveillance and data collection in physical spaces that are outside of the gallery setting? Moreover, can a greater awareness of the scale of personal data collection increase public engagement with issues of digital privacy? *Habitual Instinct* emphasizes the lack of privacy even in a scenario where only one type of sensor is being used to collect and understand the physical world.

The physical world is perceived to be the last of a user’s personal space. For example, one of the first major modern data discoveries about Apple Inc. was that the company was storing the physical location of users using latitude, longitude and time stamping. This happened in 2011, and it was reported that all of this user data, while only available on a user's computer via iPhone backup file or the actual iPhone,this data was not unencrypted and was being stored without user consent (unlike the requirement of 3rd party apps to notify the user when they use their location). [Cheng, 2011].

From attending an OpenFrameworks workshop, I learned about computer vision. This discovery made me realise that the future was not going to consist of only screen specific media. The future will be a combination of physical and virtual worlds woven together. The world that tries to balance the combination of physical and virtual experience will allow for the creation of stimulating environments that

are experiential and interactive. Given the technical complexity of these new spaces, the importance of user privacy within them is an important consideration. If the public is expected to participate within newly immersive environments, it should be clear to the participants if data will be collected about them, how it will be used, and if it will be shared with other partner companies. In my thesis project, I endeavour to increase people's interest / awareness in their digital data, especially in physical spaces. The significance of their data needs to be communicated in order to galvanize people to take appropriate precautions to protect and control their privacy online and in the physical world.

Social media helps with connectivity but will certainly not replace physical interactions and shared experiences with friends — the physical world still provides these. I am relieved the future won't consist solely of isolated individuals using laptops, virtual reality or augmented reality as their only source of human connection. For a while, it seemed that the only way to connect with people and recharge was to "disconnect" with devices like mobile phones. With the advancements in physical computing and the focus on social connectivity, I believe technology will be adopted that will help grow physically present immersive and experiential interactive experiences, and not diminish the interpersonal relationships that we find so valuable.

Research Question

The primary research questions that will be the main focus throughout my thesis research are:

- How can an artwork reveal the complexities and aspects of data collection through an interactive environment?
- How can visually communicating the data collected by an artwork prompt awareness of surveillance and data collection in physical spaces that are outside of the gallery setting?
- Can a greater awareness of the scale of personal data collection increase public engagement with issues of digital privacy?

Literature Review

In the book *The Age of Earthquakes. A Guide to the Extreme Present* by Douglas Coupland, Hans Ulrich Obrist, and Shumon Basar, the authors, write about contemporary relationships with technology and virtuality. One quote directly relates to the social impact that technology can have on society: "The unintended side effects of technology dictate our future." [Basar et. al., 2015] This quote points out possibilities of anomalies that develop when technology is adopted too quickly, and without fully understanding the impact it might have on our society, culture, or behaviour. The concern stems from complexities of technologies, the closed nature of the platforms, and the amount of data they can collect. This closedness makes it difficult to fully understand the significance of what software users agree to when adopting a new platform or technology.

In the following sections, I define aspects of the current relationship society has with technology and our connections to this system. To begin, an examination of *The Work of Art in the Age of Mechanical Reproduction* by Walter Benjamin, who dissects society's relationship to technology in arts and media during the introduction of film to the general public. This section describes responses to the introduction of technology in media as "inauthentic," compared to the present day, where new technology in the arts is embraced. Through a discussion of Foucault's essay *Technologies of the Self*, Foucault discusses the differences between the two sayings "Know yourself" [Foucault, 226] compared to "Take care of oneself" [Foucault, 226]. His comparison traces the meaning of the terms concerning historical civilizations and their faiths. In this section, instead of looking at religious influence in a historical context, social media is the focus and how it has replaced some of the functions of religions. The slow transition examined by Foucault with a shift in the cultural power of religious institutions to the acceptance of social media is connected by examining the value of technology in the arts and media. Arts and media connection are following the transition from Benjamin's belief in theater and painting increase these mediums value by saying "The here and now of the original constitute the abstract idea of its genuineness." [Benjamin, 5]. Though Hito Steyerl challenges his belief in her essay *In Defense of the Poor*. She explains the shift in digital images and despite being easily duplicated, they are still valuable because their existence is "about [their] own real conditions of existence: about swarm circulation, digital

dispersion, fractured and flexible temporalities" [Steyerl, 8]. Without the transition of power and the acceptance of increased value in digital media, the way social media platforms are used today most likely would not be as popular. If they were not as popular, they wouldn't be capable of gathering as much data about their users, which would diminish their revenue and company value. From the shift in cultural power, we will ground *Habitual Instinct* in a speculative future with advanced AI systems that have developed their own sense of agency. In this proposed future we will examine the impact of data collection that happens online through web-based analytics systems, and examine how these systems can be implemented in the physical world. The goal is to bring awareness to how individuals are under surveillance and when data is being collected. I conclude by examining how *Habitual Instinct* was developed to recognise and understand the affective experiences of users interacting with the installation, controlled by basic AI. I state the final intention of fostering discussion and contemplation about interacting with the piece, as a means to help users work through their responses to the current state and future development of AI. The implementation of AI in *Habitual Instinct* is to create a relationship with the piece with exterior ideas about data collection, surveillance, targeting advertising in the physical world and the overarching theme of privacy. Regarding privacy, it is important to consider who and what might have access to this information. Being aware of how the current digital landscape functions, allows for educated decision-making in how, or even whether those people decide to use these systems, use them with custom security settings, if at all.

Current Relationships with Technology

To understand the feelings surrounding our culture's connection to technology, we must first examine and try to understand what is the current relationship we hold with technology and its digital connectedness. How does it help us? What is the general feeling about it, and what is the general sentiment towards the level of connectedness we embrace on a daily basis? This includes the dependency on the internet for many daily tasks, always keeping a cellphone on nearby, the rise of smart homes and IoT, and the increased awareness of cyber-warfare, hacking and how these digital activities can have a tremendous impact on our physical lives because of the data involved.

The Age of Earthquakes: A Guide to the Extreme Present expresses both feelings and affects we experience regarding the level of connectedness in the world today. For example, we have conflicting feelings and indecisiveness about the positives and negatives of this situation. It could be said that “The odd thing about right now is that people are more connected than they’ve been ever before — except they’ve been tricked into thinking they’re isolated. How did that happen?” [Basar et. al., 132] Another question is how technology is an enabler to stay connected, providing access to information to learn something new and incorporating a sense that “I miss doing nothing.” [Basar et. al., 180]

The idea of the “aura” proposed by Benjamin involved a connection to authenticity and how “aura” is lost through automation and digitization. Hito Steyerl argues that the contemporary interpretation has developed to be able to support some artistic mediums that are experienced as authentic but are completely digital. “Altogether, poor images present a snapshot of the affective condition of the crowd, its neurosis, paranoia, and fear, as well as its craving for intensity, fun, and distraction. The condition of the images speaks not only of countless transfers and reformattings, but also of the countless people who cared enough about them to convert them over and over again, to add subtitles, re-edit, or upload them.” [Steyerl, 6-7] She goes further to describe how the aura of digital images includes a sense of authenticity through the way that they are distributed and consumed. “By losing its visual substance it recovers some of its political punch and creates a new aura around it. This aura is no longer based on the permanence of the ‘original,’ but on the transience of the copy. It is no longer anchored within a classical public sphere mediated and supported by the frame of the nation state or corporation, but floats on the surface of temporary and dubious data pools.” [Steyerl, 8]

Understanding the current state of technology in our society, how it is consumed and whether it can be considered authentic allows us to now go back and look at how technology and digital media have evolved to the present state. A historical narrative will help show how technology has been adapted, with habits and behaviours formed. The historical narrative contributes to disclose how habits and behaviours

were formed, and the possible impact that these habits may have in the future with current trends in advancements AI and surveillance techniques.

Historical Relationships with Technology

To help answer how proposing a speculative future can help people contemplate their relationships with technology and consider how they want their futures to connect with the advancements in the future, we must look at the developmental start and impacts that society grew through, including the evolution and introduction of digital media into the mainstream. This analysis will be done by looking at Walter Benjamin's *The Work of Art in the Age of Mechanical Reproduction*. This essay discusses the artistic authenticity and transition from painting to film and cinema. In this essay, Benjamin discusses how the screen actor's performance "has become transportable" [Benjamin, 21]. "The screen actor is conscious, all the while he is before the camera, that in the final analysis he is dealing with the audience: the audience of consumers who constitute the market" [Benjiman, 21]. The concept of awareness with how a performance can be consumed is transferable to the present day. To modernize Benjamin's concept, replace "actors" with "users of technology" in the "filming" as "digital analytics." The difference is that those screen actors are always aware that they are performing for an audience, where arguably the contemporary digital user is unaware of every instance of being filmed while participating online. This performance and filming have migrated into the traditionally physical world that technology has been integrated into every aspect of the physical world from mobile devices, transportation services, security systems and the Internet of Things (IoT). In the article "Reacting to Reactions" Rob Horning helps connect the similarities between the actor, the digital participant, and cinema through the lens of archiving data to generate demographic statistics.

Journey to Today's Relationship with Technology

Technology and media have transitioned from passive consumption to an active acceptance whereby these systems collect and gather data to benefit the individual, society, and corporations. This can be examined by a reading of Michel Foucault's essay *Technology of the Self*. To help understand our current

relationship with technology, we need to explore the function that technology provides to the populous, as well as the history of what is being fulfilled by the technology. By looking at Foucault's reading of this evolution, we can better understand what technology provides society and users on a psychological level. This provides a lens to discover if our current relationship with technology and the way it is consumed could be adapted to suit better and respect the needs of contemporary society. In this, I look at how revealing this history and relationship with technology and power can influence people to question their own emotional attachment and contact with their connected devices and the world around them.

Foucault starts by dissecting the differences between "Know yourself" and "take care of oneself." He compares this to examine the power dichotomy and relation between religious institutions and the ability for self-actualization and self-affirmation of our own control, destiny, and importance. When discussing "salvation religions" such as Christianity, Foucault states "Each person has the duty to know who he is, that is, to to try to know what is happening inside him, to acknowledge faults, to recognize temptations, to locate desires" [Foucault, 242]. In these findings of self-reflection, "everyone is obliged to disclose these things either to God or to others in the community and, hence, to bear public or private witness against oneself" [Foucault, 242]. It was this "self-knowledge" [Foucault, 242] that Foucault claimed that purified the soul [Foucault, 1997]. Purifying the soul was done more recently in monotheistic religions through penance and confession. "Penance is not nominal but theatrical" [Foucault, 244] and the theatrics are associated with the search of approval and validation. Now, with the update of social media, we can observe a transition from penance to a religious figure, to companies and platforms used for various forms of social media. It is now possible to receive the self-validation and knowledge that was provided through penance and the church, through posting and projecting a persona on social media. Our social posts are now our public confessions that are used to search for self-validation. Building an online profile that projects whom you want to be, starts to become problematic. The problem is that data from social media can be cross-referenced with email data, search and online browsing history data and even GPS location data from cell phones and car hire services. Also, since these

platforms are not private, but public they have turned into platforms to project our most ideal self, but the “theatrical” self [Foucault, 244]. The avoidance of “self-examination, [...] implies that there is something hidden in ourselves, and that we are always in a self-illusion that hides the secret” [Foucault, 247]. Through wishful projections on social media, we may no longer be taking the personal time for ourselves to understand who we are. With the cross-referenced data available through all of the online accounts that users have, especially data that gets gathered from seemingly private internet sites, this data can with more public profile behaviours result in interesting discoveries or severe personal contradictions. It may be possible through big data analysis for companies to build a more realistic personal profile about users than they even know about themselves. Data doesn’t lie, it may be wrong, but it’s conclusions are based on some level of quantitative analysis. The intelligent algorithms that make up these systems start to know us better than we know ourselves. Our secrets and self-actualization no longer come from a monolithic religious figure, our penance has begun to transition to being fulfilled by these technology companies who are building digital services that make up what is often referred to as “the cloud.” Technology is now our “God.” The ritual of confession once a week to “clean” ourselves can now be done from anywhere at any time throughout the week. This psychological instinct for recognition, acceptance, and purpose developed through cultural history has become an addiction. Portions of the population are losing touch with themselves because of this. The search for acceptance and access to social media everywhere augments the sense that surveillance and data collection through social media isn’t much of an issue or priority to some people. This is because technology seemingly cares and is paying attention to them. The process of Social Media Confessions and openly generating and supplying large sets of data unbeknownst “permits the master to know because of his greater experience and wisdom and therefore to give better advice” [Foucault, 248]. This tradeoff for potentially better services that know you could lead to “renouncing your will and yourself” [Foucault, 249] to corporate interests, all while losing touch with self-awareness.

If technology and big data replace the traditional role of our understanding of God, there are some immediate hesitations that start to develop. Secrets, as described by Foucault, that was revealed by

God are now disclosed by technology and big data. No longer secrets that we have; they can be used predict, or reveal our lives. But if we project a persona of how we want to be seen, data analysis collected about us by technology companies, gain access to our private, personal and repressed identities. This deterministic profiling through data obtained by AI could start to suggest and make predictions to us. These include our repressions, our secret or illusory selves, rather than the publicly projected persona we worked on to create. This creates a huge disconnect with the individual, their physicality, digital persona and how they are seen by others. The irony of this is that this particular outcome was generated by the same services and means that were created to supply a feeling of self-satisfaction, self-actualization, and comfort by the user.

This leads to the understanding of computerized disclosure of reality and its interpretation of the physical environment. This perception and understanding are very different compared to a human's perception — even if only because of the biologic differences between humans and mechanical robots. When technology shows us the world that it sees, it may not be what we expect or anticipate.

At first, using technology allows us to show our followers what we are doing for self-confirmation and reassurance. Now social media is the basis of a sophisticated statistical analysis engine. Big data is being collected from so many sources; technology is now showing us the reality that we are hiding from ourselves and are ignoring or unaware of. The digital computers are not like our brains; they don’t behave like our brains. The concept of memory and use of describing neuroscience and memory retention in the article The empty brain: Your brain does not process information, retrieve knowledge or store memories. In short: your brain is not a computer addresses this exact problem with how we understand and look at computers and their algorithms. “The idea that memories are stored in individual neurons is preposterous,” says Epstein, pointing out that that, “Obviously not, and a thousand years of neuroscience will never locate a representation of a dollar bill stored inside the human brain for the simple reason that it is not there to be found” [Epstein]. This article is a potent example of how the interpretation of a computer's perception of reality is different from humans. An example given is, if

humans and computers perceive the world differently, how come humans use the method that computers store memory as a way to explain how the human brain works? Computers store data literally whereas humans are “always in a self-illusion that hides the secret” [Foucault, 247]. This distinction is important to understand, to be responsible for our individual data. Is society ready to be presented with the reality that technology is gathering about our lives? What will the impact be if humans become so dependent on technology that we lose or are forced to observe reality without our own perception and agency about our surroundings?

Habitual Instinct strives to influence people to engage in the discussions and decision-making processes for the adoption of new technology. The way the project tries to influence this behaviour is by shedding light on the complexities and thoroughness of interactive media and its environments, challenging the user's expectations against how they understand their relationship with technology. With a better understanding of how present technological systems are structured, hopefully, participants of this project will be better prepared to make better-educated decisions or get involved in the discussions when new technology is being discussed for adoption into the public sphere. These discussions could be about how interactions with new systems are being used and referenced for data analysis demographics.

Regarding Foucault's essay, society may accept a level of observation and surveillance because we are searching for the validation of our existence, thoughts, and behaviour. What if the validation we receive from these technologies when compared to the validation from our friends are more literal or inclusive of data errors, on the other hand, since these systems have an accumulative larger set of data about us compared to our friends? Seeing a perspective of reality through the eyes of technology and collected data could improve our society, forcing us to address blatant issues that might otherwise be overlooked due to human bias in perspective. Could data and technology start to force us to come to terms with many potential flaws in our human psyches? Another aspect to consider is if the data collected for digital services has errors in the data set. How might this impact on an individual, population or country?

At what point does a small margin of error collectively accumulate over time into a catastrophic inaccuracy in the data set?

Data, AI and Digital Agency

With a better understanding of why we participate and interact with contemporary social media platforms and other technology systems, it's possible to critically look at the current impact that our behaviour and interactions with many daily necessities like phones, cars, and homes have on our individual and collective lives. First, the purpose and methods used for data collection will be reviewed, then how this data can be used to improve autonomous systems but also generate some unexpected social artifacts. Lastly, with the amount of data and current advancements in Artificial Intelligence, especially Machine Learning, I investigate the impact of large data sets. Autonomous systems can combine to foster digital agency and unpredictable outcomes from technology either through interaction or completely digitalized infrastructure systems. The impact of having human control removed from some of these scenarios is considered.

To start, in early 2016 Facebook released a new feature for users' post. The feature is called "Reactions." It allows users to select an additional 5 reactions to a friends post in addition to the traditional "Like" response. This feature was perceived as a user experience (UX) improvement, but it was also a new source for extensive user behavioural data collection. Why would Facebook add a new set of "Reactions" buttons to compliment their existing "Like" button? According to Horning, the reason for Facebook adding Reactions to the newsfeed was to find "out who will work those extra milliseconds to react... as useful demographic information" [Horning, 2016] all while providing "users with a kind of comfort zone for emotionality while they are on Facebook" [Horning, 2016]. By introducing a level of comfort to the user, Facebook was able to extract more granular analytics about their users while they perform on Facebook. Dichotomies like this example are happening on most major digital service platforms. Digital performers may not be aware that a record of their participation and interactions with a

platform or space is being tracked, indefinitely stored and archived for further analysis. This is done to financially benefit the company by improving the effectiveness of their targeted advertisements.

The Facebook example can be applied to an analysis of new features to help generate user demographics based on the decisions made by the system's users to Internet of Things (IoT) and other digital systems in the physical world. Some examples of these systems could be surveillance systems, municipal infrastructure, autonomous and smart car environments. For example, a Facebook “reaction” chosen by a user would be classified differently depending on if they opted for a reaction like “angry face” versus the traditional “Like” reaction. Data about this decision is captured and may include the duration it took for a user to decide what reaction to select. This decision process may eventually make it into physical stores for product selection or for knowing the relationship between house temperature and if anyone is home. The capabilities of data collection from the physical world are being deployed at a growing pace with the increased rate of IoT and connected devices that are installed in people's homes. According to a press release by Gartner from 2015 titled “Gartner Says 6.4 Billion Connected "Things" Will Be in Use in 2016, Up 30 Percent From 2015.” [Gartner, 2015] the company predicted that by 2020 there would be 20.8 billion connected devices in use. They also note that 5.5 million IoT devices will be connected to the internet every day. That will bring the total number of IoT devices up to 6.4 billion objects in 2016, up 30 percent from 2015. That is a huge source pool for statistical data. According to a Deloitte article titled Internet of Things: From sensing to doing, Andy Daecher and Robert Schmid report that IoT devices will “generate 507.5 zettabytes (ZB) of data per year by 2019, up from 134.5 ZB per year in 2014” [Daecher et at., 2016]. This number is astonishing. This is just IoT devices and not online services like Instagram, Google, or Facebook. Understanding how and why this data is collected, communicating at what scale it is collected, and the insights that this potential quantity of data may provide will help underscore the significance of investigating if an artwork can visually communicate what data is being collected in a physical space and in real time. Through this communication, I am aiming to prompt awareness of surveillance and data collection in physical spaces after the participants leave the gallery setting.

The reasoning for having *Habitual Instinct* participate with the audience and communicate how the installation sees the world is important to the research questions and significance of the project. By shedding light on the complexities of the present digital and physical ecosystems and their required infrastructure, the users will hopefully start to recognize the amount of time, money and resources that are needed to maintain and keep these services up and running. Contradictory though, the users of *Habitual Instinct* will also be presented with techniques used to gather data but also be shown the sheer quantity of data points able to be collected by systems with more sensors than *Habitual Instinct*. Understanding the complexity and infrastructure required, hopefully, a connection will be made that the reason for the data collection is revenue to help keep these systems running, but it is also for profit.

Artificial Intelligence

These two interdependencies in data communication will potentially create a dialogue and get participants to discuss and contemplate their own relationships with technology and how it benefits or hinders them. Hopefully, the impact or curiosity will open a dialogue about the morality of digital privacy and surveillance culture and whether users are open to and willing to trade off personal data and privacy for access to some of the digital “for free” services and platforms. Even further, does this belief hold strong when data collection and analysis shifts from an online medium to In Real Life (IRL)? If it is not a fair tradeoff, what would be a fair compensation paid to the company to have users access these services completely anonymously and without any data collection being done for their online session? Alternatively, would the users just abandon a platform completely once they understood the amount of data being collected about them?

The analysis of a Speculative Future helps transition to the topic of Artificial Intelligence and concepts around digital agency. The topic is necessary to associate with Speculative Design because no one really knows what will happen to humanity as AI goes further into the unknown. It is this reason alone that the argument for Speculative Design by Bratton has the biggest impact. In an idea borrowed from

Donald Norman, Bratton suggests that “[t]he futures that are probably most worth designing are those that exceed human phenomenology’s intuitive scales of anatomically-embedded spatial navigation and the temporalities of organism life span. It is important to mobilize SD on behalf of conditions that are not-yet-existing here and now, and for that we must further shed local social history’s mooring privilege.” [Bratton] Not only will these autonomous digital systems collecting vast amounts of information, but they are also making decisions about culture, economics, and society, independently of the original computer programs. It is the uncertainty and giving up control of Big Issues like the “Flash Crash” that happened on May 6th, 2010. This stock market crash has been largely attributed to automated High Frequency Trading systems. The journal entry The Flash Crash: High Frequency Trading in an Electronic Market looks at “how high frequency trading [can] contributes to flash-crash-type events by exploiting short-lived imbalances in market conditions” [Kirilenko et al., 2]. It was the algorithms in these systems that created the “unusual high traffic and frequency of triads the Dow had plummeted 998.50 points, its biggest intraday point drop ever. The swing from its intraday high was 1,010.14 points” [Lauricella, McKay]. Having automated systems that can cause such an impact on the economy or other areas of governance could be very detrimental. This is another concept that *Habitual Instinct* aims to explore, through publically showing the real-time data that is being collected throughout the duration of the installation.

