

System + Method

The datafication of self-knowledge contextualised through contemporary art practice

Michelle Woulahan
practicing as Antoinette J. Citizen
Bachelor of Fine Arts (Honours)

An exegesis submitted in (partial) fulfillment of the requirements for the degree of Doctor of Philosophy.

RMIT JULY 2015



Abstract

System + Method is a practice led inquiry into the datafication of self-knowledge, as seen in the increasing prevalence of life logging and self-surveillance technologies. The thesis takes a personal look at the value of data, reflecting on how data practices claim to shape us into the 'best' versions of ourselves. Using humour, performance and applying evolving technologies in the best spirit of artist's DIY, I have experimented with the material forms and animating spirit of the contemporary desire for a more measured self. Drawing upon theories of the self from Hume to the pop psychology of the self-help movement, the project critically examines the desire for and consequences of the quantified self in a broad historical context. The project accumulates in exhibition utilising performance and disparate materials from current technologies, electronics, structural forms, objects of the everyday and embeds processual elements into the final works.

Declaration

I certify that, except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; and any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

Michelle Erin Woulahan
Practicing as Antoinette J. Citizen
01.07.2015

Acknowledgments

Dominic Redfern, Scott Mitchell, Ian Haig, Courtney Coombs, Kate Woodcroft, Catherine Sagin, Carolyn England, Sarah-Jane Woulahan, Nikita Aganoff, Neville Aganoff, Mark Webb, Courtney Pederson, Mark Pennings, Charles Robb, Robert Leonard, Peter McKay, Jan Duffy, Matthew Perkins, Rachel Haynes, Ryan Renshaw, Raymonda Rajkowski, Simone Hine, Kyle Weise, Connected Community Hackerspace, Library at the Dock, Media Lab Melbourne and Doc Emmett Brown.

Table of Contents

CHAPTER ONE: Inroduction.....	1
CHAPTER TWO: Practice + Research.....	3
Studio Science	
Maker Culture	
Post-Internet Art	
Performing the Artist	
CHAPTER THREE: Quantification + Self.....	12
Self Knowledge through Numbers	
Life Loggers	
Logging Devices	
CHAPTER FOUR: Art + Data.....	18
Data as Material	
Data Visualisation	
Critique of Data	
Art and the Quantified Self	
CHAPTER FIVE: System + Method.....	31
Device for Tracking	
Method for Timing Thoughts	
Method and System for Logging Thoughts and/or Actions	
Portable apparatus for Maintaining Human Needs	
System and Method to Assist an Insomniatic State for Creative Thought	
System and Method for Predicting the Future	
Method for Counting Qualia	
Device, System and Method for Durational Recordings of Categorical Information	
CHAPTER SIX: Conclusion.....	50
REFERENCES.....	51

Chapter One: Introduction

We find ourselves swimming — or, as some would have it, drowning in information.
(Cook, 2011, p72)

“The Quantified Self” is a movement that presents the idea of enabling a higher awareness of self through technological self-surveillance. It is a practice that seeks answers through numbers, and utilises data collection and analysis to give the users an objective view of their biology, actions and behaviours. Quantified selfers are persons who use life-logging devices in their everyday life. While life-logging individuals are at the extreme end of the scale, automated logging has started to be embedded in the technologies that everyday people use today. Mass data acquisition is becoming increasingly prevalent in our contemporary culture. We are being tracked, traced and remembered through our digital footprints. We are categorised and quantified by these interactions. As we progress into a world of ubiquitous computing, it seems likely that datafication will continue to increase significantly. Through this research project I place the idea in question — can the self be quantified? What can we learn about the human condition through numbers? Before heading blindly into a future where every aspect of our lives is subject to datafication, quantification and analysis, it is important to reflect on the impact this technology has on our culture and sense of being.