These systems do seem to improve the standard of living, but it is important to understand the big picture of handing over the majority of control of our economic infrastructure or handing over the same decision that humans used to make completely and blindly to automated systems where human life is on the line. Are we willing to accept the outcomes of relinquishing the feeling and belief of our own control to an autonomous system that is capable of making life altering decisions on our behalf?

It can be argued that there is a trade-off between these digital and social systems that are used to improve society's quality of life, but when does their evasiveness become too much? Or, at what point does the risk of having no humans ethical perception present, while analyzing or altering the physical

world become too much of a risk? Will we know when it has become too much? This discussion leads us into the next section to expand into Artificial Intelligence and digital agency.

Agency

While researching and discovering the way to convey an association with “living effect” or “aliveness” is distinct from ‘liveness’ and is the more applicable theorization of artists’ works and exhibit lifelike characteristics or elicit a response from the audience that is suggestive of a fellow life-form” [Langill, 257], the article in *The Living Effect: Autonomous Behaviour in Early Electronic Media Art* describes the work of Norman White, Max Dean. These two artists demonstrate the importance of conveying the aliveness into electronic arts to make it more believable and to create a better connection with the participants.

Mimus

An excellent example of digital agency is *Mimus* by Madeline Gannon. This piece will be examined in more detail during the Art Review section, but it’s relevancy to the current context is great enough it needed to be briefly mentioned here as well. The premise of Mimus is to look at the future relationships between humans, robotics, and automation. If you consider “[o]ur current model for robotics and automation primarily consist of systems for optimization and control: we tell the robots what to do, and they do it to maximum effectiveness” [Mimus] and that with these “[r]apid advancements in machine learning and artificial intelligence are making our robotic systems smarter and more adaptable than ever, but these advancements also inherently weaken our direct control and relevance to autonomous machines.” Rather allowing for the natural adoption of the unknown scenario of allowing robots to optimize ourselves out of “our own obsolescence, now is the time to rethink how humans and robots are going to co-exist on this planet.” This is referencing the ideas of Speculative Design by Rabbie and Dunne and trying to present a future where society can co-exist with these advanced and “aliveness” [Langill, 257] mechanical beings to benefit society. Giving *Mimus* the intuition to explore the area around where it has been installed, and the personality to decide what is interested in and when it

gets bored, opens the discussion about communication between autonomous systems and humans, as well as getting humans to start to accept that these new robotic systems are not just controllable objects, these “robots are creatures, not things.” [AtonAton, n.d.]

Conclusion

The impact of data collection goes far beyond having companies be able to create more accurate targeted ads to turn a profit, and users data has a significant impact and influence on the economy, social beliefs and the sharing of information and ideas. With large data sets and advancements of AI, it’s clear to see that true digital agency is in the future. And our behaviour and may be used to train or teach, or have the AI system learn about our world, develop their own understanding and have a drastic influence on our future. Will these agential systems keep in tune with the better or worse side of our society, will they try and correct humanities pitfalls? This is all areas that are unknown to AI researchers. The closing questions here, builds into the next section, about a speculative future.

A Speculative Future

Looking at the theories of Benjamin and Foucault and understanding the current data, security, and digital agency through AI that is developing, it is possible to understand better how the current relationship with the digital evolved which will help us speculate on what it might become. In this section the focus will be on the importance and benefits of Speculative Future projects, the proposed speculative future *Habitual Instinct* investigates in relation to human-computer relationships and control, data and surveillance, AI, interaction and reaction between the participant and the system, and finally digital agency. As stated by Benjamin Bratton, in the article “On Speculative Design,” speculative projects have the most impact when their “uncertainty is deliberate and that our interpretation depends on thinking it through. Ideally, if as we examine the work more carefully, we are yet even less sure how “real” the work is (even unsure of the designer’s intentions), then it is possible that instructive fault-lines between common sense and emergent reason can be discerned.^19” [Bratton]. This uncertainty about whether the conceptual themes and the technology used in *Habitual Instinct* are presently being used on

the population. Alternatively, how much data is truly being tracked about us? As well, is this piece actually storing, tracking and archiving all of this data? What is it going to be used for?

Relationship + Power

Up until recently, the relationship with technology has been one-directional, meaning humans would command a device to execute a task and the device would return the outcome of that task. There was never a scenario where the system could decide if it felt like executing the task or return the result. As an example, there's a whole software industry based around the concept of Software as a Service (SaaS). Even though there are some economic benefits for the software company "software-as-a-service (SaaS) model, customers can access software online as needed instead of permanently installing it on their computers." [Ojala, 54] This gives the customer control over when they need certain technology and when they don't. This one directional relationship is changing with advancements in AI and machine learning. The possibility is that technology will start to act under its own free will and develop its own sense of agency and self-identity. It may even develop its own source of to perception of the present either through a digital or mechanical basis and not representative of human perception is stronger now than it has ever been in the past. Society is only now starting to see what it will mean to accept and live with the artificially intelligent objects or beings, depending on how you decide to classify these materials. Speculating on a future that seems we are already headed down with big data collection and analysis, The project creates a physical environment that encompasses a potential future of AI, ideas of digital and physical devices being alluded to as a point of interest. We are turning to technology to confirm our existence. With this, we are interested and willing to participate with a beaconing of technological behaviour and interest. It isn't until we participate and interact with these devices that it starts to be apparent that they are not interested in us, but they are interested in what we provide to it — data points.

Data and Surveillance

What makes *Habitual Instinct* speculative, is the data collected by the project, and how this data is being used. The collected data points are archived and then also displayed in a digital 3d space or converted

into a physical study. This data storage, retention, and recall of this data is currently practiced by many of the large technology companies today. With *Habitual Instinct*, there is no personal identification stored about the user when they interact with the piece. Whereas in the speculative future where this system would exist, the assumption is that the data scanning would be directly attributed to a digital personal of the user within the space. This persona would be representative of the person in both the digital and online realities but also the physical space as well; the persona is used to store all identifiable behaviour of a person from their browsing data to their physical movements, decisions, and behaviour. Physical movement throughout an environment isn't usually considered something concrete or permanent but with advanced surveillance techniques, improved data tracking algorithms, adoption of cellphones and the cost to archive data this is becoming the case — essentially the ability to indefinitely archive data.

Similar to web traffic, data collected through physical behaviour and movement can both help provide a user with better services from a corporation, but the data has a dual purpose which is for data analytics to help foster economic growth and usually improve targeted advertisements for the company as well. "Design is also the means by which pathological relationships to material culture are made more efficient and more delightful, and we are worse for it." [Bratton]. With this, what is the payoff for having less privacy but more convenience through attachment to digital objects? Is accepting a trade-off between privacy and potentially increased service or simplicity really the best future for humanity? The speculative part of the project is the interactions of the piece and the collective behaviour of the *Habitual Instinct* system with the individual. This relationship aims to explore the connection between technology, privacy, data, and reality by allowing the participants to connect and consider their data collected by *Habitual Instinct* as a tangible extension of their physicality. Bratton states, "Ambiguity, abstraction and ambivalence are signals of successful Design Research, and the best SD projects position us between pro and con interpretations: is this ethical and/or unethical, is this remedy and/or poison?" [Bratton]. The importance of the digital embodiment of the self is more important now than ever as the popularity of Artificial Intelligence, Machine Learning and other software algorithms are becoming more accessible and acceptable to use by corporations, hackers, artists and the open sourced community.

Artificial Intelligence

Using basic AI methodologies and fundamentals such as learning on the fly, decision making based on real-time sensors and procedural algorithms that allow for machines to exhibit “behaviour and the potential for living effect in situ that determines machinic aesthetics.” [Langill, 257] The paper by Caroline Langill titled *The Living Effect: Autonomous Behaviour in Early Electronic Media* that was edited into the book Relive published by MIT Press discusses the development of autonomy, “aliveness” [Langill, 257], behaviour and the “transferral of agency from human to machine” [Goodall, 442]. *Habitual Instinct* presents a potential interaction experience between a digital system and a user.

The behaviour in this speculative universe does enough to bring a participant near, collect their required data and then disengage. The project gathers the presence of a participant and then actively tries to avoid them. This allows the project to gather data at any movement about you. This connects to a speculative future through the realization that the exact area of interest by the device is unknown — each sensor has its own degree of autonomy. It is the AI that determines where it is interested in; this will only be discovered when a participant in within that area and the installation reacts to their presence. This uncertainty exemplifies the unknownness of the future and humanity's relationship with AI. It is an exemplary example given by Horning about Facebook Reactions, and the purpose of collecting data and by “[a]dding the extra options basically allows Facebook to extract more information about all users and more labeling work from some of them.” [Horning]. Basar, Coupland, and Obrist say it best when referring to big data and data analysis “Machines are increasingly talking about you behind your back” [Basar et. at.]. This becomes interesting because it becomes unclear as to what is exactly happening to the large amount of data that is being archived. It is for the system to decide what it finds interesting or not. This interest in data is represented by the systems autonomous avoidance algorithm. When a participant is avoided, the subsequent data from that area starts to be overlooked. This area that is overlooked starts to resemble a “data black hole.” This artifact of seeming missing data has been acknowledged and part of the design of the system. It was purposely included to clarify that

autonomous systems get to decide what they find interesting and the possibility of important information could be overlooked.

Digital Agency

This theme of AI ties directly into speculation about agency within digital devices. The way *Habitual Instinct* is setup to function and behave freely within a set of restraints it is possible to see how that once the piece sees an audience member, acknowledges and then avoids the space where the viewer is. Not only does this behaviour miss data it also transfers control to the individual sensor and the system as a whole. When the sensor or system is interested in collecting data again, it can start scanning that previously overlooked space in the physical world again. This is relevant because it hands the decision making about the perception of the physical space over to a completely digitally autonomous system which perceives the world alternatively from how human perception and understanding of reality works. This transfer of agency discussed by Goodall in the paper “Surely a being that is empty of agency must draw it from somewhere, and the only source to which it is connected is its own creator, who after all, deserves what is coming to him because, not content with making objects that are agency neutral, he has created an agency vacuum that must—automatically, so to speak—seek to fill itself.” [Goodall, 3] *Habitual Instinct* is representative of the globally networked system of digitally smart devices being developed by humanity and is slowing consuming our individuality.

Conclusion

Using Speculative Design as a way to connect key themes in contemporary society and their potential evolution into the future, *Habitual Instinct* is able to condense the social discourse surrounding A.I, privacy, and surveillance into one space that can be experienced all at once. By presenting unfamiliarities by means of a speculative future where an experience like *Habitual Instinct* might exist in a less obvious and secretive way allows participants to experience an environment that could be a potential future. It makes it possible to observe how this affects their behaviour while interacting with the piece too. With constant surveillance, Walter Benjamin's observation about the theater vs. screen actors

is relatable today. “An actor working in the theater enters into a part. Very often the screen actor is not allowed to. The latter’s performance is not a single entity; it consists of many individual performances.” [Benjamin's, 20] At the very least the goal is to have the participants start to consider if this aligns with a future that they would be willing to be a part of. By creating a potentially uncomfortable or overwhelming experience for the participants, hopefully, it will propagate into a discussion and the involvement of voicing opinions about the future ethical decisions with the ubiquity and adoption of new technology, and if it aligns with the future, they want to exist in.

Affect and the Relationships with Future Technology

The areas *Habitual Instinct* generate accumulative affects is through the scale, materiality, embodiment and anthropomorphism, strange behaviour, autonomous interactive decision making and the transparency of the scanning actually collecting data and archiving it. The identification that the displayed visuals are real-time interpretations of the participants displayed back to them through the perceptual lens of technology. The combination and the overall strangeness of the experience are aimed to create a sense of curiosity, combined with an overwhelming feeling of anxiousness, uncertainty and a slight feeling of a loss of control over the participant's physicality as they start to recognize that their data is a digital representation of their physicality. The goal with the combination of the seemingly subtle experiences is to create affects of unidentifiable but recognisable uneasiness. The explanation by Brian Massumi mentions that “[t]he disconnection between form/content and intensity/effect is not just negative: it enables a different connectivity, a different difference, in parallel.” [Massumi, 85] between “content and effect”[Massumi, 85] and “form of content … and intensity”[Massumi, 85]. *Habitual Instinct* attempts to create a disconnect through a few conflicting experiences to draw out and identify the contradictions between habits and instincts with their participation in an experience. The piece may get the participants identify the contradictions between habits and instincts through their interactions with the installation. The contrasting attributes are between the friendly and light materiality of the interactive robotics, anthropomorphic tendencies of the ultrasonic sensors resembling eyes, letting Simplex Noise determine the sensor movement for a more organic movement with the abrasiveness in the realization of

the quantity of data being collected and archived about the participants combined with the alien responses and avoidance to participant interactions. The participants may start connecting their experience with *Habitual Instinct* and start contemplating their own use of technological devices that they use daily.

A dynamic uncertainty is attempted to be created between the installation and the participants. This might happen when the installation explores and detects its surroundings and reacts to anything present in front of it. This behaviour is intended to create a feeling of uncertainty about how they should interact with the piece. The participant will hopefully become uncertain about their movement. “Confidence is the emotional translation of affect as capturable life potential; it is a particular emotional expression and becoming-conscious of one’s side-perceived sense of vitality.” [Massumi, 103] In this manner the *Habitual Instinct* confuses the dynamics of human effects with technology. Intensity is created through the transfer of agency and unpredictable interaction and response experiences between *Habitual Instinct* and the participants. “Matter-of-factness dampens intensity.” [Massumi, 86] “...intensity will be equated with affect.” [Massumi, 88]

Showing this data in an articulate form might allow participants to connect their interactions with the piece and start to understand how the installation intercepts the participant's movements. “Perception between the machine and us blurs. It emerges from the latches onto affects flowing through the world and not the other way around.” [Salter, 83]

At first it might seem that the *Habitual Instinct* is only using the sensor data to interact and participate with the users in real time, but this is not the case -- once the realization of the archival and visualization of these interactions become apparent to the users, may this change their understanding, feeling or level of comfort while interacting with this piece. Even if there is a slight pause of consideration about if the participant want to continue interacting with the installation, it would be considered a success in terms of having the participant question their role within the current environment as well as what they are

giving up in terms of personal agency and privacy to interact with the piece. “Autonomic nature of affect; on affect as suspension of action-reaction circuits and linear temporality in the sink of what might be called ‘passion,’...” [Massumi, 89]

Conclusion

Does presenting the opportunity to identify your physical self through digital imagery make someone feel more embodied or connected to themselves? Having users identify their affects throughout the interactions, as all of the working parts of the installation come together, does it make them more embodied or connected to themselves? Alternatively, does it create the feeling of being more connected to their digital data and online persona as they see how their participation are reflective as accurately and as expected or were the nuances in how it was understood caused by the system (*Habitual Instinct*)? Are the users more protective or aware of their physical movements because they are more self-conscious and aware or protective about the information they are emitting and being tracked? Very basically, is the importance of digital privacy, security, autonomous systems and data transparency now more important than in the past? This may or may not be the cause because there are more possibilities for how data can be collected about you, and if the amount is very tangible or understandable, does this alter our feeling towards the current infrastructure of the connected culture we have today.

The intention of *Habitual Instinct* is to combine a sense of the global experiences with technology, connectedness, and data into one space where the user is offered an opportunity to confront all of these ideas. Hopefully, this connection will help keep an open dialogue about the future of society and its dependence on AI, data, technology within a livable limit and become more opinionated about what they feel is best for their personal and social privacy.

Art Review / Critique

To help understand where my art practice sits within the existing artists and their bodies of work we will be examining select pieces of work how they are relatable and inspirational to me as an artist but also how my work fits into this landscape.

The Helpless Robot

Figure 5.0. Norman White, The Helpless Robot (1987-96).

The Helpless Robot by Norman White is the first piece that is going to be analysed for artistic review. The reason is that White is a pioneer in electronic media art, but he is also Canadian and has taught at OCAD U. The piece that is going to be looked at is The Helpless Robot and references themes of Affect and AI in a similar way to *Habitual Instinct*. Unlike other works by White, “this one has no motors but

instead, must depend upon its synthesized voice to encourage people to move it as it would "like."" [White, artpage]. White further states that the piece was developed “primarily as an apparatus to test out different techniques of automatic knowledge-building; in this case, the machine attempts to assess and predict human behavior.” [White, artpage]. This is interesting since that idea is still relevant to today's interactive pieces using trying to mimic and influence human interaction using Machine Learning or other types of Artificial Intelligence. There are some connections between *The Helpless Robot* and *Mimus* by Madeline Gannon which is looked at later on in this section. The fact that *The Helpless Robot* requires human assistance to move is also along the lines of deliberation about the progression of AI in the upcoming years. For example, major researchers in the area of Artificial Intelligence have signed an ongoing letter for the development of ethical and societal emphasis for future AI research. This petition is called Open Letter on Artificial Intelligence. In this letter, it emphasizes that AI is not only a computer science problem but its “research is by necessity interdisciplinary because it involves both society and AI.” [AI Open Letter] White’s piece is one of the first pieces that play on this potential of a demanding technical future that is the master of humans and can learn from human behaviour to be more efficient with its needs. The relation between *The Helpless Robot* and *Habitual Instinct* is in terms of exploring the relationship between robot and human, as well as the inevitability for advancements in robotic intelligence and agency. Trying to influence participants to consider the implication and their feelings of these developments. One of the main differences between *The Helpless Robot* and *Habitual Instinct* is that it’s looking at AI and human-computer relationships through the eyes of data, and what it means to allow autonomous systems have access to a diverse set of data whereas White’s piece is more interested in having *The Helpless Robot* learn about its immediate environment.

Robotic Chair

Figure 5.1. Max Dean, Robotic Chair (2006).

The piece by Max Dean titled *Robotic Chair* is a piece that falls apart and then autonomously puts itself back together. The system used an “overhead vision system and controlled over a wireless network by an external computer.” [Dean, Donovan, D'Andrea]. The chair evokes emotions in its viewers by using its repetition of falling apart and re-building itself, a perceived trait of determination to “reminds us not only of our fallibility but also of our innate capacity for re-creating ourselves.” [Dean, Donovan, D'Andrea]. Part of what makes the piece so strong is the effect created in the viewers while watching the chair struggle to put itself back together. It is perpetual, and it never changes. The empathy of struggle and it’s believable movement that reflects that of a familiar animal allows us to project a “likeness” onto the piece making it more relatable and emotionally connective. The association between the Robotic Chair and *Habitual Instinct* is summed up by Caroline Langill's reiteration of Penny’s question about “why do we want our machines to appear alive to what is it that makes some machine-based artworks elicit emotions we usually associate with our relationship to other humans.”? [Langill, 258] What *Robotic Chair*

does is surface these emotions in the viewer, this is what is trying to be done through the introduction of movement and response to interaction in *Habitual Instinct*. At first *Habitual Instinct* has a very robotic motion algorithm but it evolved into a more relatable and associable movement with the introduction of the Simplex Noise algorithm to control the motors that are used for orientating the ultrasonic sensors. The inclusion of this algorithm creates a whole new dimension to the relationship between the user and the installation. It increases the belief of autonomy and decision making that each robot has. It creates an association between a living organism and the *Habitual Instinct* installation.

Tape Recorders

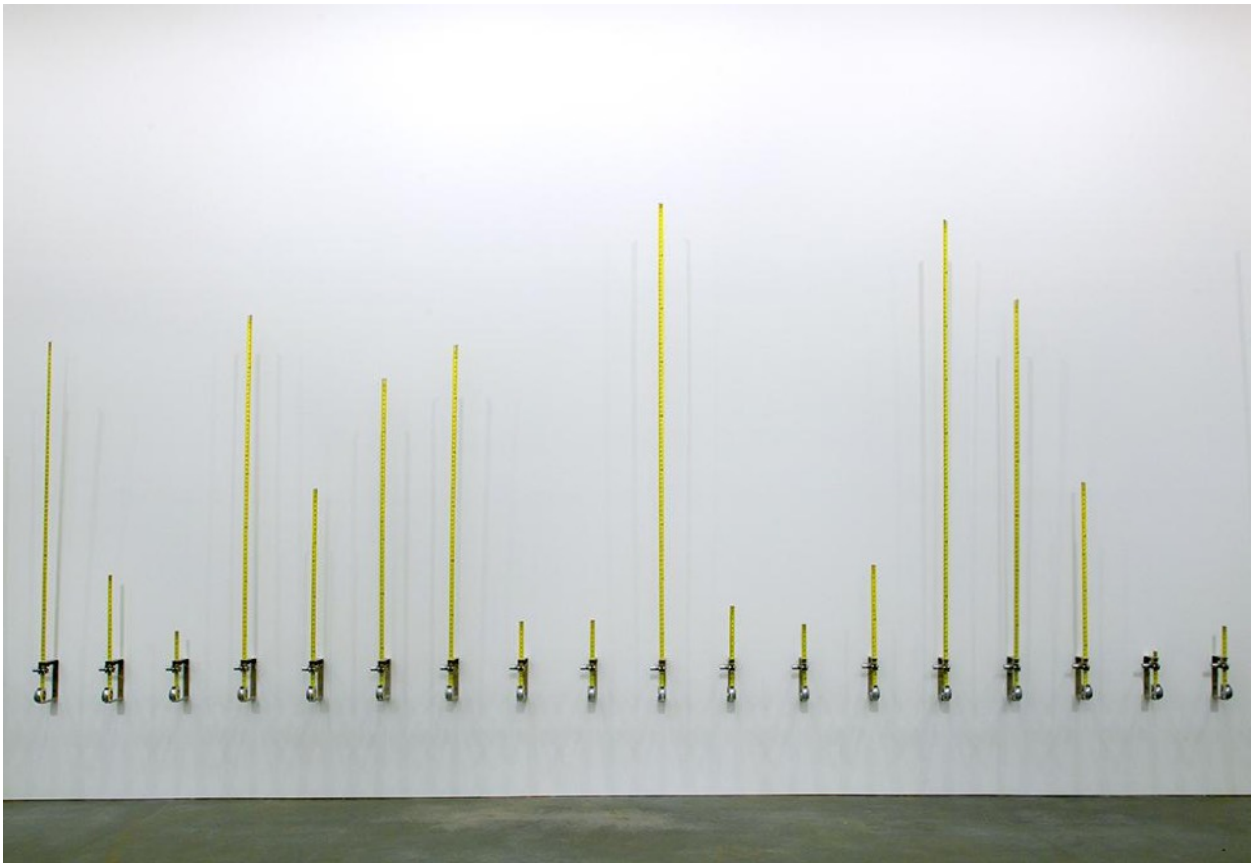

Figure 5.2. Rafael Lozano-Hemmer, Tape Recorders, Subsculpture 14, 2011.

Rafael Lozano-Hemmer's piece titles *Tape Recorders* is a great example of displaying human interaction in a tangible way. Shown here is the version Subsculpture 14, 2011 that was shown at Museum of

Contemporary Art, Sydney, Australia. The installation consists of automated measuring tapes that extends and raised up. The height of each measuring tape is in direct correlation with the amount of time a person has been present in front of each tape measure. Once the tape measure fully extends, it tips over and recoils. And the whole process starts over. After each hour a printout of the cumulative time in minutes that the participants have been present in front of the piece is printed. Lozano-Hemmer describes the significance of Tape Recorders which was a part of a larger exhibit at the MCA in Australia. “Recorders is an exhibition which presents 12 installations that all have something in common, which is that they are crowdsourced. The content of this work is entirely derived from the public itself.” [Lozano-Hemmer, 1:49] There are similarities with *Tape Recorders* and *Habitual Instinct* in the way that they both look at communicating the concept of intangibilities in a physical way. Where *Tape Recorders* looks at the duration of time that the piece is interacted with, *Habitual Instinct* is demonstrating the data that is collected through digital eyes peering into the physical reality.

Wooden Mirror

Figure 5.3. Daniel Rozin, Wooden Mirror (1999).

Another artist and piece that have been an inspiration have been the original *Wooden Mirror* by Daniel Rozin. During a previous trip to New York, I had the opportunity to interact with it as one is hanging in the lobby of the NYU's program ITPs lobby. It was incredible seeing the real-time interactions, as well as the effect of hearing all 830 servos, rotate to visualize the image of the viewer. *Wooden Mirror* is an excellent example of a kinetic piece that plays with light and reflection on different surfaces to display a replication of the viewer standing in front of the piece. Examining the piece, it is interesting to have it reflect the image back to you as the camera sees you. With *Habitual Instinct*, the difference is that it is interested in discovering and learning about what is in front of it. The piece explores what is in front of it and reacts to what it finds. As well, rather than trying to how a replica of the physical world, *Habitual Instinct* is interested in the digital artifacts of technology trying to understand its environment and any errors of interpretation." Perhaps it is possible to look and *Habitual Instinct* as a more contemporary version of *Wooden Mirror* that has been updated alongside the cultural adoption of technology. In the late 90's people were still getting used to technology and being presented with an interpretation of your face would be seen as friendly and embracing. However, in the mid to late 2010's technology has been embraced and the tone of discussion about technology has shifted to being more aware of the impact that self-actualization will make on society.

Level Cleared

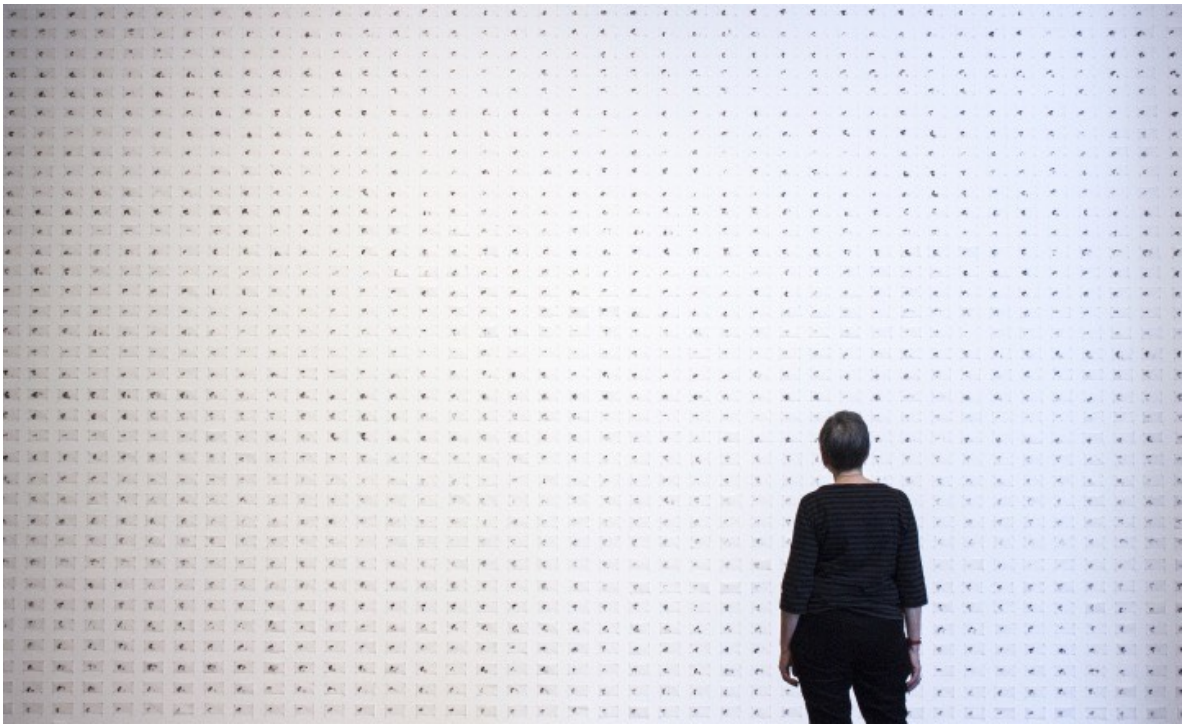

Figure 5.5. Evan Roth, Level Cleared (2012).

The series by Evan Roth, *Level Cleared* visualizes and “aims to make apparent the amount of time and repetitive gestures required to “win” the game. The resulting visualisations contrast the excitement that happens in the gaming environment with the monotony that actually takes places in the physical world.” [Roth, Blog Post] In *Level Cleared* Roth played the mobile game Angry Birds “from start to finish with inked fingers.” [Roth, website] A lot of his “work deals with humour and pop culture references, but it’s also a dark view of what people call “casual computing.” We have powerful computers in our pockets but what do we use them for?” [Pianezza, AQNB]. While Roth looks at the monumental amount of data that a user produces while using devices such as their phone to play games or browse social media. By quantifying this user behaviour, it can open discussion about the dependency and ubiquity of these technologies and the internet. *Habitual Instinct*, on the other hand, looks at the passive data that is collected about users in physical space. In response to Pianezza’s question “The Internet is ephemeral by nature. How do you think about your work in such a context?” Roth explains his interest in how “, as

well as the effect of hearing all 830 servos, is changing constantly and that this thing that I love is a moving target" [Roth AQNB] and his work "has a life right now because we do this movement with our fingers on our smartphones 20 times a day now but how will it look like in 50 years?" [Roth, AQNB] but "how those things will age and how people will experience that in the next two or three generations."

As Roth said in his interview with AQNB about *Level Cleared*, "I would love to see someone walk into the gallery, look at this piece and cry" in relation to visually seeing the amount of time spent during casual computing. This is relatable to me too; I want participants and viewers of *Habitual Instinct* to be struck back about the sheer amount of passive data collection that is happening around them and the possibilities of inaccuracies in this data and how that can impact totally unrelated areas of their life down the road. The other similarity between Roth's work and mine is the focus on archiving a how and what the internet is at present. *Habitual Instinct* is also showcasing the archival if physical interactions with the connected space around us. Instead of looking at how the digital and internet culture will be seen and understood in future years, *Habitual Instinct* is exemplifying that our present interactions in the public and private spheres are not just movements that happen in the present and are forgotten, these movements and interaction and behaviours that are made in the presence of connected devices, the Internet and technology are observed, analyzed and archived indefinitely as a continuing history or recording of human-computer interaction.

Mimus

Figure 5.6. Madeline Gannon, Mimus (2016).

Image by ATONATON, LLC. / Autodesk, Inc.

The premise of *Mimus* by Madeline Gannon is to look at the future relationships between humans, robotics, and automation. If you consider “[o]ur current model for robotics and automation primarily consist of systems for optimization and control: we tell the robots what to do, and they do it to maximum effectiveness” [Mimus] and that with these “[r]apid advancements in machine learning and artificial intelligence are making our robotic systems smarter and more adaptable than ever, but these advancements also inherently weaken our direct control and relevance to autonomous machines.” Rather allowing for the natural adoption of the unknown scenario of allowing robots to optimize ourselves out of “our own obsolescence, now is the time to rethink how humans and robots are going to co-exist on this planet.” This is bringing the ideas of Speculative Design by Rabbie and Dunne and trying to present a future where society can co-exist with these advanced and “aliveness” [Langill, 257] mechanical beings to benefit society. Giving *Mimus* the intuition to explore the area around where it has been installed, and the personality to decide what is interesting and when it gets bored opens the discussion about communication between autonomous systems and humans as well as starting to

accept that these new robotic systems are not just controllable objects, these “robots are creatures, not things”. [AtonAton, n.d.]

An example of this would be Madeline Gannon’s work, and the project named *Mimus*.

> “Unlike in traditional industrial robotics, Mimus has no pre-planned movements: she is programmed with the freedom to explore and roam about her enclosure. Mimus uses an array of depth sensors embedded into the ceiling to sense and respond to visitors. If she finds someone interesting, Mimus may come in for a closer look and follow them around for a bit. However, her attention span is limited: stay still for too long, and she'll try to get your attention… but eventually she will get bored and go find someone else to go investigate.” [Gannon]

Mimus and *Habitual Instinct* share a similar discourse, but there are also distinctly different. When *Mimus* explores the agency of robotics the audience is forced to question “who can be a performer, what does it mean to transfer agency, and how can we reconcile a machine-based object that displays a living effect?” [Langill, 266] These are all questions that are becoming ever more relevant in today's world of AI and machine learning. *Habitual Instinct* is more interested in the impact of how this style human-computer interaction impacts, alters and interns affects our perception and the relationship with technology and digital spaces. The focus of the project is to reveal and make accessible the steps and processes that take place to allow systems like *Habitual Instinct* and *Mimus* to interact and make these decisions about how they might interact and participate with their audiences as well as the steps or data used by these systems to come to these conclusions.

With the experiences like *Mimus* and *Habitual Instinct*, that I’m looking to offer a glimpse into a Speculative Future, the term originally coined by Anthony Dunne and Fiona Rabbi. The goal of Speculative Everything is to propose alternative futures to allow open discussion and have the population decide or influence the present to hopefully create the ideal future. It is put best in the words

of Dunne and Rabbi who explain the purpose of Speculative Design, they “believe that by speculating more, at all levels of society, and exploring alternative scenarios, reality will become more malleable and, although the future cannot be predicted, we can help set in place today factors that will increase the probability of more desirable futures happening.” [Dunne, Rabbi, 6]. It is as if Speculative Design allows for the testing of multiple futures to help the present society get to, or avoid particular scenarios that are desirables. It’s important to acknowledge that “new ideas are a what we need today. Conceptual designs are not only ideas but also ideals, and as the moral philosopher Susan Neiman has pointed out, we should measure reality against ideals, not the other way around: ‘Ideals are not measured by whether they conform to reality; reality is judged by whether it lives up to ideals. Reason’s task is to deny that the claims of experience are final— and to push us to widen the horizon of our experience by providing ideas that experience ought to obey.’” [Dunne, Rabbi, 12]

C.V.Dazzle

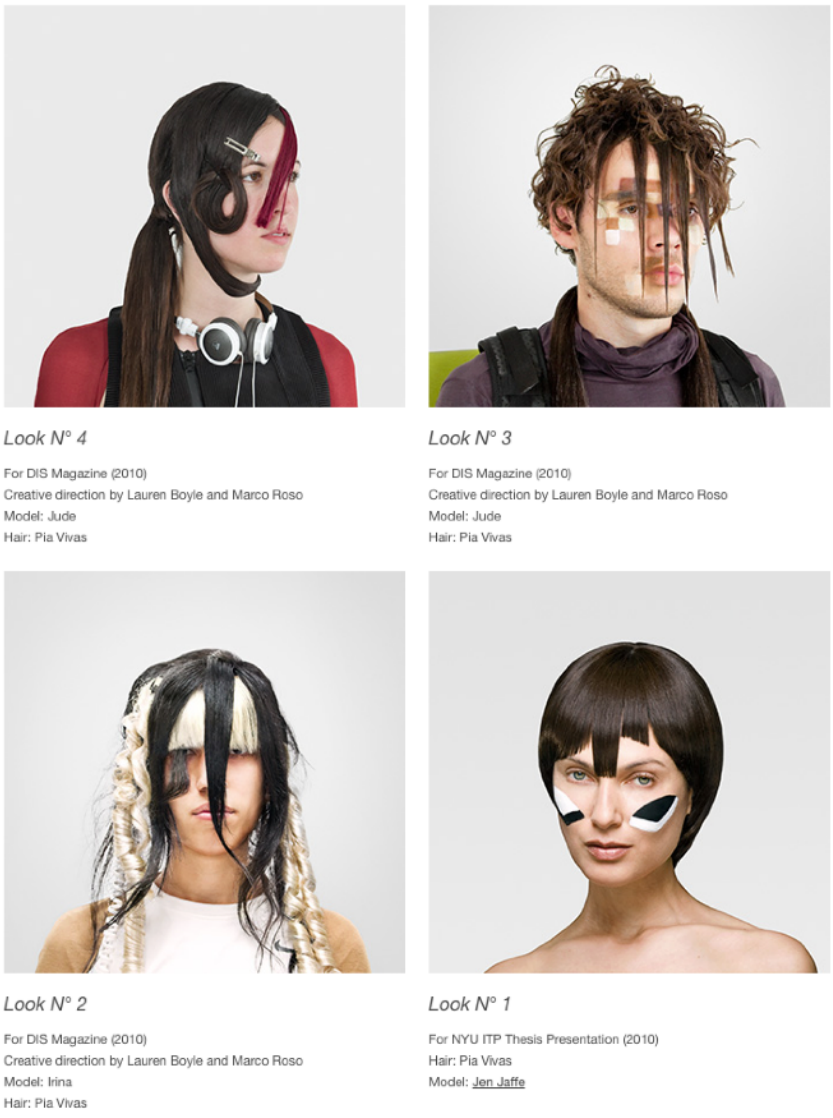

Figure 5.7. C.V.Dazzle Lookbook by Adam Harvey.

There are open source tools and browser plugins that can be used to help see how, and by who a user's online data is being collected. Some of these tools can even block some analytic software too. Another service these add-ons help with is visually showing how your browser and the sites you visit are interconnected through these tracking services, as well as how your browsing habits and the information

collected by you being online, can make their way back to some companies that will use this for monetary gains.

In just a few minutes of testing Firefox's *Lightbeam* and visiting 25 sites resulted in being connected to 237 third party sites or services.

Figure 5.8: Lightbeam header, site connections tally.

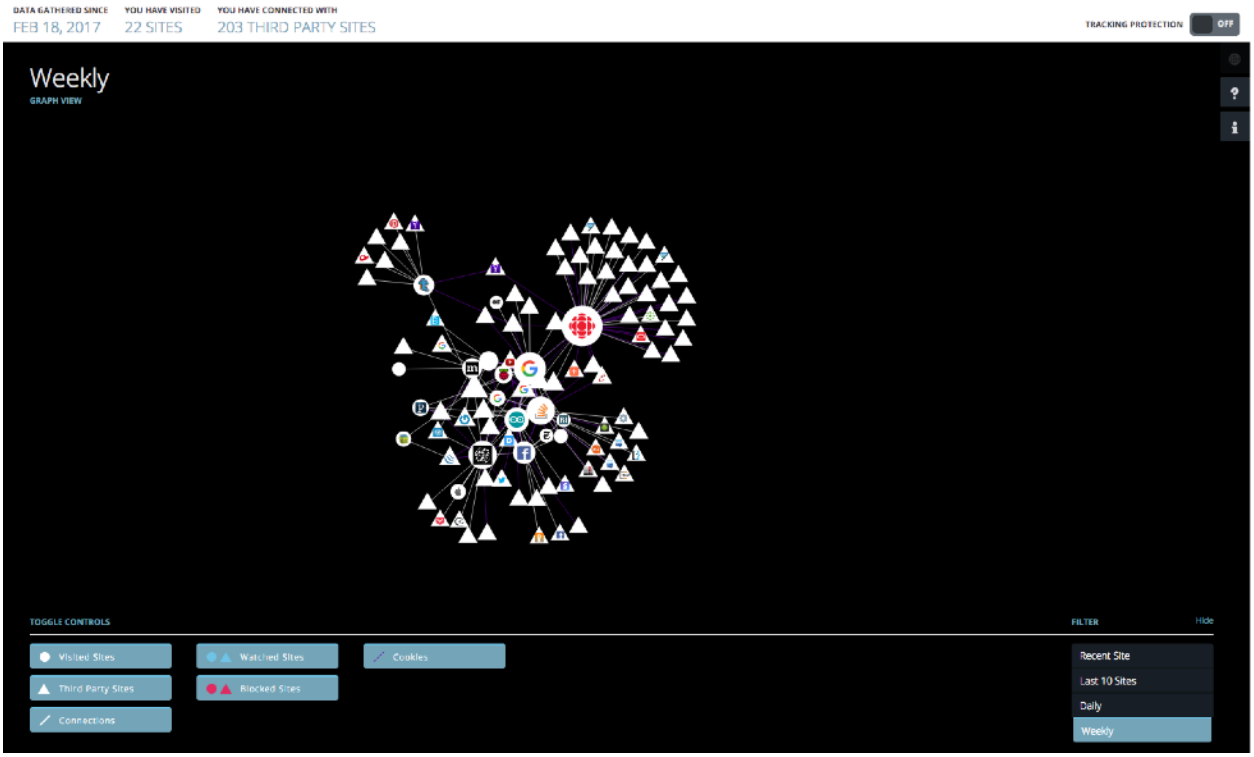

Figure 5.9: Lightbeam dashboard.

How would a service like this be made possible in the physical word? With our physicality being the last of our personal space, how could we protect or preserve this independence from digital tracking and

observation? This is why the discussion surrounding data privacy and digital security is so pivotal; it environment just apply to web traffic and the internet — it now applies to the physical world too. The artist working in this space is Adam Harvey. His project *C.V.Dazzle* confuses computer vision algorithms and helps combat physical tracking systems that can identification people through video cameras [Harvey]. Although the project is conceptually and visually interesting, the eccentric patterns applied with makeup to the face and geometric hairstyles are not practical for the general public or daily use. They may even attract more attention in the flesh by people who are in the immediate vicinity counteracting the purpose of trying to stay anonymous in a digital surveillance system.

This interaction paradigm of considering robotics as a creature ties into the work mentioned above with Norman White, Max Dean and his *Robotic Chair*, and the article by Caroline Langill. The evolution from the other works to *Mimus* and in a sense *Habitual Instinct* is that these systems are not just self-aware or react to an audience or user, they now have relatable personalities and characteristics based on the AI intelligence of these systems able to learn, adjust and evolve into their own unique creature. It is the anthropomorphism that generates attachment and interest between the systems and the audience. Without these projected attributes the engagement level would slowly dwindle due to the predictability in the behaviour of these pieces of art. With AI and these robotic creatures ties into the discussions by Chris Salter in his book *Alien Agency* where he investigates three of the projects that he has collaborated on that developed a level of agency which was unexpected and unintended to have been present at the start of the projects.