In beginning postgraduate studies, compelled by a preoccupation with the future, I sought to investigate the future of mixed reality technologies. My initial research focused on the theoretical advancements in technologies that have the potential to increase the interconnected relationship between computer and human, and computer and the environment. I steered my research project to engage with the notion of combining the ‘real’ and the ‘digital’ through working with interactive media. I proposed working with video and light installations and electronic objects that would be responsive to elements of their environment. Coming from a mainly video art background, I needed to develop my skills to be able to create interactive works to pursue this research enquiry.

Early in the project, I dedicated my time to learning programming platforms Arduino and Processing, as well as working with electrical components that could sense or activate the environment. Working directly with programming and electronics I delved into the unseen world of data; where everything was reducible to ones and zeros, inputs or outputs. Before that point I had thought my creative research would involve animating the world with virtual imagery, pondering a future with far more advanced technologies. Instead my research turned to reflect on ubiquitous computing and the role data plays in our lives. I began to see how the data that overlaid our world already presented a form of a ‘mixed reality’. Information travels through the air in waveforms, digital devices surround us, our society is completely reliant on data. This divergence led to the new foundation for my

research project: how data would potentially come to effect the relationship between humans and computers sooner than virtual or augmented systems would.

Using practice-led research as methodology I have been able to fluidly progress my project, allowing the research to evolve with practice. In chapter two, I speak to my methodology, unpacking methods I use in my creative process. This exegesis has been pivotal in providing a space to objectively reflect and understand the methods I have been working with intuitively throughout the project. Positioning my project within the area of the quantified self, naturally I have explored methods of quantification as research. While these methods may assume the appearance of scientific research, the artworks I create have not sought to further quantifiable knowledge. As information and data becomes more and more prevalent within our society, it is a natural progression to see this reflected in contemporary art practice, and see data utilised as a creative medium.

In chapter four, my contextual review, I speak broadly to the use of data as a material in contemporary art. I focus on the critical use of data in art, and point to the prevalence of data visualisation in both art and design. I conclude with artists who engage with the concept of the quantified self, or self-surveillance practices, like Michael Kontopolous, Ellie Harrison and Jennifer Lyn-Morone. Through this exegesis I write to produce an academic translation of the body of work, in order to give a further voice to the research. In chapter five I provide an account of the works produced as the output of my research and point to bundle theory, transhumanism and healthism as methods to contemplate the quantification of the self. Through the chapter I trace a lineage of the quantified self, to self-help and divination practices, reflecting on how all these practices attempt to offer an increased control over an uncertain destiny. My works utilise a combination of disparate technologies and performance strategies to create humorous and speculative reflections on the quantification of self-knowledge. I present neither a 'for' nor an 'against' resolution to quantified self practices. Rather I use the critical space art provides to reflect, and provide a platform for discussion and thought.

Chapter Two: Practice + Research

My methodological approach for this project is practice-led research. My understanding of practice-led research is best exemplified in Brad Haseman's (2006) essay "Manifesto for Performative Research":

Practice-led researchers do not commence a research project with a sense of 'a problem'. Indeed they may be led by what is best described as 'an enthusiasm of practice': something which is exciting, something which may be unruly, or indeed something which may be just becoming possible as new technology or networks allow (but of which they cannot be certain). Practice-led researchers construct experiential starting points from which practice follows. They tend to 'dive in,' to commence practicing to see what emerges. They acknowledge that what emerges is individualistic and idiosyncratic (p3-4).

I began with a research area that was captivating to me and I employed artistic practice as a means to explore, speculate, understand and question this area. I also acknowledge practice-led research in terms used by Carole Gray (1996) where practice and theory are reciprocal: "critical practice should generate theory and theory should inform practice"(p15). While I agree with this statement about the reciprocal relationship, my experience of practice-led research has not been as iterative. Instead of the schematic view of theory informing the reading of practice, and practice then leading the direction of theory, what I have found is a more unsystematic approach. This is evident in the inability to separate my theoretical reading, technical learning and experimentations from the practice of making works.