From examining the artists and selected pieces from their body of work. Through these examinations, it's possible to draw associations between themes in their accumulative body of work which leads to the main areas of *Habitual Instinct*. These themes are Human-Computer Interaction, past, present and future relationships with technology and our data, computer perception of reality, anthropomorphism, artificial intelligence, and data archival. The decision of how much data is gathered, where it is stored or what happens with is becomes completely removed from the human psyche. It’s the technology that gets to

decide how it interacts with society; it has the ability to grant the functionality and utility that technology provides to a populous such as all of the of the useful and beneficial dependencies that technology offers humans as a tool set. The system decides who has access and access to what. As Basar, Coupland and Obrist state in *The Age of Earthquakes. A Guide to the Extreme Present*, “The future loves you but it doesn’t need you.” [Basar et. al., 63]

Research Methods, Planning and Research Methodology

The research conducted for *Habitual Instinct* is based on grounded theory and done in an iterative and developmental process. Starting from initial sketches, to multiple iterations of prototypes, each iteration was sketched out, and an interaction and responsive behaviour framework were planned. These planned ideas were then tested by implementing them in the appropriate medium. Once implemented, they were tweaked, and bugs are resolved. Including the user interaction behaviour and response in these implementations allowed for the analysis of the data set being collected and visualized too. Visualizing the data was beneficial to get an understanding of how the connection between the installation and the data will be understood. The was research done to explore the different mediums, methods, and ideologies for communicating this data set for various results. These results were reviewed for effectiveness in communicating the desired result. For gathering information during each of these steps I am:

- Planning and mapping out user behaviour
- Planning and mapping out the installations possible interactive responses
- Planning and considering the overall experiences
- Experimenting with ways to communicate to the viewer, the volume of data collected
- Sharing and conducting user tests with each completed study

Figure 6.0. Jordan Shaw, 10 Minutes of a Chair on August 19th, 2016 (2016).

Studies

Introduction

Habitual Instinct evolved through 6 studies. The first study was overly mechanical and bulky and consisted of a single sensor. The second study refined the object to a smaller visual footprint and switched the type of motor being used. The third study had an even more refined visual footprint and improved mounting for the sensor, and servo motor and the objects during that period on a peg board. The fourth study was a single stand-alone object that scanned the area in front of it. It was connected to a wifi network and archived the scanned data in a cloud data service. There were also 4 separate

interaction modes with this study. The 5th study involved 13 objects mounted on a pegboard a switch from aluminum to acrylic for the brackets and had interaction improvements. Finally study 6 was building out and working on networking the microcontrollers, experimenting with mounting bracket materials and shapes and other smaller nuances to refine for a better final installation.

Curious

The idea of *Habitual Instinct* started by going through and discussing the potential of an accumulation of ideas that had been gathered over the years. These ideas were at various stages of the ideation process and ranged from a few bullet points through to extensive sketches. While discussing some of the ideas with peers, some of the ideas started to show that they held more merit over others. This meant that some had more potential for further exploration and expansion than others too. The original idea of *Habitual Instinct* started from a project that was completed for an OCAD University Fall 2015 class, Creation & Computation. In this class, a project called *Curious* was worked on. The final piece was called Curious and was an autonomous kinetic light bar suspended from the ceiling that tries to get the attention of participants, but then when you get too close, it becomes squeamish and scared of these biological beings. When it becomes scared, it loses its confidence to interact with them and goes into hiding. It was curious about the human population within the gallery space but was often frightened away from those attending if they got too close. If the viewers did get too close, *Curious* would lift itself high up into the ceiling to get away from them. The piece was built with two stepper motors suspending a 1 meter long RGB LED light tube. On the floor, against the wall facing towards the center of the room, there were 5 ultrasonic sensors used to track the position of the viewers. The position of the viewers allowed the motors to adjust and tilt the light bar to the opposite position that people were viewing the piece. If the person were on the left, the left side of the light bar would raise, the right side of the bar would lower or stay put, and the lights would visually flow to the lowest point of the light bar. If a person approached the piece in the middle or from both left and right sides equally, the piece would quickly scurry up as high as it could go and turn off all of its lights off in an attempt to hide from the viewers.

Figure 7.0. Curious.

Figure 7.1. Curious.

With *Curious* and genuinely interested exploring the concept and interaction of a piece that explored its environment lead to a bunch of new ideas and concepts about interactive but behaviourally adverse environments and user experiences with technology. During the process of ideation, additional concepts and new aesthetics started to take shape and become more refined. It was here that the focus began to be placed on the ultrasonic sensors that observed and interacted with the environment, not just using the sensors to control other moving components.

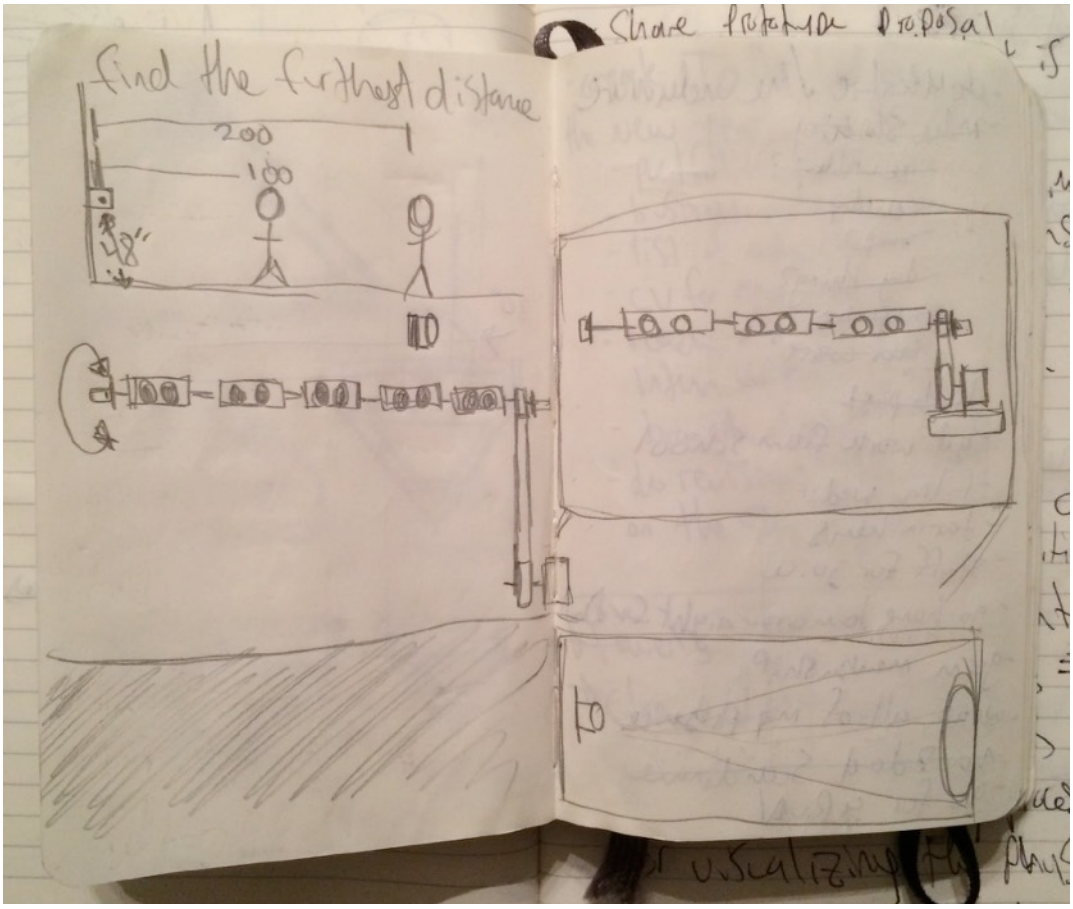

Figure 7.2. Sketches after Curious, before Habitual Instinct.

The original sketches for *Habitual Instinc*t were influenced by the aesthetic of the ultrasonic mounting bar for Curious. It's possible to see the similarities in the sketches — the original sketches for the installation had grouped together rotatable ultrasonic sensors mounted on an axle connected to a timing

belt and a motor. This lead to another round of ideation, sketches and prototype design iterations where the focus was to isolate a single sensor and control that one sensor on the x-axis. The main research and test for this were to confirm and conclude the feasibility of the proposed interactions between the robot and the human. The goal of this study was to test how well the sensor could be controlled by a motor. It was also this first study that was built to the specifications and mechanics of the first sketches which used a timing belt, stepper motor, pulleys, and an axle that had the ultrasonic mounted to it to control the orientation of the sensors.

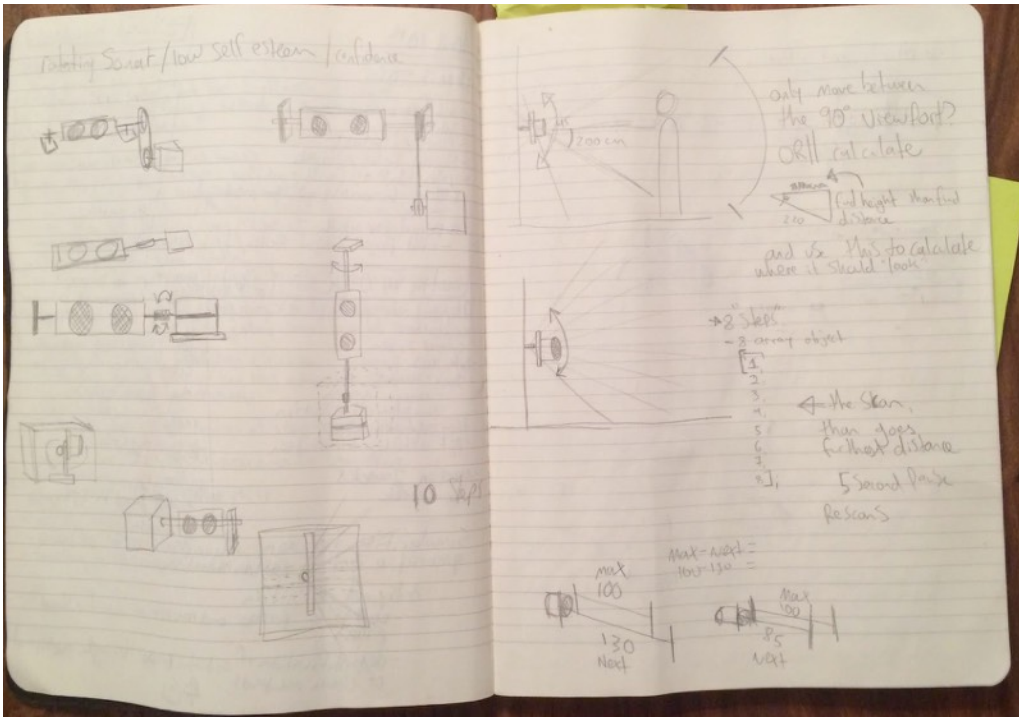

Figure 7.3. Initial Habitual Instinct Sketches.

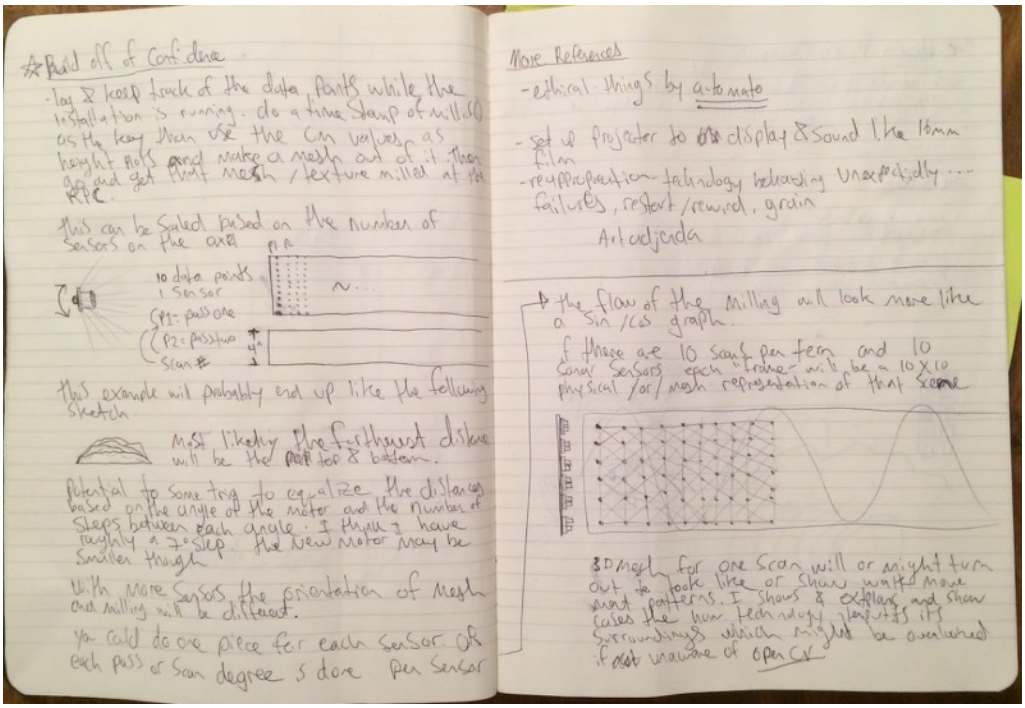

Figure 7.4. Initial Habitual Instinct Sketches.

Study 1

The first study for *Habitual Instinct* was designed to become familiar with the initial components of the project as a whole and to test if the assumptions of what the interactions and responses of a reactive robotic object could be. Part of this study was also to explore materials and the embodiment of mechanical movement as the piece scanned the room and sensed what was in front of it. This first study also focused on visualizing the collected, scanned data in various ways and alternative methods of archiving and preserving the collected data through visuals and data physicalizations.

Embodiment and Physicality

The embodiment of the piece was done to display the key components such as the stepper motor, ultrasonic sensor, and minimal wiring while the remaining electronic components such as the microcontroller, circuitry and the power supply were concealed. The study consisted many ready-made pieces that made it look quite mechanical. The materials such as a wooden box that was fabricated from

repurposed plywood, an old stepper motor, a new set of pulleys and timing belt and two bespoke L-brackets. The ultrasonic sensor was mounted to the axle which was supported by the L-brackets. The axle was controlled and rotated by the timing belt that connected the axle to the stepper motor. The materiality was interesting because it had a presence that despite only having one sensor had an impact.

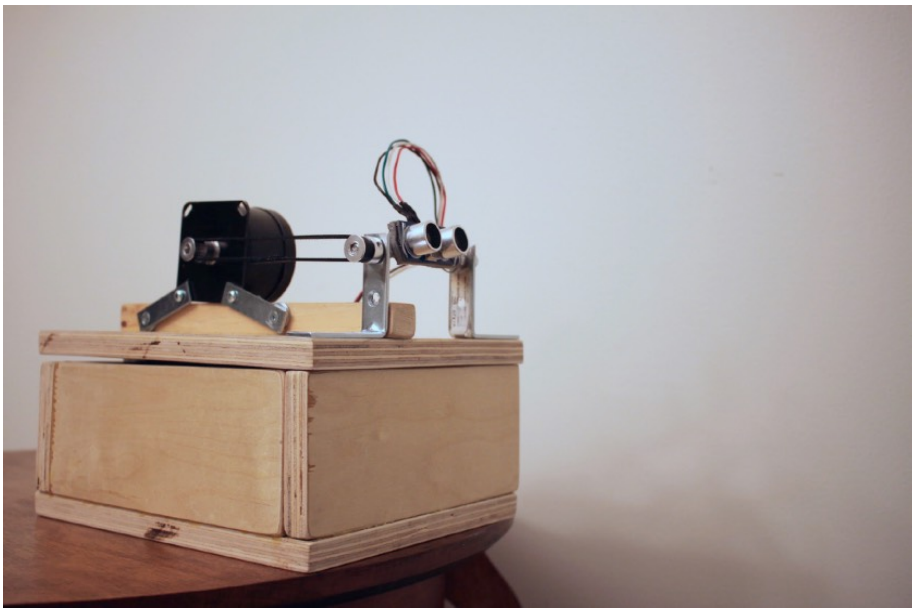

Figure 7.5. Mechanical aesthetic used for object during Study 1.

Data Collection

The first study was also used to confirm the method of data collection for accuracy and feasibility in terms of finding a way to organize, store and archive the gathered data. The archival of the data was important for two reasons. The first reason is that it was necessary to archive the data, so it exemplifies the themes surrounding big data and surveillance but also to be able to access the data later to use it for source material for communicating the concreteness and permanence of digital data by means of visuals or physicalizations. At first, it seemed logical for organizational purposes to use the JSON format which is shown in *Figure 7.6*. At While this worked at first this later became an issue due to the amount of data and the frequency of data transmission from the Arduino microcontroller through the Serial Port to the Processing program that was saving the data file. Because of a technical issue the data packet being

sent needed to be optimized. A set of custom string delimiters was selected and used instead. This shrunk the size of the data packet being sent drastically and resolved the issue.


```
[
  [
    {
      "distance": 181,
      "angle": 0,
      "id": 0,
      "time": 315
    },
  …
  ],
  [
    {
      "distance": 113,
      "angle": 90,
      "id": 9,
      "time": 417
    },
   …
  ]
]
```


Figure 7.6. Initial JSON data formatting.

The data collected during Study 1 was sent to a Processing app through the serial port and saved locally on a laptop as a .txt file. Following the local storage, and emphasize the archival significance of data collection the data collected by Study 1 was sent to PubNub, a data storage and streaming service. The benefit of Pubnub is that it has the capabilities to retrieve the archived data from any other device that is

connected to the internet who has the correct access credentials. This will be helpful later with the retrieval of the data for the other section of the project.

Figure 7.7. Outdoor tests during Study 1, 2016.

For testing, during the Study 1, a series of different objects, environments, and locations were tested. The limitation of the technology needed to be determined and the accuracy and resolution of the data required to be understood. One major test that was conducted was outdoors where there were a few unpredictable environmental variables. The scan was done using a lawn chair with a storage lid positioned vertically on the seat. The setup can be seen in *Figure 7.7*. Multiple scans, of varying durations, were completed of this physical configuration but there was one scan that lasted 10 minutes which stood out. This data set which consisted of 20 scanning sweeps generating roughly 26 data points per sweep. This added up to a total of 508 data measurements collected at rotating angles during the 10 minutes the piece was running. It should be noted that during this specific test a participant walked between the object and the chair twice. This was done to try later and recognise this participation in the data set which ended up being used later for a few concretization of data explorations.

Visualization, Physical and Archival of Data

Having a data set collected from the physical world, the next step was to use that data to populate a visualization to try and better understand what the data could explain about the world through the perception and interpretation of a digital device compared that of a human. The first visual component of this study was using test data generated from randomly generated numbers with a set maximum and minimum value. These values were plotted on a 2d bar graph as seen in *Figure 7.8*. This initial Processing app evolved into a visualization tool for future studies with a capability of more sophisticated visual displays. Now, using the data collected from the scan from *Figure 7.7* and a refined visualization, the Processing app was able to show the scanned data from scanning a chair for 10 minutes. The goal was to help understand the digital perception and perhaps the interpretation of what the object experienced and saw during that time. Would this match a human's perception or assumption of what the object would see during that period? Would it be possible to pick out when a participant passed in front of the sensor? This visual of the data set is seen in *Figure 7.9* as a 3d wire mesh model. Is anything unexpected from our human assumptions of what should be visualized or shown? What are interesting shapes or areas of the model that are unexpected?

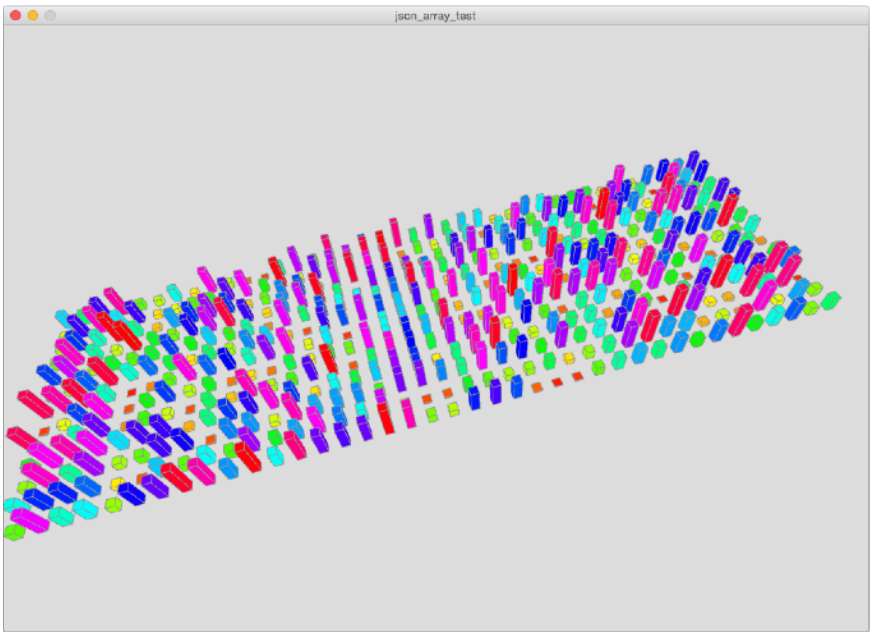

Figure 7.8. Test data 2d bar graph.

The bar graph software was extended to resemble a landscape and geographical terrain. This was inspired by Daniel Shiffman's generative Terrain Processing tutorial (Shiffman, 2016) the following mesh was created.