My practice is not limited to physical engagement with materials, but employs a plethora of moments, ideas, thoughts, experiences, and information gathered from disparate sources, culminating in a body of work for exhibition. In the midst of creative practice it is difficult to see the linear progression, because it is intertwined with emotional experience and beliefs. Barrett (2007) states "creative arts research is often motivated by emotional, personal and subjective concerns, it operates not only on the basis of explicit and exact knowledge, but also on that of tacit and experiential knowledge"(p116). This exegesis has been pivotal in providing a space to objectively reflect, to see progression of practice and understand the methods I have been working with intuitively throughout the project. Through this exegesis I write to produce a linear narrative to give the body of work a further voice.

Studio Science

"Studio science" was a term used by Kate Woodcroft to describe my work *System and Method to Assist an Insomniatic State for Creative Thought*, in an introductory essay to the work exhibited at Level ARI in Brisbane. The term 'Studio Science' plainly described the way I combined a scientific(ish) method and a studio art practice. Studio Science, however

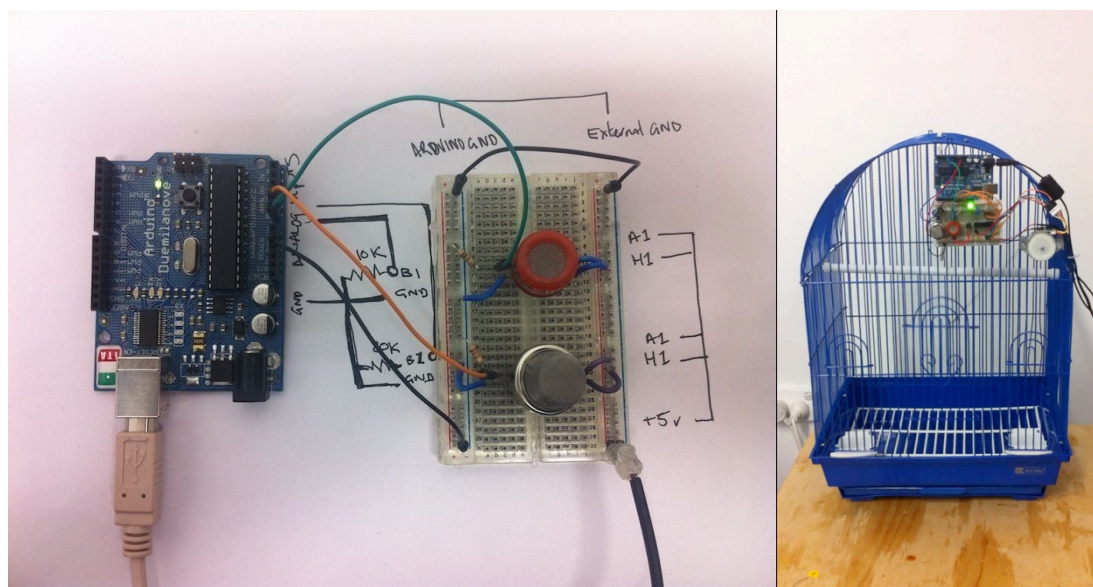
simplistic a term, seems to be able to encapsulate the playful non-science-like-science my practice embodies. Maybe this is just because I always say “studio science” with the melody of Oingo Boingo’s song “Weird Science” (1985); the theme song used for a movie of the same name about two teenage boys creating an ideal woman (Frankenstein’s monster style but much better looking) using a computer program, some electronics, and a Barbie doll all within their bedroom. Fact, fiction, intelligence, advanced technology, magic, desire and stupidity all exist as one, and this is exactly the un-precise method my practice embodies.

Positioning my project within the area of the Quantified Self, naturally I have explored methods of quantification as research. While these methods may assume the appearance of scientific research, the artworks I create have not sought to further quantify knowledge. As Sian Ede (2000) states: “If the ultimate goal of contemporary science is a single irrefutable Grand Unified theory, contemporary art anticipates not one but multiple, unfixed interpretations”(p29). These ‘interpretations’ form the basis of my research. I engage with scientific methods through a speculative lens, questioning in order to formulate ongoing research within a creative practice that is not based on definitive answers. Unlike scientific research, which seeks objective findings and accurate measurements, my practice embraces human error and subjectivity. Studio science, or the method in which I employ science in my research differentiates itself from actual science and from other kinds of pseudo-science by not making any claims to its validity. I do not and do not wish to adhere to any kind of scientific methodology.

Maker Culture

During this project I have become an active member of the maker community. “Makers” refers broadly to people, groups and communities whom engaged with DIY creative production; spanning fields of electronics, engineering, programming, metal and woodworking and other forms of arts and crafts. This global community has been made possible by several factors, the first being desktop manufacturing. 3D printers, laser cutters, computer aided design software and other previously industrial tools are now available at an affordable price and a size suitable for home use. The maker culture is also reliant on the internet as a digital means of collaboration, promoting open-source practices and using common design standards to facilitate sharing and learning (Anderson, 2013). Knowledge is shared and exchanged freely across continents and countries, information is reworked and rewritten, problems are asked, solutions are found: it is a community of digital collaboration. There are some communities that share the maker ethos but focus within creative art practice, often labelled ‘media labs’, such as F.A.T lab, Graffiti research lab, Media Lab Melbourne, Kitchen Budapest or Eyebeam. These types of labs however are small in number in comparison to makerspaces that are becoming abundant across the world.

Upon moving to Melbourne to start post-graduate studies, I became an active member of the Connected Community Hackerspace and Media Lab Melbourne, and also found myself in an extensive community of online makers, through various forums and blogs. This involvement and sense of belonging to the community directly influenced the outputs of my research. The maker community fosters learning through doing, with value placed on peer-led and open-source practices (Halverson & Sheridan, 2014, p496). These values are echoed within my research, becoming more prominent within the works as the project has progressed. My initial contextual review looked to artists working with interactive media, light installations, 3D mapping and high-end art/design pieces. The closed systems of these works became a point of contention, as they did not value the same ethos I was developing within my maker community. This resulted in me feeling compelled to ‘open’ the works quite literally; developing a style that would allow the audience a complete view of the internal structure, displaying the electrical components rather than concealing them. I also began intentionally using existing open-source hardware and software, and sharing my work and modifications in the same way.



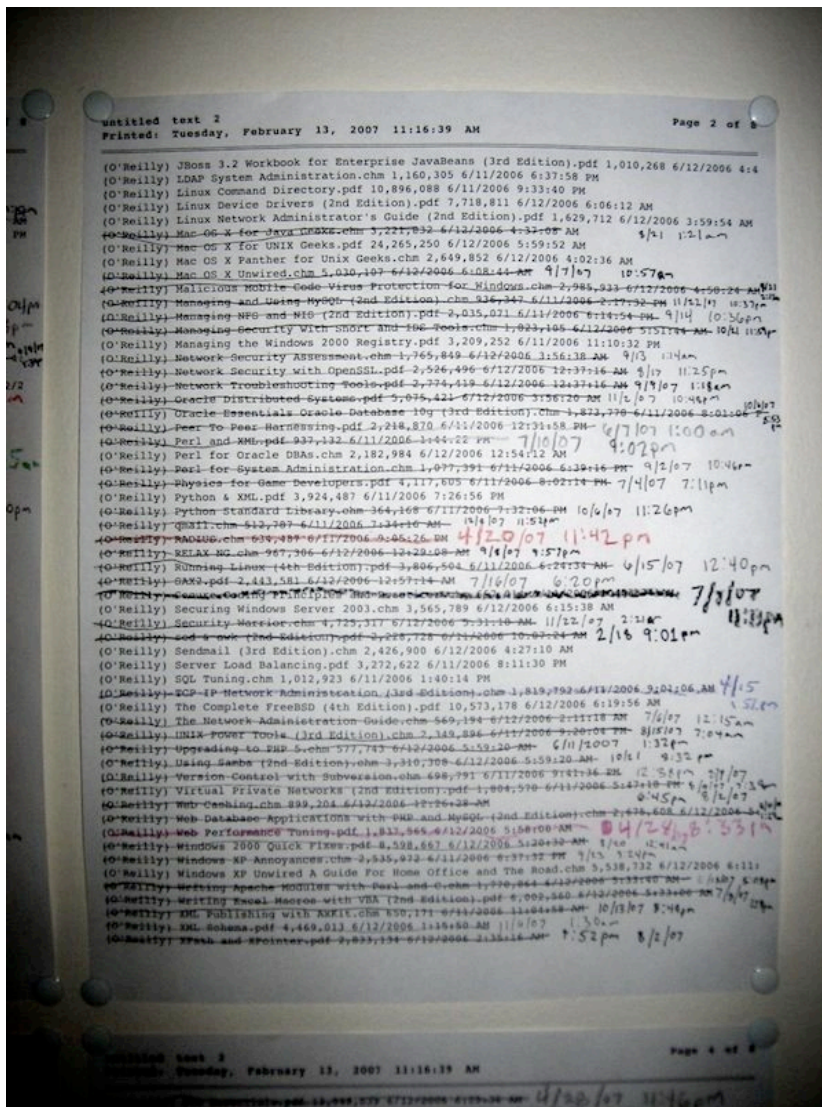
Canary in a Coal-mine (2010) Antoinette J. Citizen