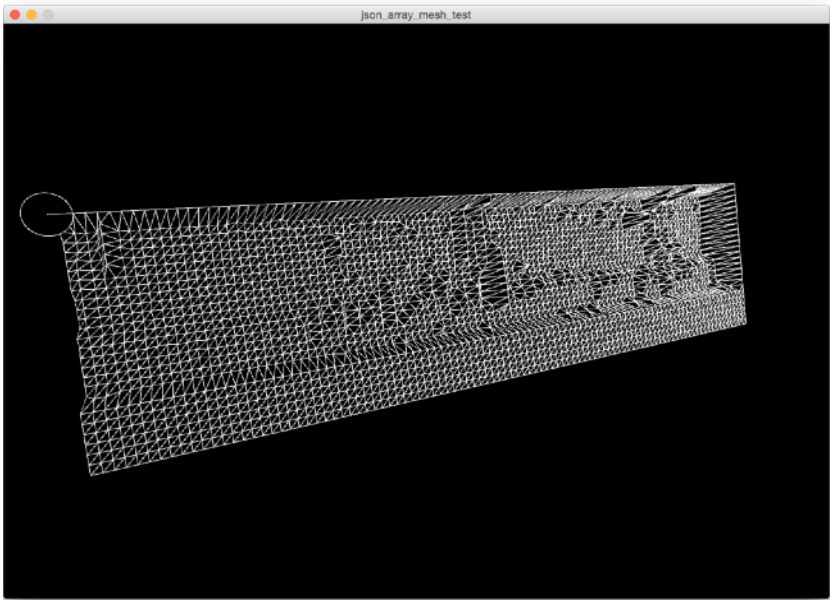

Figure 7.9. A 3d mesh generated by data scanning a chair for 10 minutes.

Figure 7.10. 10 Minutes of a Chair on August 19th, 2016.

10 Minutes of a Chair on August 19th, 2016 is a 4’ x 6” relief comprised data points gathered by scanning an empty chair during study 1. This piece is a physicalization piece that was created with the collected data points *Habitual Instinct’s* Study 1. The model displays the shape of the chair captured over 10 minutes. There are anomalies in the reading which can be attributed to sensor error or a physical interference with the sensor reading. At first, I thought of these artifacts as “errors.” Some viewers of the piece instantly thought these mysterious spikes were “ghosts.” A representation of a measurement that was what we weren’t expecting to happen turned into a mystical phenomenon. This is interesting because rather than accepting what caused these measurement oddities as being unknown or that it was an error with the technology or resulted from another physicality in our world such as a sound wave from another emitter, it was not thought that this was actually what the sensors measured. This alternative sound could also be plausible because the sensors used, HC-SR04, emits and listens at 40Hz. This sound wave is not detectable by humans but is by the sensor. This means that there could be

ambient noise lower than 40Hz that could be interfering with the sensor readings. To generate the CNC piece, data points needed to be gathered and saved from the tests done during Study 1. Processing was used to plot the points in a 3d sketch that resembled a geographic plane. This 3d mesh was used to CNC mill the shape into a piece of lumber in OCAD University's Rapid Prototyping Center.

Figure 7.11. Rhino export of the 3d Mesh that was sent to the Rapid Prototyping Center for CNC Milling.

Interaction and Response

The behaviour of study 1 was that the ultrasonic sensor rotated 180 degrees around the x-axis. Degree 0 was facing down, 90 degrees was facing straight ahead, and 180 was facing up. There were two different behaviours programmed into this study; the first was if the user was within a pre-predefined distance from the robot, and the ultrasonic sensor was oriented within a certain degree range — for example within 45 degrees and 125 degrees, the device would quickly re-orientate it’s gaze to either 0 or 180 degrees depending on which side of 90 degrees the study was orientated when it discovered a

person or something of interest. Once the detection happened, and it was reset to either 0 or 180 degrees the scanning would commence immediately. The second behaviour had the same logic except when it reorientated itself to 0 or 180 degrees it paused and waited for a predefined amount of time. The duration that it paused when it discovered a person was was for 5 seconds.

For this first study, the object only scanned during the movement from 180 to 0 degrees, i.e., from facing up to facing down. It then would respond to the measurements that it made during the scanning movement while moving back up between 0 and 180 degrees.

Figure 7.12. First visual mock-up and representation of installation object grid.

Grid Visual Representation

In tandem with working on the reliability and accuracy of the sensory and making it was needed to mock up some visuals to help communicate the holistic vision of the project. *Figure 7.12* is the first mock up of this sort. It emphasized the visual weight and space that installing so many devices would create if they

were mounted on the wall. It also opened up the discussion about how all of these devices which were autonomous would communicate with each other creating some unity. The first study also allowed for the discovery of the bit of humour that was held in the behavioural aspect of the interactions. This humour is the perpetual circular repetitiveness of the behaviour of this initial study but also the holistic ideas surrounding *Habitual Instinct* in general. The motor controlled sensor but the sensor data was what was controlling the motor controlled the motor.

Conclusion

This first study allowed for learning more about the different components and their own unique challenges which have been useful throughout the later studies. It also helped get the behaviour in front of some testers and see how they would interact with the device, and how the device would respond to the participants on a very basic level. It helped demonstrate the potential for interacting with a physical object, as well as the “aliveness” [Langill, 257] that is attributed to the physicality of the two round cylinders that represent eyes on the ultrasonic sensor. Lastly, this study helped to identify some potential technical and physical difficulties such as syncing the sensor readings with the rotation of the sensor controlled by the motor to make sure that accurate measurements were being recorded.

Seeing the output of Study 1 and how the object saw the world was a fascinating realization. Despite the amount of data being collected, the data resolution was still very lo-fi. Seeing the information displayed in this 3d fashion it made it easy to identify unique characteristics of the environment from the scanning process. These artifacts were speculated to be caused by either a mistake by the sensor or a physical audio interference from an external sub-human audible sound source, but still within the 40Hz ping range of the sensor. At the 40 Hz level, humans can’t hear this sound by it would still be picked up by the ultrasonic sensors as something that could influence the real ping sound the sensor is expecting in return.

Getting to the realization that inaudible environmental sounds can interfere with the readings opened a new door in human perception and its limitations compared to digital systems and sensors that can experience and perceive the world completely differently. Not just by the clarity humans can interpret and understand in their surroundings, but in the way that there are senses and physical data sources in our world that humans are mostly oblivious or blind to. Seeing these errors led to the discussion of *Habitual Instinct* not only revealing the interconnected environment of physical data and our digital ecosystem but also visualizing and communicating the invisible physicalities that surround us but are visible to digital technologies through different senses. If humans can't perceive a physicality within the world, it doesn't mean that it isn't there.

Study 2

Study 2 was done to research a more compact physicality for the motor and sensor object. This new system required to visually be lighter, more financially viable and easier and more time effective to assemble. A new form factor and the mounting solution was used to allow for easier wall mounting or hanging, and multiple mounting arrangements were investigated as well. Finally, a preliminary real-time data representation was created to communicate the perception of the physical world through the lens of the 5 sensors.

Figure 7.13. Habitual Instinct Study 2 Installation.

During Study 2, the decision was made to switch from using a stepper motor to using servo motors instead. The new object mounting system was a pair of bespoke aluminium L-brackets to hold and mount the ultrasonic sensor and servo motors. The fabrication and final brackets are shown in *Figures 7.12 - Figures 7.17*. The form factor was tidied up by positioning the mounting brackets for the servo directly behind the ultrasonic sensor. This made the shape of the full bracket, motor, and sensor more of a square that protruded from the wall than anything else. It also allowed individual robots to be more densely clustered.

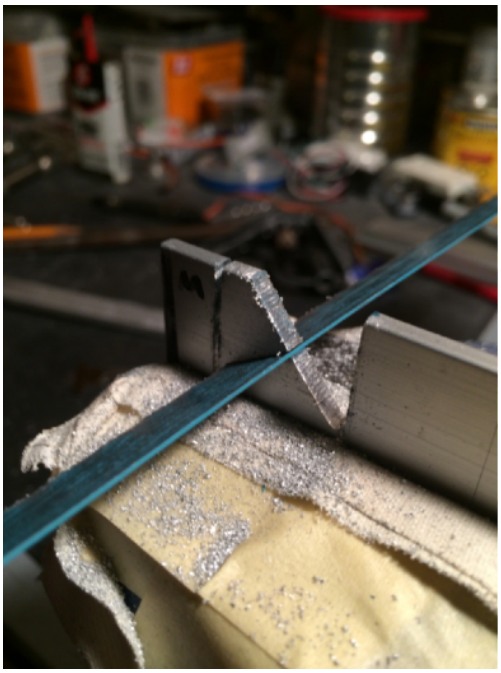

Figure 7.14. Early fabrication of the L-brackets.

Figure 7.15. Aluminum L-brackets with sensor..

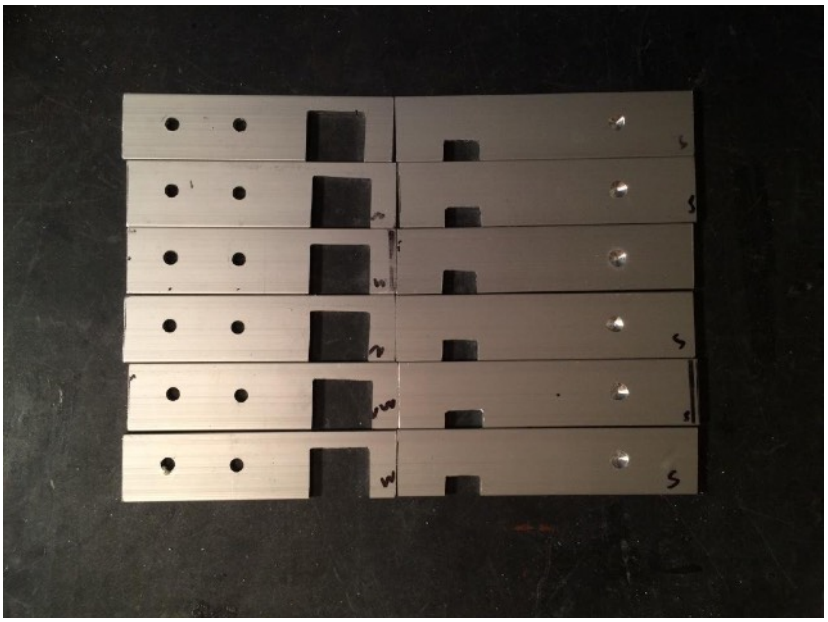

Figure 7.16. Completed L-bracket design but still unbent.

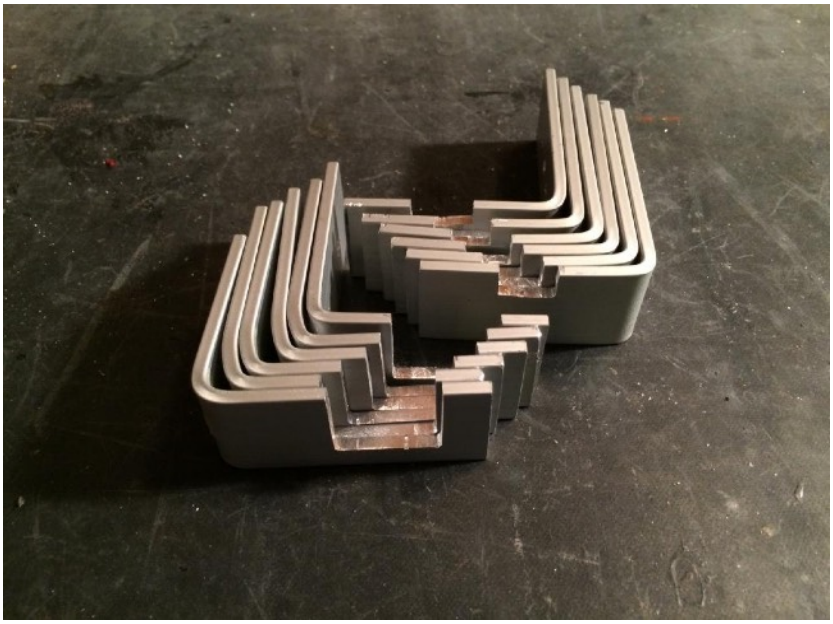

Figure 7.17. Bent L-brackets.

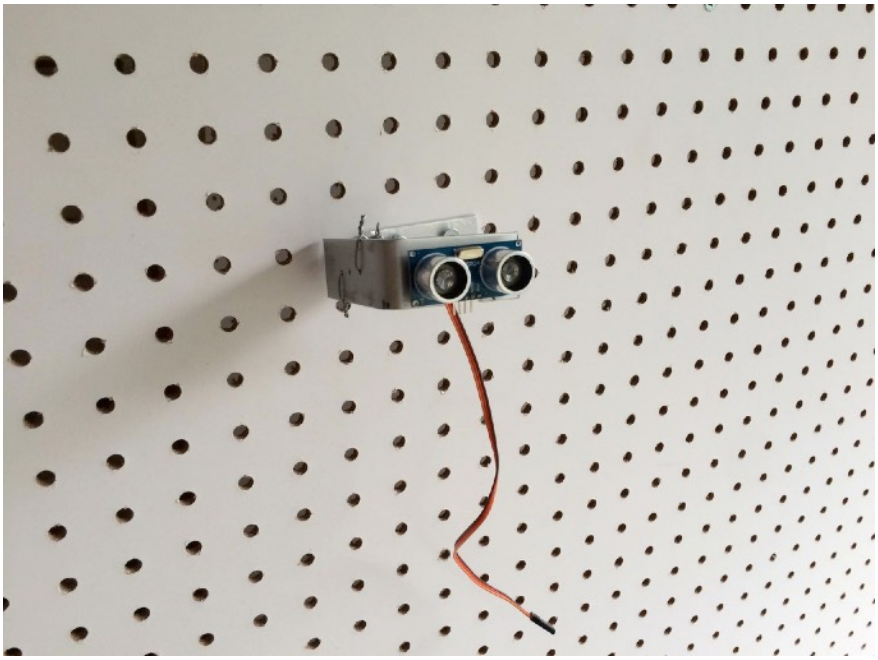

Figure 7.18. Form and materialization of for Study 2.

Positioning, Spacing and Pattern Exploration

A 2D mock-up of the possible mounting bracket arrangements was done to explore the scale, spacing, placement, mounting patterns and other creative and technical decisions needed for other iterations. The below image, *Figure 7.19* is one of many of these studies imagining *Habitual Instinct* in a visual space with a unique sensor mounting pattern.

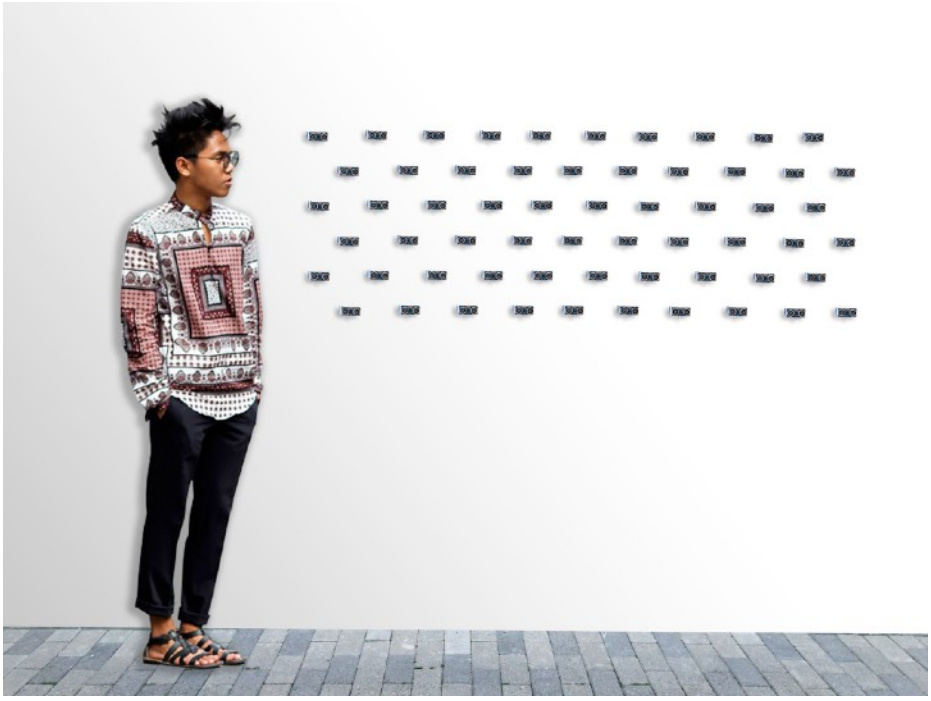

Figure 7.19. Potential wall mounted arrangement for expanded research.

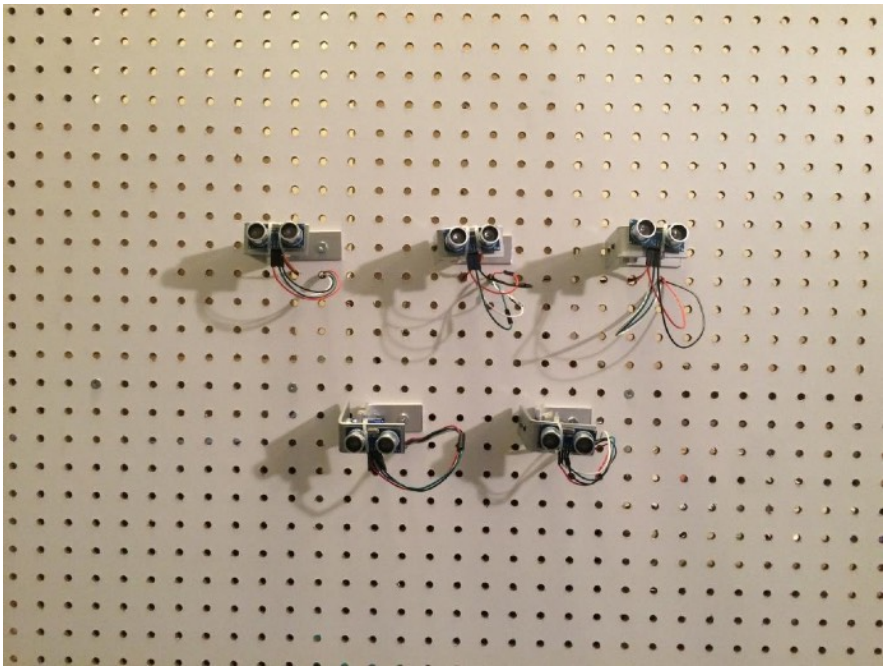

Figure 7.20. First cluster of 5 mounted objects. Study 2.

To accurately display the scanned data, the study also examines methods of physical world positioning that is translated into the digital world. Study 2 was the first real time interpretation of how the 5 sensors perceived the world in front of them. The flow was to send data from the Arduino, passing through a Processing app via a serial port and storing the data in PubNub. This data was then streamed back down to another Processing app that handled the real-time data visualization. Since the sensor was rotating around the x-axis, it was decided to explore using a point cloud to interpret the data. To represent the scanned data points in 3D space, each robotic object used a unique ID that was stored along with the sensor data. This ID was referenced in the visualization Processing app as to where that ID needed to be positioned on the X/Y grid. A system was also devised that 1 mm in the real world would represent 1 pixel in the digital representation. This was an important discovery as the most recent study for the project uses 84 sensor objects which need to be accurately represented positionally in the digital world.

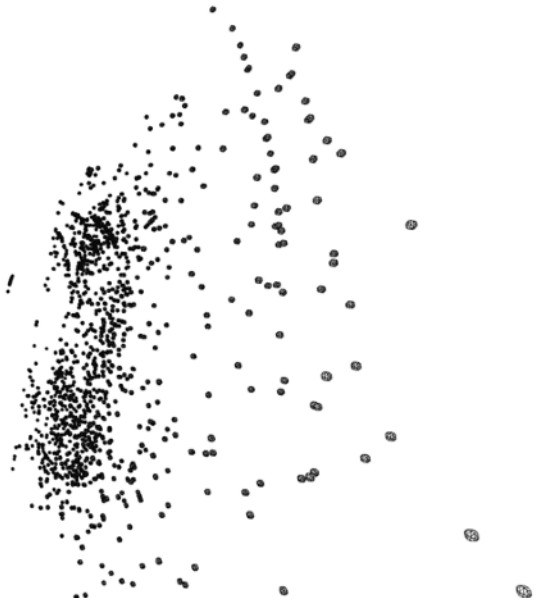

Figure 7.21. Scanned data displayed as a point cloud for a few scans that just iterated over 5 positions along the x-axis.

With these points being updated in real time, it was slowly possible to start and recognise the participant's movement within the area being scanned by the sensors. One piece of valuable feedback

was about the engagement level of the point cloud. Since the point cloud updates were at a steady, yet moderate pace, there were times with an empty screen or with no animation with nothing happening. The visuals needed to be more engaging to the audience. The solution was that future studies would introduce generative controlled rotation, zooming, fading and vector force algorithms to keep the point cloud's visuals engaging and thought provoking for the participants.

Conclusion

While conducting Study 2, the most important aspects that were learned progressed the overall project was the design and creation of the first iteration of the final L-bracket's form factor. Solving how data is streamed and stored from the installation to the visuals through Pubnub set the stage for all of the remaining studies. Finally, displaying real scanned data in real time and how the clusters of the robotic objects saw the participants and the interpretation of this data was a significant milestone for the project. This connection of the working themes and technical internals of the piece confirmed that real-time data could travel from the physical world and make it through the data stream pipeline, represented digitally, the interpretation and conflicting perceptions between the digital and human views of the world, and that potential for affects that may surround this interactive and strangely responsive environment.

Study 3

Study 3 explored the scaling and modularization aspects of the interactive system. During this study it solved many logistical aspects of the project including power for a large number of servos and sensors, the technical requirements of networking and data flow between hardware devices, different interaction modes that the system will inevitably need rests and breaks during the showings. The rests taken by the installation are both required and would be integrated into the series of interaction modes that the piece would be able to generativity decide to rotate through, to draw out potentially different affects. As well, stress testing of the installation was discussed along with the modularity and transportation of the piece between the locations of building, testing, and showing. Some sample interaction modes could be; stop, start, sine wave, sweep, noise algorithm, sweep interact, and noise algorithm interact.

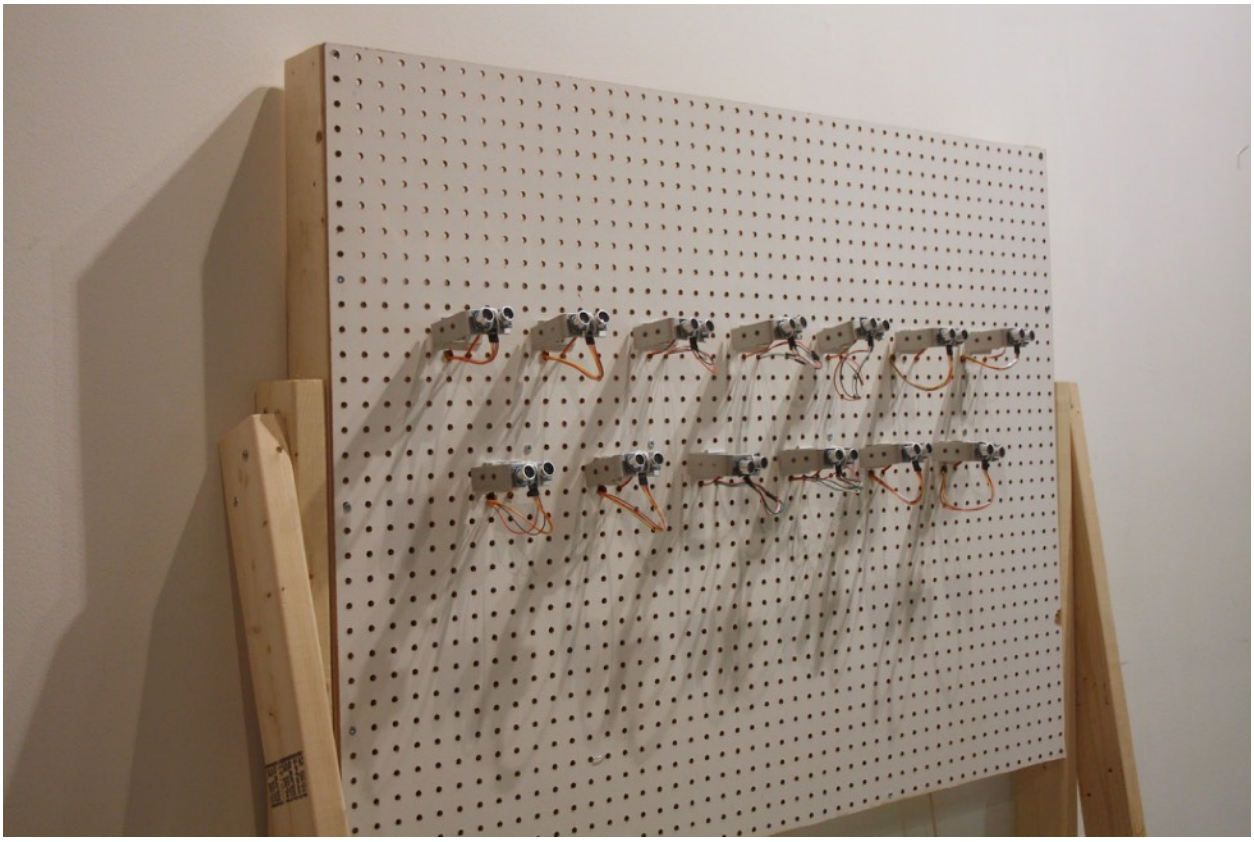

Figure 7.22. Habitual Instinct, Study 3.

One of the more serious issues was getting the installation to continuously run, non-stop for a number of minutes or hours. At first, the piece would only run for around 5 minutes before crashing. The solution was to abandon using the JSON format for data structure and replace it with a delimited string with custom delimiters. The data stayed the same, the syntax and format were just a smaller size. Another update was to switch from using Processing as the intermediary between the installation and Pubnub to a Node.js application. Not only does Node.js handle network processes with more grace it also opened up the possibility to run app sending data to Pubnub on various platforms like a Raspberry Pi. Using the Pi, also allowed for using the mini-computer as a controller for the 4 Arduinos in the final piece. The Pi will be the Master while the Arduino Megas are listening for commands from the Pi. This wouldn't have

been easily possible if Processing was still going to be used to process the scanned data. The last technical issue explored was to extend the mechanical life of the motors. While testing there were problems with motor burn out and jittery motor movement. The solution was to make sure that the motor didn't have constant torque applied to it all of the time.

Conclusion

Scaling up the nodes of interaction in this study created new technical and conceptual challenges. Working with 13 modular pieces makes it easier to predict what problems will happen when working with more objects, i.e., 50, 75 or 100. It helped sort out important decisions for future studies such as wall mounted clusters, networking and the power supplies, serial communication control, the different modes, affectiveness of the interactions and come up with a solution for a modular design to ease the transportation of the installation.

Study 4 (Creation By Error)

Creation By Error (or Study 4) started as another project to explore the data physicalization of information collected through automated digital means. Part of this study was looking at materiality, embodiment assumptions, and digital perception. Through the fruition of this study, it has been shown publically twice, and these exhibitions helped work out some technical issues, as well as discover meaningful interaction and behavioural assumptions with how the final piece may be participated with or explored by the users.

Creation By Error challenges and forces us to question our assumptions about the precision and accuracy of digital devices and how they are used to interpret and understand the physical environment. With a custom fabricated robot that emits an aura of "aliveness" and a bespoke networked system, the project captures, compares and materializes the discrepancies between our interpretation of the physical world and that of the robotic system. We are forced to contemplate the level of trust we hold in the data that's being created by many digital systems.

The *Creation By Error* robot is set placed facing a blank wall that is to be scanned. The space would be for participants to wander around the installation to be observed, analyzed and indefinitely archived. The archived data is used is visualized and projected in real-time next to the robot. A static hanging mobile is hung nearby. It displays the mean error of the measurements that were collected over an hour. The IRL distance measurements from the robot to the wall were calculated and then differenced with the 100,000+ data points that were gathered by the robot. It's these differenced measurements that form the shape of the hanging mobile.

The contrast between the real-time data projection and hanging mobile created through data error and digital perception opens a discussion around the level of accuracy and truthiness that data may have especially when these digital systems start to interpret their surroundings in unique ways, just like humans. The understanding of the physical world by digital systems may not be as mechanical and resistant to interpretation as once thought.

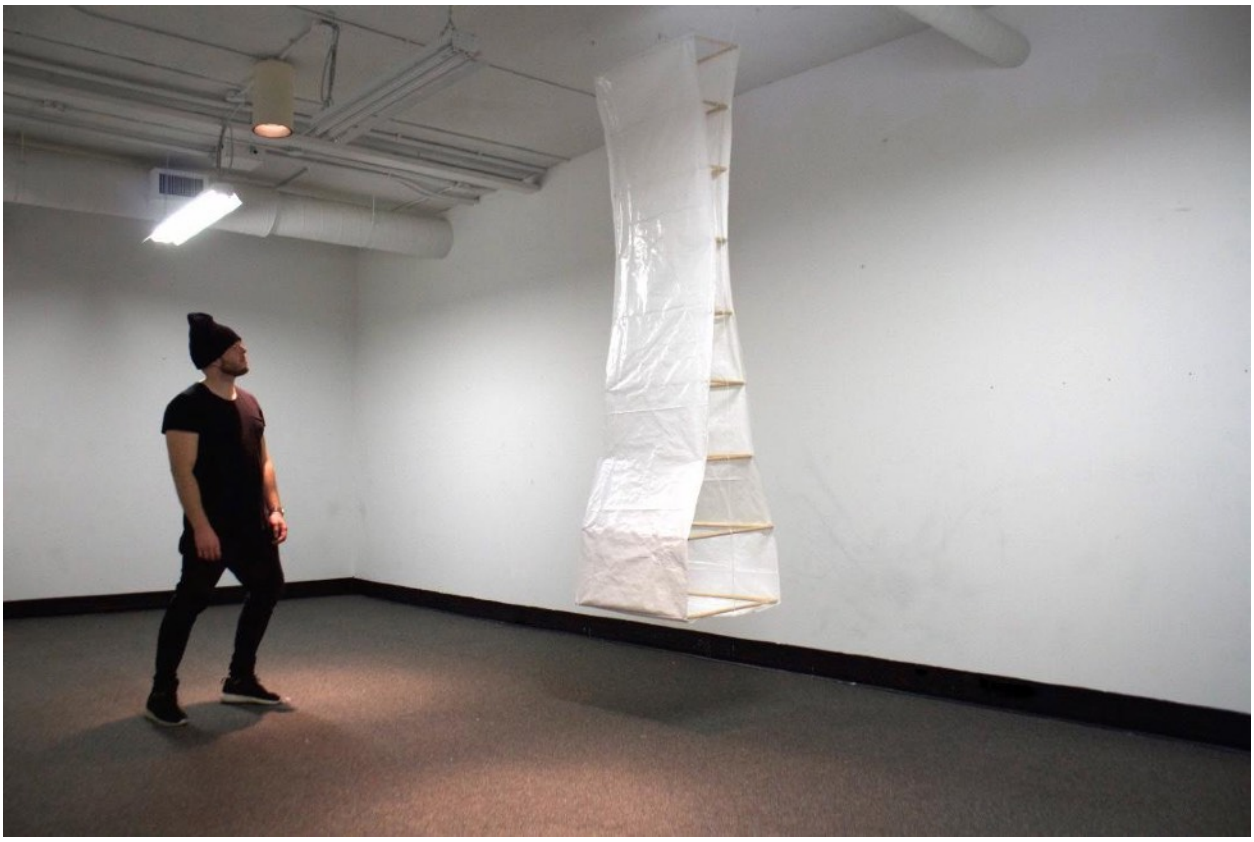

Figure 7.23. Creation By Error. 2016.

What was the output?

In *Creation By Error*, the data being displayed was collected specifically for this project with a custom robot. The robot consisted of an Arduino Micro, a tact button, a small servo motor, an ultrasonic sensor, custom built “L-brackets” and the Node.js programming framework. The “L-brackets” were designed to allow the servo motor to rotate the ultrasonic sensor around the x-axis. The sensor was able to rotate a total of 180 degrees. When at degree 0, the sensor is pointing directly down towards the floor, and when at the 180th degree it is pointing up towards the ceiling. The robot was set up facing an empty wall that stood at the height of 2.4384 meters (8 feet) and was 160 cm away from the wall. The robot was turned on and was left uninterrupted for one hour. During the one hour period, the device collected a total of over 100,000 data points which were distance measurements. These measurements were gathered at every angle between 0 and 180 degrees. Each angle that the robot measured had a total between ~800 to ~1,200 unique data points. Using all of the data points, the mean distance for each angle that the

robot scanned was calculated. Doing this calculation provided real insight into to how the robot saw and interpreted the space it was in front of. It also shows the fluctuation and anomalies in the digital measurement over time.

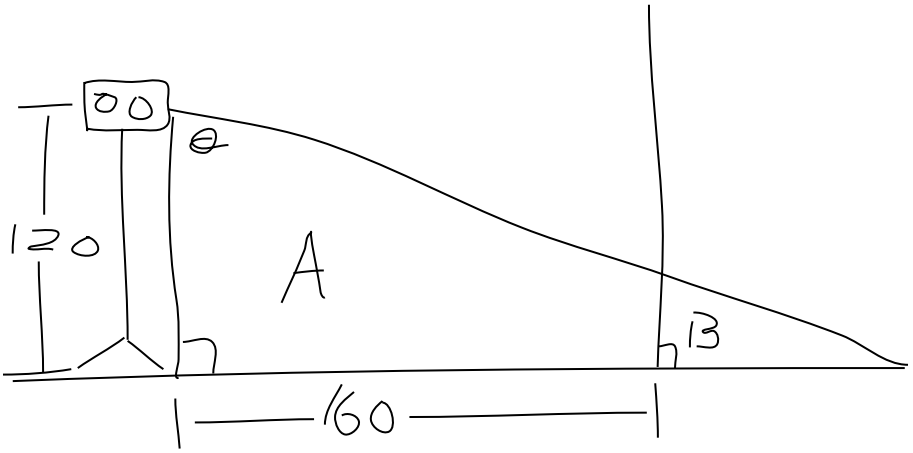

Figure 7.24. Illustration for the sensor, wall, physical distance calculations.

For each angle that the robot scanned, the real physical distance was also calculated. This was done using trigonometry. The distance from the sensor to the wall was calculated by taking the height that the sensor was from the floor and the angle that the sensor was pointing. With this, the hypotenuse of Triangle A in *Figure 7.24* was calculated.

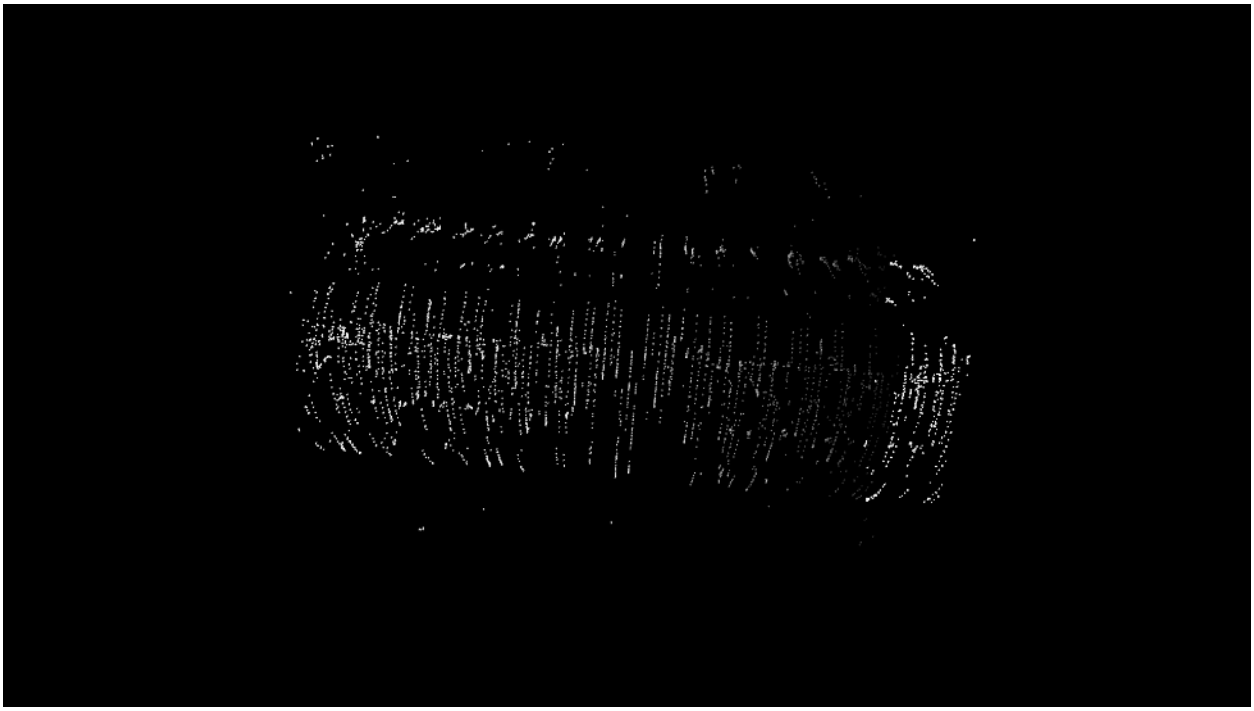

Figure: 7.25. Creation By Error data capture, 3/3/2017 12:54:39.

While testing for the Open Show, there were a lot of valuable discoveries that turned out to substantially help in the effectiveness of Creation By Error but also moving forward on my final thesis project Habitual Instinct. The most valuable takeaways from this preparation and exhibition included learning that after roughly 10 minutes of running the microcontroller or the ultrasonic sensor seemed to overheat and would start to return unusable distance measurements between that usually were between 0 cm and 15cm. This behaviour would happen regardless of someone standing in front of the sensor. The solution to this involved adding logic so that for every 10 minutes the piece ran, and the sensor was sweeping, the piece also was given a 1 minute rest. This rest allowed the chips to cool down in temperature. Exhibiting at the Open Show also allowed for brute force testing the durability of the installation components. It was discovered that around 20-25 hours of motion, the SG90 servo-motor would wear out. Knowing this bit of information also helped with the predictability of Habitual Instinct and how frequently the servos might need to be swapped for a new one. It was while preparing for the Open Show that the realization that a data smoothing algorithm was necessary to improve user interaction with the piece. The smoothing algorithm helps to determine if the object should respond to a participant

or if to wait for more data before assuming that there is someone in front of the sensor. This is where there is a divergence between the interaction data and the data used to plot the digital perception of the physical world are two slightly different things. For the interaction, the smoothing algorithm prevents jumpy and erratic movement from the object if it read inconsistent measurements. It does this by averaging the previous 5 measurements and then decides if it should respond to this data. This is used to make sure that if there is indeed a participant in the caring cone and not just an outlying data point. In contrast, the data points that were visualized were not analysed or smoothed over. This meant that any data no matter how unusual would be visually displayed for the viewers. Finally, having the system autonomously decide what it's next interaction mode would be after the one minute of rest was enough to intrigue participants and discuss the objects unpredictability and our expectations we project onto it. It was with these discussions, and the time people spent asking questions and observing the interactions that I concluded that having the different modes and that the reactions the piece had to the presence of attendees were positively received.

Regarding the visual communication of the data being gathered, there were also some valuable technical learnings. With the amount of data being collected and displayed using Processing, the technical decision to push and pop particles in and out of a Java ArrayList was too resource heavy for the amount of data being collected. This resource intensive process created slow responses in the visualization which made it look very glitchy. To resolve this issue a pre-cached 2d array with the particles were created on initialization of the application. The 2d array consisted of 5,000 particles with an opacity of zero. With these particles, when new data was received by the application the app rearranged the relevant particles and updated the opacity to be visible. This fixed the computational glitches and improved the particles behaviour significantly. Also, adding the ability to turn on and off particle fading over time helped visualize what data sets were the most recent and allowed participants to identify their presence and interaction with the piece more quickly. Finally, a rotation and zoom movement of the particle system was added and were a success. I received multiple bits of feedback about how the

additional movement around the point cloud and the transition of zoom values created a more engaging visual component for the audience.

Figure 7.26. Assembling Creation by Error.

To visualize and communicate the margin of error between the digital measurements and the physical world, a to scale sculpture was built and hung from the ceiling. The materials used to fabricate the sculpture was wooden dowels, a white tarp, string and wood staples. The dowels were used to create 9 wooden ribs representing 9 measurements read at different angles. The size of the ribs were dependent on the difference between the physical and digital measurements. Lastly, the tarp was cut to size and draped over ribs of the sculpture.

The interest in taking these robotic measurements and comparing them to the known distances was to investigate, and generate dialog about the reliance society has on technology and at times a perception of “perfectness” that the digital can create. This “perfectness” can sometimes create a blind trust in what people accept from technology. By showcasing the error in the digitally collected measurements, I hope to spark critically thought about what information people receive through digital mediums. The fascination of concretizing digital data and creating physical embodiments of this data was connected to the CNC piece *10 Minutes of a Chair on August 19th, 2016* (Figure 7.10) from Study 1. Creating permanence and physically tangible representations of invisible information helps understand and perceive the digitally invisible world around us.

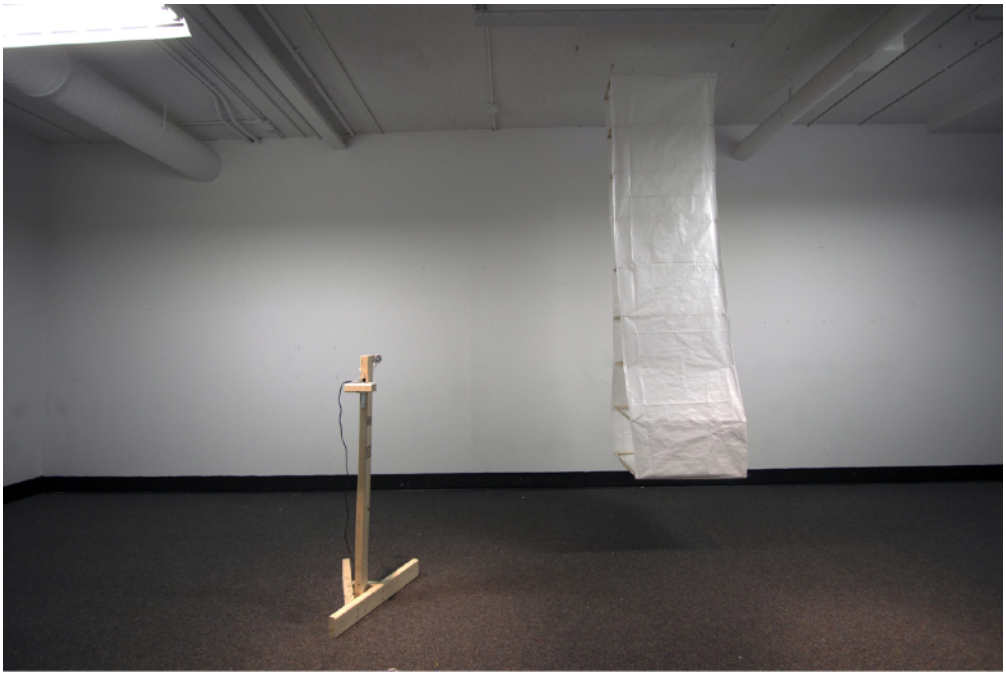

Figure 7.27. Creation By Error final installation.