Canary in a Coal-mine (pictured above) I made in the process of learning how to create circuits for gas sensors. In the work a methane and carbon monoxide sensor was used to trigger a motor that would lift up the door of the birdcage if gases were present in the air, thus allowing the bird to escape instead of meeting an untimely death. The picture to the left is a photo I posted to my blog as a demonstration of the circuit design. While this is quite an early work within the research, unrelated to the final body of work in *System and Method*, it is exemplary in demonstrating the maker method and mentality I use. Learning and making happen in parallel, with works often resulting from playing with new technical skills or materials. I make, learn and share as part of my process. Makerspaces tend to engage in creating functional devices, whether it is for games, educational, props, professional or home use. There is generally a purpose for the outcomes. The works I

make in comparison do not have a 'functional value' in the same sense. They are artworks and thus the functionality is often quite different. *Canary in a Coal Mine* for example has a function, but its function as a device in the world is completely redundant. However as an artwork this redundant function is utilised to explore and speculate.

Post-Internet Art

Almost all I know about electronics and programming has come from the engagement with forums, online communities, tutorials and blogs on the Internet. But while my research is informed from being a part of the maker culture online, my relationship with the internet in my practice goes beyond that. There is not a work within this project that does not have a piece of it come from the digital landscape of the web in some way. Whether it be a piece of code, an image, a thought, an inspiration or a material. "Post-Internet Art" refers to a contemporary approach of visual artists. The 'post' prefix refers to after the proliferation of the World Wide Web rather than suggesting that the internet is now over, or after 'Internet-Art,' the later being a genre in and of itself. The term was first used by Marisa Olsen to differentiate her practice from that of Internet Artists, "what I make is less art 'on' the Internet than it is art 'after' the Internet. It's the yield of my compulsive surfing and downloading. I create performances, songs, photos, texts, or installations directly derived from materials on the Internet or my activity there" (as cited in McHugh, 2011).



Computer Skills (2006) Charles Broskoski

An example of a post-internet artist is Charles Broskoski. Broskoski, an American based artist, downloaded 356 O'Reilly ebooks¹ from torrents files for his work *Computer Skills* (2006). For 400 days Broskoski read these 356 O'Reilly books, marking each one off a list, amending the date and time (as pictured above). As Broskoski read each book, he took notes, "these notes varied throughout the project, in the beginning they were standard school-style notes, but they evolved into something different by the end." (Broskoski cited in Peyton, 2008). Broskoski mirrors my own practice in his use of a post-internet method with a performative element. The performance is exhibited only through the documentation of the note taking; the audience is not privy to the performance itself.