How did it evolve the thesis?

With the project Creation by Error and having it publically shown, the process helped focus on the development of the object's aesthetic, the creation of custom software tools and the creation of a few custom software libraries. Even though this might seem to be a distraction from *Habitual Instinct*, it was an asset in regards to helping itemize tasks and stay focused on the long-term thesis project. *Creation By Error* allowed for the improvement of the objects interactivity and response with participants. This improvement was partially solved by using a smoothing algorithm for the measured data points. This means that the previous 5 measurements would be averaged together before calculating if the measurement was within the area that the robot cared about and would respond to the viewer. This smoothing algorithm was to help create a more recognisable interaction experience between the viewer and the installation. It should be noted that even though the robot reacted to the smoothed measurement values, each measurement that the sensor collected was archived on PubNub and streamed to the Processing application. The two libraries that were written for *Creation By Error* was the

Arduino Simplex Noise (https://github.com/jshaw/SimplexNoise) library and a port of the original Arduino NewPing Library to work on the Adafruit ESP8266 Feather (https://github.com/jshaw/NewPingESP8266). Both of these libraries have been open sourced on GitHub and available to the public. Even though both libraries were used for *Creation By Error*, SimplexNoise was the library that became very useful for the final version of *Habitual Instinct*.

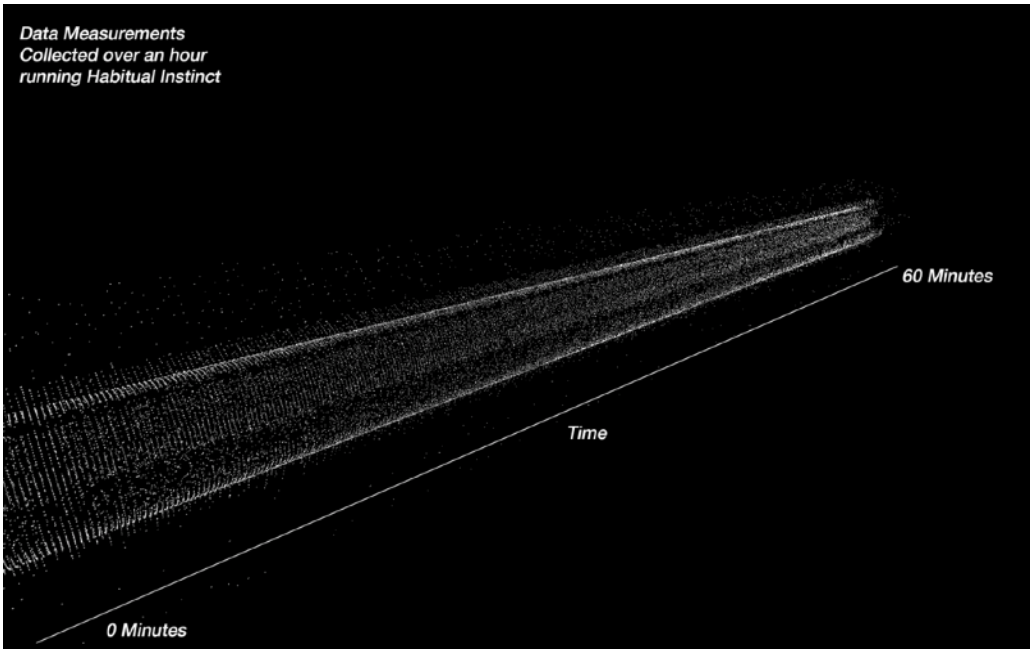

Figure 7.28. A visualization of the over 100,000 data points collected while scanning for Creation By Error.

Conclusion

Creation By Error was to create a piece that included a non-digital form factor as a component of the traditional digital and physical computing themes of other studies. Part of this was to be pushed out of the comfort zone of familiarity. By doing this *Creation By Error* was shown publically twice which would be considered a success. Also, the scale of the piece accurately represented data and significance of study which help with the exploration and importance of the message by allowing viewers to interpret the lifesize oddities between digital and physical perception and their inconsistencies. Once again the

embodiment of the analog piece was interesting since it represented something that didn't exist before, it was created out of nothing, only conflicts in perception between physical and digital realities.

With the direction of this study, it was considered to shift gears away from the sensor wall mounted grids to a more single embodied sensor, and place multiples of these free-standing objects within a space? The decision was made not to change the direction of the project. I will put further exploration expanding this form factor as a further development and research for the future. One thing that should be noted is that *Creation By Error* has been accepted to be shown which meant that there were a few technical updates that needed to be updated before the exhibit. Luckily these updates were also very related to work that also needed to be done on the project of my thesis piece. While finishing up Creation by Error, I was also in tandem progressing my thesis as well.

Study 5 (Materialism)

Study 5 was about exploring materials for the installation of *Habitual Instinct*. This study has been ongoing throughout the duration of the project and evolved over time as for how the piece was going to be embodied, the scale of the piece, where it was going to be installed, and the budget. The key components that material exploration happened were with the brackets, mounting panels, attachments to the of the motors and sensors to the brackets, wiring, installation mounting solution screen-based visual mounting solution to integrate the digital perceptual visuals cohesively into the piece.

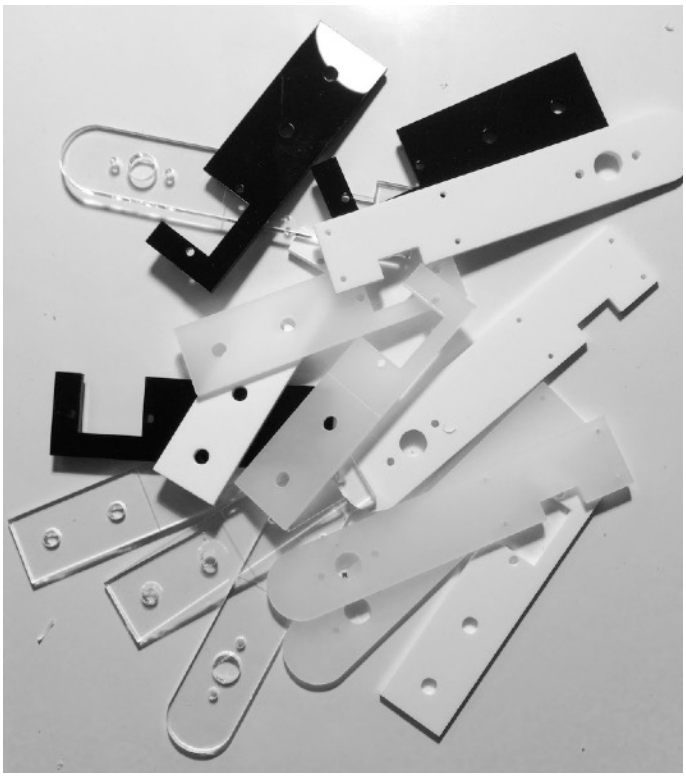

Figure 7.29. Material Study for mounting brackets.

The goal for the materiality is to allow the objects to continue to feel inviting and have a low visual weight without having them seem to toyish or unfinished. This will have a clean look but also make them seem familiar to the viewers as they come into view of the installation. The importance of this material choice and study adds to the formation of the user affects as well as the cohesive and completeness feeling that the piece is required to display.

Study 6 (*Habitual Instinct*)

Digital Exploration Study

With the initial physical study complete and a planned but still work in progress (W.I.P.) human interaction and experience underway the focus shifted to creating a digital interactive prototype. Processing was chosen for this. This digital prototype was used to communicate the project vision in higher resolution that the 3d mockups did previously. Using Processing, a 3d sketch with 140 “sensors” was programmed

with the addition of a mannequin was placed in the 3d space too. This mannequin represented a participant interacting with the installation. Control of the figure was through the keyboard arrows. While the mannequin was leaving and entering the view range that was calculated for each of the 140 3d sensors, the 3d sensors would quickly rotate and reorientate themselves to avoid looking directly in the direction of the mannequin standing in front of them. The purpose of this 3d simulation was to demonstrate the project vision on a large scale, in terms of the interaction and the behaviour of both the participant installation.

The 3d simulation also emphasized and made me realize that the piece would need to potentially different movement and behaviour patterns for detecting participants, reacting to them and for general movement when the piece is trying to attract participants to come and try and interact with it and finally a way to reset all of the sensors back to a default position that would sync and reset the positions of the sensors. Even though each robot in the system is autonomous, for visual unity and “aliveness” [Langill, 257], the group of sensors also needed to have a certain degree of cohesion between them as well.

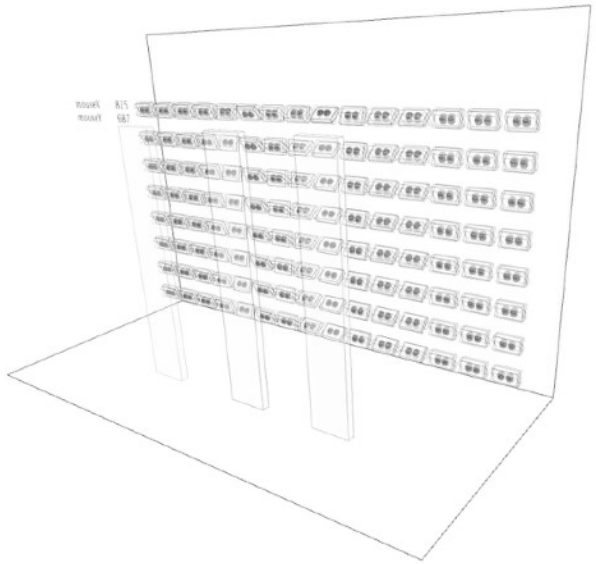

Figure 7.30. 3d simulation of early versions of Habitual Instinct.

Architectural Render

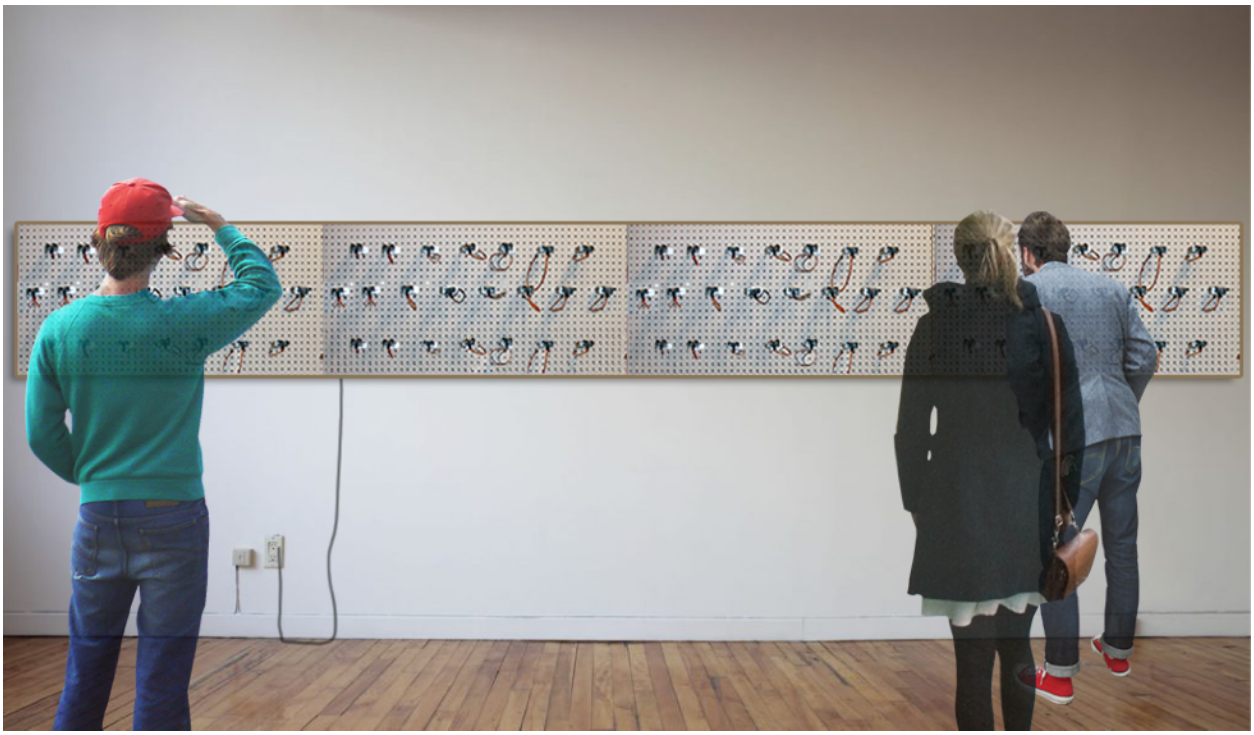

Figure 7.31. Artist rendering of completed installation of Habitual Instinct. 2016.

In here, the final discussion about setting the piece up in its completeness in the ANTLab, the testing, networking, programming, and visualization development will be described here. Documentation will also be inserted here along with what was done to scale the installation up from a 4' X 3' prototype to a 16-20' x 3' installation.

The infrastructure and system ecosystem needed to be planed. Below is the drawings demonstrating how all of the modular pieces connected together. It includes the overall system, planning power, circuits, wiring mounting and technology stack.

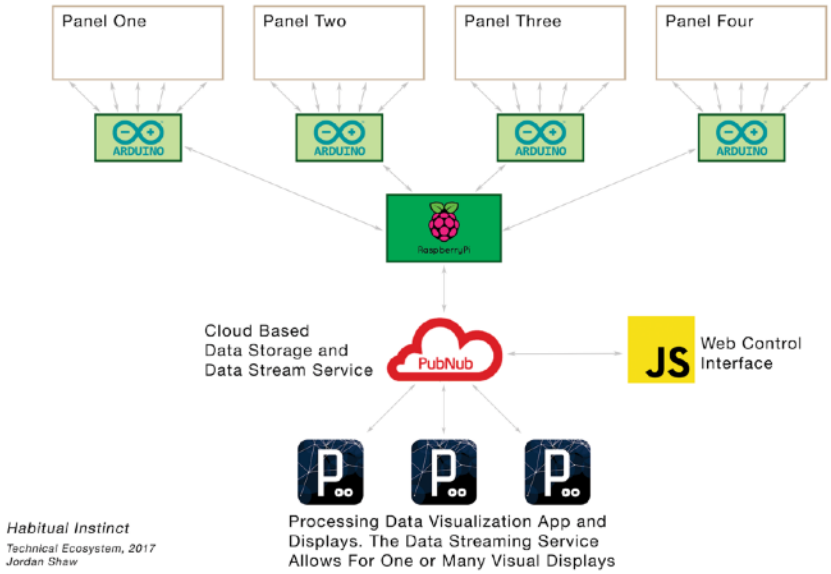

Figure 7.32. The Habitual Instinct Installation Ecosystem.

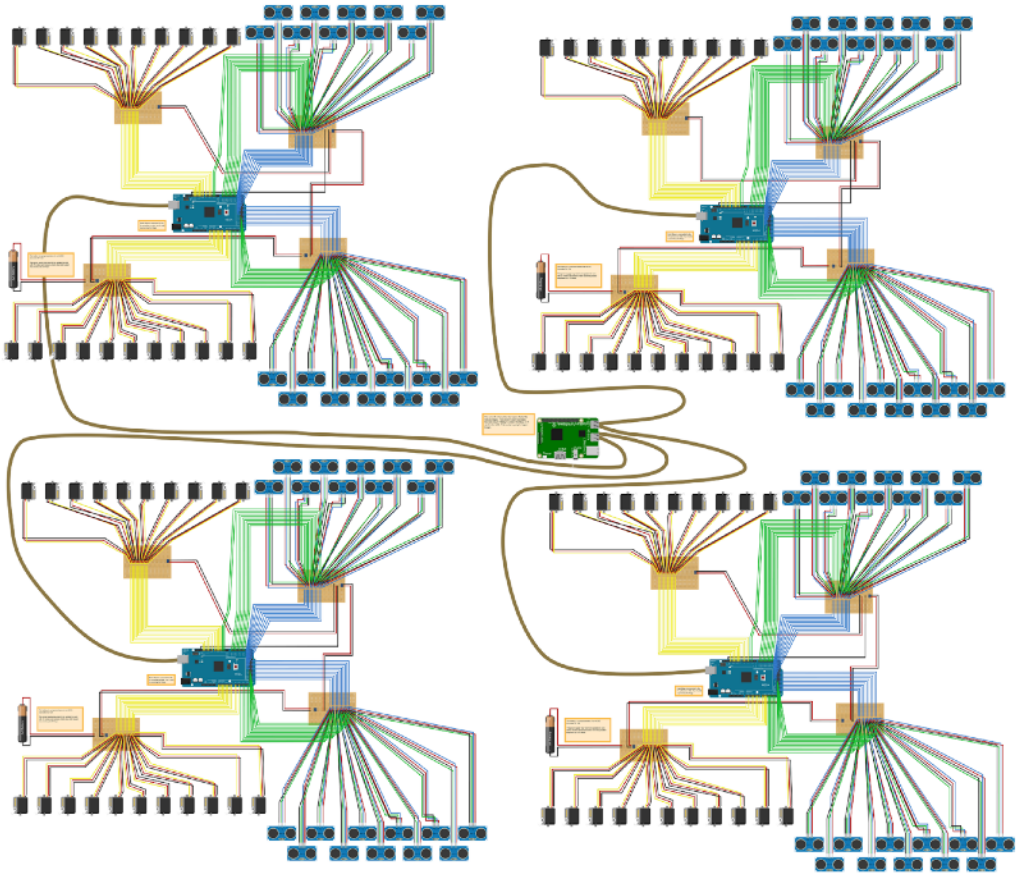

Figure 7.33. Habitual Instinct Schematic. 2017.

The technical infrastructure of *Habitual Instinct* consists of using 3 Arduino Megas and a Raspberry Pi as the Master controller, PubNub for the data storage and streaming and a Web GUI to control the Pi's interaction mode which gets delegated down to the Megas.

Exhibition

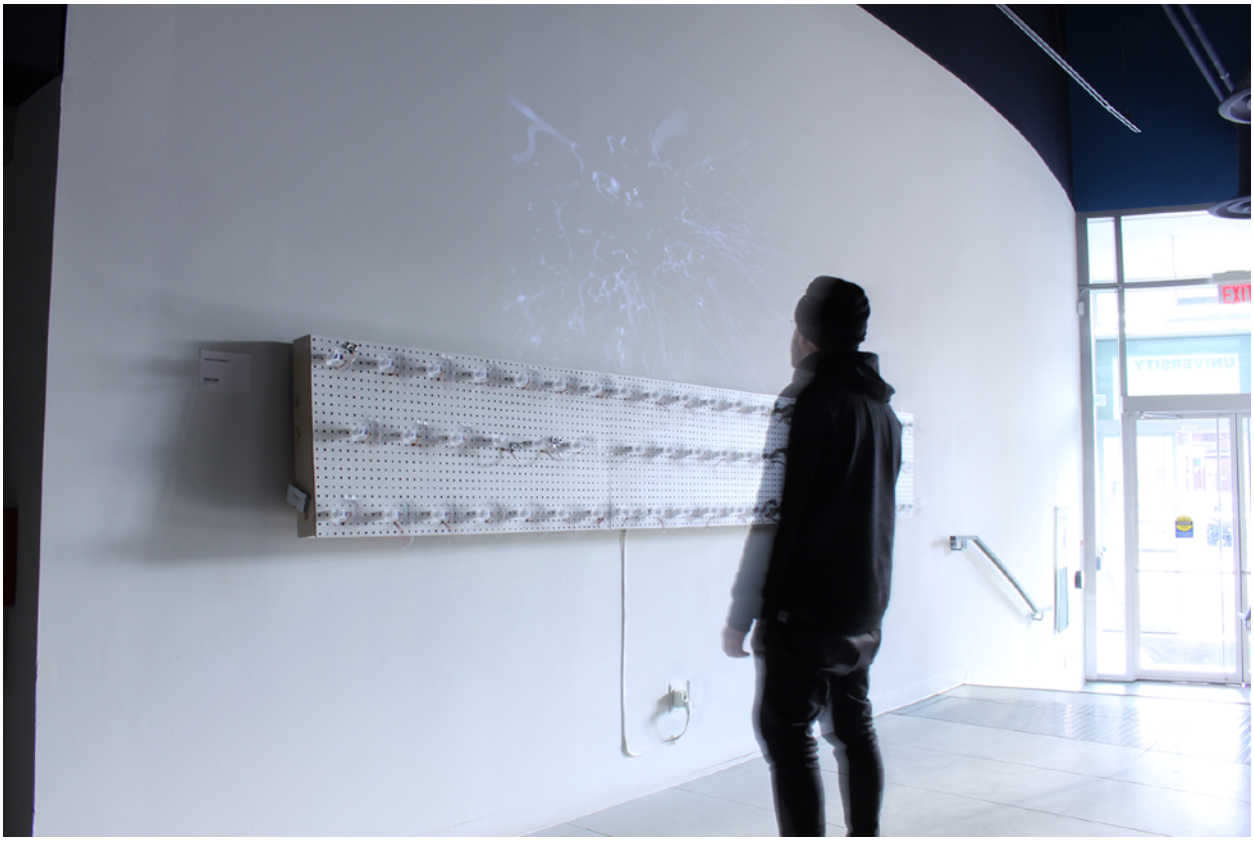

Figure 8.0. Habitual Instinct, Graduate Exhibition. Open Gallery, 2017.

The final exhibit and defense were a success. There were a number or learnings that took place preparing, exhibiting *Habitual Instinct* for the public over four days and having the piece run for over 24

hours. The themes of these learnings are broken down into four groups; planning and setup, technical learnings, interaction findings and participation feedback and a final reflection of the experience.

Similar to planning for the critiques earlier in the year, proper planning needed to be to move the three panels that make up *Habitual Instinct* to the gallery space. To prepare for this custom wall mounting brackets needed to be built, each panel needed to have all of its cables secured to prevent and undesirable movement. Finally, each panel was shrinkwrapped and moved from the ANTLab to the gallery a few blocks away.

The technical learnings that happened during the final exhibition were that having the whole installation powered through one outlet with a single on/off switch kept the piece looking clean but also simplified the maintenance of the installation. There was also a HDMI cable that was kept connected to the Raspberry Pi in the case of an emergency required some debugging with the node.js script. It was also very helpful having the web GUI available from my phone to help manage the installation. Not only did it help demonstrate the different modes during the defence, but it also was helpful to be able to display the multiple modes during the opening. The GUI also had a serial reset function which helped resolve any serial communication data buffer issues between the Pi and the Arduinos. Over the 4 days of the Graduate Show, there were some hardware failures. These failures were minor and because of the visual aesthetic and movement of the piece were not too noticeable. By the end of the show 4 servo motors wore out and were no longer responding, and 2 ultrasonic sensors had their wires snap off just below the sensors pins. Despite only being able to fix the wear-and-tear of showing the installation when the piece is removed from the wall mounts the technical issues are solvable. The solution would be to replace the servos with ones that have metal gears and to use a different style of jumper wire for the sensors that could withstand the continuous bending of the wires generated by the rotation of the motors.

During the Digital Futures Graduate Show, there were some observations that I was able to make with how participants interacted with *Habitual Instinct*. It seemed that even though people experienced the

interactions working at various distances from the wall mounted piece, most of the participants seemed to naturally walk up to it within a distance of 30-60cm and waited for the piece to react. It was almost as if by being closer and more intimate to the installation, that its response or interaction would be more observable or exaggerated by their presence. The other interesting component was that participants were infatuated by the level of anthropomorphism that the individual robots held. I overheard some gallery attendants discuss the behaviour of specific robots over others and even picking favourites. This connection to the piece, as well as to the individual robots was an interesting observation for me. This connection with the piece also came across in a holistic way as I experienced viewers become mesmerized and zone out in the middle of a conversation with me. This behaviour also was observed as a third party bystander. I was told that with the smooth movement of the sensors in search for something in front of them, the continuous flow of the visuals and the ambient noise generated by the motors created a state of hypnotism that was quite relaxing. This behaviour was one that wasn't intended or expected. It was only after the piece was installed that the connection between the installation and both the natural attraction to fire while camping or waves at a beach were made. Relaxing until they remembered that *Habitual Instinct* was gathering and storing data about them. I was told that it was this constant tension between relaxation and reminder of its actual functionality that sparked contemplation, conversation, and reflectivity.

Over the duration of the show, I received some insightful feedback. Some of the feedback was related to the level of anthropomorphism that was seen in the piece. One comment that stood out was that *Habitual Instinct* was "cute, creepy and beautiful." This comment was elaborated on by stating that those words or feelings are rarely used together and but with *Habitual Instinct*, it seems to work. Other feedback was related to the expectation that the visuals displayed above the piece should show or at least hint at some recognisable form from the data that the robots were collecting. I was told by a attendee that it is an interesting choice that I choose to obscure the data intentionally by adding movement and decreasing the opacity of the points over time. Despite this intentional decision to add that visual feature, it was rewarding to see that this was a point of interest that sparked a larger decision

about the participant's expectation with how technology perceives the physical world and humans. A peer commented on this topic by connecting the expectation of seeing yourself in the installation and this narcissistic tendency as political commentary about society and how this might become a challenge as AI becomes more prominent in society fighting for the attention of humans. Lastly, many attendees commented on the added dimension the installation developed by having the 60 servo motors and the soundscape that was created when the installation was running.

As a final reflection for exhibiting *Habitual Instinct*, the feedback, engagement, and participation between attendees, as well as with me was motivating and inspiring to continue making pieces surrounding the topics about our relationship with technological, our expectations and privacy, surveillance and data collection. The installation was successful with how it engaged with the participants and drew them into the space where it was installed. With regards to the visuals, it was reaffirming to experience how the abstractness of them helped generate discussion about expectation and our perception with how technology sees us. For future exhibits, it would be worth investing in micro-servos that have metal gears instead of plastic ones to help with the longevity of the installation. As for the installations behaviour, I believe it would add an extra dimension to the piece by removing the hard-coded position of the caring code with a generative determined area that each robot cared about. This implementation could perhaps evolve and change over time in a unique way for each individual robot. This could be done by adding some form of machine learning logic and behaviour to the objects. Lastly, since the soundscape of the running installation was consistently brought up, it could be interesting to explore what else could be done to explore different sounds based on sensor movement and user interaction.

Conclusion

When understanding how technology has evolved to its current state and setting the stage to critically think about and decide the future of implementation of technology and privacy we were able to challenging the relationship with technology it is possible to have participants reflect on their own

relationships, ethics, and morals about digital security, data collection, and surveillance and the implementation of artificial intelligence making decisions that affect their daily lives.

Looking at the history of technology and how we developed and came to accept our present behaviour and our relationships with the digital world, we are able to examine the impact both positive and negative that data collection has had online for the web but also what it landscape might look like as tracking transitions into the physical world. The importance of speculative futures grounded a potential reality where the population, or humanity loses control of their data to an artificial intelligence global system with developed it's own agency and finally by displaying how much data can be gathered by such a minimal set of sensors, the project invites participants to discuss and reflect their internal reactions and questions with one another about the physical movement, participation, and the representation of reality by the digital system.

Contrasting the speculative interactions of *Habitual Instinct* with the revealing and exposition of the data being collected by the installation and the participants interacting with it, and having them be able to relate their movement in the physical world with the digital representation of their movements as a visualized and archived data set, not only does this unite their physical and digital presence and movement it communicates the complexity of the system, how much data is being collected about a space or a person with modern sensors and cameras but it also shows how the virtual and digital do not interpret or perceive the world how humans do. In this deviation of perception, data may get lost, misread and recorded or have valuable information that is gathered by an interaction end up being missed or skipped over by the system which sees a specific interaction or movement as unimportant. How do we feel having an autonomous system make decisions about what is important and what isn't about our lives? At first glance one system that is web based makes these assumptions we will probably manage, when many systems make these assumptions, we'll still probably be ok. It is when these systems become intertwined we start to enter into the unknown and unpredictable. It's the accumulation of data that is the significant factor.

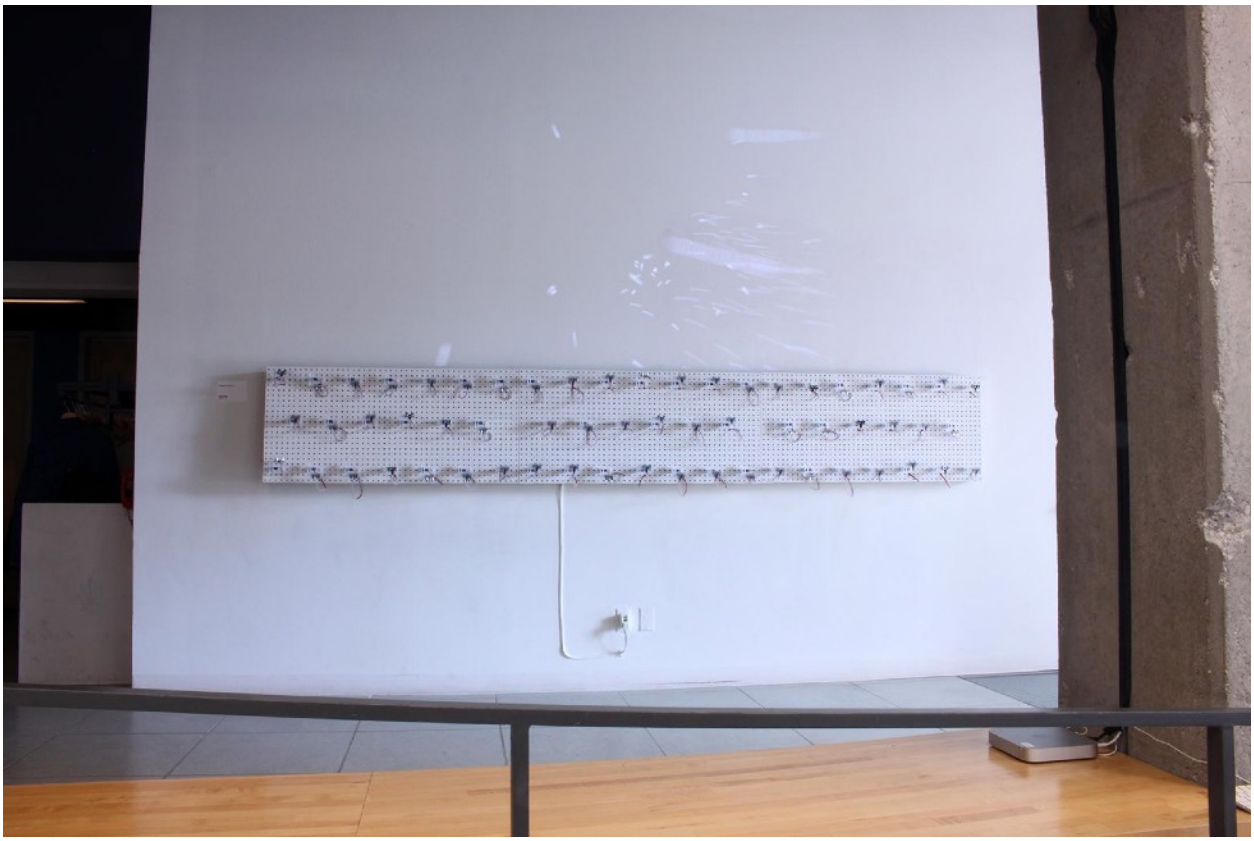

Figure 9.0. Habitual Instinct, Graduate Exhibition. Open Gallery, 2017.

The significance of the interconnected systems is that the more complex they are, the more interesting and larger the impact these systems can have on individuals and society influencing their everyday lives. This idea resonates with the development of *Habitual Instinct* and the number of objects included in the installation. Looking back through the iterations and prototypes the importance or significance of one overly mechanical stepper motor and rotating ultrasonic sensor did seem like much. It was a little buggy, collected data stored it as a .txt file and there was a processing app that displayed this data in what looked like a generative terrain 3d model. It wasn't real time, and it is hard to pick out when it was being interacted with. This evolved to a more refined object that could be wall mounted and worked in groups of 5. The interactions were cleaned up a bit. It would crash when trying to publish data to PubNub and but the concept and user experience was starting to formulate into something that seemed tangible and experiential.

When the prototype reached 13 objects the significance of the interactions and having participants interact and experience the piece started to formulate into a meaningful dialogue between the participant and the installation. Having 1-3 sensors avoid you seems cute. Having 7-8 above your presence starts to make an impact and get you to question your expectations with the installation but also the intentions of the piece itself. Even at this point, the real-time digital perception visuals has some issues, so the impact with the total of 13 objects was interaction based. Because they were slightly unpredictable with their interactions, the level of engagement with the participants also started to develop. People were interested and would watch and try to figure out *Habitual Instincts* behaviour. With Creation By Error, the real-time digital perception was working correctly and having participants see their movement and interactions both effect and and cause a reaction from the robotic component was in some cases startling to them but allowing the participants to see themselves in real time while interacting with the piece got them question how that worked, where it was being stored, even the realization that something that looked so simple could determine their placement in 3d space was critical. Now with the final piece using 60 robotic objects that span 16 x 3 feet with real-time visuals will just amplify the feelings, contemplation and general feelings of being overwhelmed with the degree of surveillance being done in the final piece.

The scale of the final piece is representative of the current state of surveillance and data security to the speculative future. It's not just the concept of the small pieces that are important and should be considered it's what happens on a holistic level of interconnectedness and once it reaches a level of over-stimulation of extreme surveillance and data analysis. By this method, it was important to create *Habitual Instinct* to the scale that it is. As the evolution of the components and the magnitude of the piece is pivotal to the understanding and creating the desired effect to generate discussion about artificial intelligence, data analysis, and surveillance. It is a perfect example of what Ian Bogost discusses in his essay Carpentry "Blending these two notions, carpentry entails making things that explain how things make their world. Like scientific experiments and engineering prototypes, the stuff

produced by carpentry are not mere accidents, waypoints on the way to something else. Instead, they are themselves earnest entities into philosophical discourse." [Bogost, 93]

Bibliography

Basar, S., Coupland, D., Obrist, H. U., & Daly, W. (2015). The Age of Earthquakes: A Guide to the Extreme Present. Blue Rider Press.

Benjamin, W., & Underwood, J. A. (2008). The Work of Art in the Age of Mechanical Reproduction. London: Penguin.

Bogost, I. (2012). *Alien phenomenology, or, What it's like to be a thing.* Minneapolis: University of Minnesota Press.

Bonnefon, J.-F., Shariff, A., & Rahwan, I. (2015). Autonomous Vehicles Need Experimental Ethics: Are We Ready for Utilitarian Cars? Computers and Society. Retrieved from http://arxiv.org/abs/1510.03346

Bratton, B. H. (2016). On Speculative Design. DIS. Retrieved from http://dismagazine.com/discussion/81971/on-speculative-design-benjamin-h-bratton/

Cheng, J. (2011, April 20). How Apple tracks your location without consent, and why it matters. Retrieved February 06, 2017, from https://arstechnica.com/apple/2011/04/how-apple-tracks-your-location-without-your-consent-and-why-it-matters/

Crary, J. (2013). 24/7: Late capitalism and the ends of sleep. Brooklyn, New York;London;: Verso.

Daecher, A., & Schmid, R. (2016, February 24). Internet of Things: From sensing to doing. Retrieved February 11, 2017, from https://dupress.deloitte.com/dup-us-en/focus/tech-trends/2016/internet-of-things-iot-applications-sensing-to-doing.html

Daniel, R. Wooden Mirror. (n.d.). Retrieved February 12, 2017, from http://www.smoothware.com/danny/woodenmirror.html

Dean, M., Donovan, M., & D'Andrea, R. (n.d.). ROBOTIC CHAIR. Retrieved February 11, 2017, from http://raffaello.name/projects/robotic-chair/

Dunne, A., Raby, F., & Books24x7, I. (2013). Speculative everything: Design, fiction, and social dreaming. Cambridge, Mass: The MIT Press.

Epstein, R. (2017, February 06). The empty brain. Retrieved February 06, 2017, from https://aeon.co/essays/your-brain-does-not-process-information-and-it-is-not-a-computer

Feldbloom-Wood, R. (2012, January 12). Robotic Chair (2008). Retrieved February 12, 2017, from http://www.bravofact.com/2012/01/12/robotic-chair-2008/

Foucault, M. (1997). Essential works of Foucault 1954-1984 (P. Rabinow, Ed.). New York: New Press.

Gartner Says 4.9 Billion Connected. (2014, November 11). [Press release]. Retrieved February 11, 2017, from http://www.gartner.com/newsroom/id/2905717

Gartner Says 6.4 Billion Connected "Things" Will Be in Use in 2016, Up 30 Percent From 2015. (2015, November 10). [Press release]. Retrieved February 11, 2017, from http://www.gartner.com/newsroom/id/3165317

Goodall, J. (1997). Transferred Agencies: Performance and the Fear of Automatism. Theatre Journal, 49(4), 441–453. http://doi.org/10.1353/tj.1997.0103

Harvey, A. (n.d.). Camouflage from face detection. Retrieved February 18, 2017, from https://cvdazzle.com/

Horning, R. (2016). Reacting to Reactions. The New Inquiry. Retrieved from http://thenewinquiry.com/blogs/marginal-utility/reacting-to-reactions/

Jansen, Y., Dragicevic, P., Isenberg, P., Alexander, J., Karnik, A., Kildal, J., … Hornbæk, K. (2015). Opportunities and Challenges for Data Physicalization. Proceedings of the ACM CHI'15 Conference on Human Factors in Computing Systems, 1, 3227–3236. http://doi.org/10.1145/2702123.2702180

Kirilenko, A., Kyle, A., Samadi, M., & Tuzun, T. (2016). The Flash Crash: High Frequency Trading in an Electronic Market. Journal of Finance, Forthcoming, 1–42. http://doi.org/10.2139/ssrn.1686004

Langill, C. S. (2013). 15: The Living Effect: Autonomous Behaviour in Early Electronic Media Art. In Relive: Media Art Histories. The MIT Press.

Lauricella,T, & McKay, P. A. (2010, May 7). Dow Takes a Harrowing 1,010.14-Point Trip. Biggest Point Fall, Before a Snapback; Glitch Makes Thing Worse. Retrieved February 13, 2017, from https://web.archive.org/web/20100509100118/http://online.wsj.com/article/SB10001424052748704370704575227754131412596.html

Lozano-Hemmer, R. (n.d.). Tape Recorders. Retrieved February 12, 2017, from http://www.lozano-hemmer.com/tape_recorders.php

Lozano-Hemmer, R. [MCA Australia]. (2012, January 08). Interview with Rafael Lozano-Hemmer. Retrieved March 12, 2017, from https://www.youtube.com/watch?v=C2Tw82ajwnQ

Lund, J. (2013). Press Statement for Fear of Missing Out. Retrieved from http://jonaslund.biz/works/the-fear-of-missing-out/

Massumi, B. (1995). The Autonomy of Affect. Cultural Critique, 31(31), 83–109. http://doi.org/10.2307/1354446

Massumi, B. (2008). The thinking-feeling of what happens. Online], Inflexions, (May 2008), 1–40. Retrieved from http://wiki.dxarts.washington.edu/sandbox/groups/general/wiki/be128/attachments/4b234/Massumi-the_thinking_feeling_of.pdf

Munari, B., & Creagh, P. (2008). Design as Art. London: Penguin.

AtonAton, Coming face-to-face with our companion species. (n.d.). Retrieved February 12, 2017, from https://atonaton.com/mimus/

Ojala, A. (2013). Software-as-a- Service Revenue. IT Professional, 15(June), 54–59. http://doi.org/1520-9202/13/

Pentland, A. (2015). Social physics: How social networks can make us smarter. Penguin Books.

Pianezza, P. (2013, October 22). An interview with Evan Roth. Retrieved February 12, 2017, from http://www.aqnb.com/2013/10/22/an-interview-with-evan-roth/

Reas, C., McWilliams, C., Barendse, J., & LUST (Hague, N. (2010). Form+code in design, art, and architecture. New York: Princeton Architectural Press.

Roth, E. (n.d.). Level Cleared: BAD ASS MOTHER FUCKER (BADASS MOTHERFUCKER). Retrieved February 12, 2017, from http://www.evan-roth.com/work/level-cleared/

Roth, E. (n.d.). Angry Birds All Levels. Retrieved February 12, 2017, from http://www.blog.ni9e.com/angry-birds-levels/

Roth, E. (N/A). Artist Statement. Retrieved from http://www.evan-roth.com/about/

Salter, C., & Pickering, A. (2015). Alien agency: Experimental encounters with art in the making. Cambridge, Massachusetts: The MIT Press.

Shiffman, D. (2016, May 04). Coding Challenge #11: 3D Terrain Generation with Perlin Noise in Processing. Retrieved February 3, 2017, from https://www.youtube.com/watch?v=IKB1hWWedMk

Steyerl, H. (2009). In Defense of the Poor Image. Eflux Journal, 10(10), 1–9.

Tegmark, M. (n.d.). AI Open Letter. Retrieved February 13, 2017, from https://futureoflife.org/ai-open-letter/

White, N. (n.d.). The Normill. Retrieved February 11, 2017, from http://normill.ca/

White, N. (n.d.). Technical details on the Helpless Robot. Retrieved February 12, 2017, from http://normill.ca/HLR-tech.html

Appendix A: Software + Open Source Libraries

Open Source

- Nervous System called OBJExport, http://n-e-r-v-o-u-s.com/tools/obj
- Creation by Error
    - Node.JS Code (physical calculations, digital calculation, maths and data files)
        - https://github.com/jshaw/data_viz_cumulative_node
    - Arduino Code (robot control code)
        - https://github.com/jshaw/data_viz_cumulative_error
- Digital Futures Open Show
    - https://github.com/jshaw/creation_by_error_processing
    - https://github.com/jshaw/creation_by_error
- Simplex Noise Arduino Library, https://github.com/jshaw/SimplexNoise
- NewPingESP8266 Library,https://github.com/jshaw/NewPingESP8266
- https://processing.org/
- https://www.arduino.cc/

Software

- https://www.rhino3d.com/
- https://www.adobe.com/ca/
- https://www.pubnub.com/
- https://www.raspberrypi.org/
- https://nodejs.org/en/
- https://www.mozilla.org/en-US/teach/smarton/tracking/
- https://www.mozilla.org/en-US/lightbeam/
- https://addons.mozilla.org/en-US/firefox/addon/ghostery/

Hardware

- https://www.raspberrypi.org/
- https://www.arduino.cc/
- https://espressif.com/en/products/hardware/esp8266ex/overview

Appendix B: Video Documentation

- Habitual Instinct YouTube Video Documentation: https://goo.gl/dTmj2G