Gene McHugh (2011) talks about the change the internet has had on art and culture in his book *Post-Internet*: "On some general level, the rise of social networking and the professionalization of web design reduced the technical nature of network computing, shifting the Internet from a specialized world for nerds and the technologically-minded, to a mainstream world for nerds, the technologically-minded and grandmas and sports fans

and business people and painters and everyone else”(p5). The internet has changed our relationship with each other, our experiences and culture. The access to information, knowledge and community is beyond parallel to anything in the past.

Olsen’s words on the ‘Post-Internet’ artist parallel the idea of the ‘cultural bricoleur’ as theorised by Claude Levi-Strauss and Jacques Derrida (Bricolage, 2012). Bricolage, French for “do it yourself” or “odd jobs”, is described by Levi-Strauss (1966): “the ‘bricoleur’ is adept at performing a large number of diverse tasks; but, unlike the engineer, he does not subordinate each of them to the availability of raw materials and tools conceived and procured for the purpose of the project. His universe of instruments is closed, and the rules of his game are always to make do with whatever is at hand” (p17). I see my practice as akin to a bricoleur: I respond to what is around me and I utilise materials and information that are present in my daily life. As an avid Internet user in 2015, however, the materials at hand are somewhat different to the ones Levi-Strauss made reference to. But nonetheless I intentionally engage with the method of the bricoleur in my practice. A post-internet artist or the technology-friendly-bricoleur could be said to be one that exploits the information and resources made available on the Internet.

Being an active member of the maker culture has allowed me to have an increased feeling of freedom on the Internet; as I view the Internet as an ultimate resource where I can find the information I need to do whatever it is that I might come up with. This seemingly unfettered access is reflected within my method. I feel unrestricted in my research within my creative practice as everything and anything may become relevant. Reading the news, looking at cats on Reddit, googling questions, using web-based software, updating my website, posting on my blog, following electronic and programming tutorials: my daily grind with the internet creates the backbone of my research. Much of my research on the quantified self came to me in this manner. I followed the rise in its interest over time via the net, from the introduction of the Quantified Self blog, to the Memoto device making its funding goals on Kickstarter and hearing about the devastating name change to Narrative on an email-out. I purchased quantified devices online like the Sleep Zeo, the FitBit and the Emotive, only to access their data online as well. The way I research is unsystematic and without order, I absorb information from wherever it comes, in whatever form, and place as much value on peer-reviewed journals as comments on a YouTube video. Not that I mistake these comments for truths, just that both inform my perspective and may influence my work with equal weight.

In late 2011 my RSS feeds, Facebook and other social media feeds were buzzing with conspiracies of the end of the world in 2012. And as with anytime you think for a second too long about anything in particular, I found myself in a hyperlink trail of Wikipedia entries, conspiracist websites and historical articles. Reflecting on the great Maya civilisation, I began to think of Google as a contemporary comparison. Switching tabs to my Google calendar I found myself clicking month to month, seeing the years scroll up

before laughing at myself for thinking I could click my way to the end of the Google calendar. I started searching for “what year does Google calendar go to,” then tried to find out what were the integer restrictions of the programming language used for the calendar. After having no luck finding any hard facts, I decided that this was a work: *End of the World* (2012) (2011). For the initial work I downloaded a freeware auto-clicker software application that allowed me to set the position of the mouse cursor and generate a virtual click at a set time interval. I then downloaded another freeware software application to screen-capture the process of the calendar scrolling. The screen capture was uploaded to Vimeo and existed as a single-channel video work on my website, with instructions to view at full screen, as to mimic the look of the initial recording — of complete desktop view with dock, menu bar and icons. The work at this point existed as an “Internet Artwork”, in that it was made in response to the culture experienced on the net and exhibited solely on the web.

In *Post-Internet Art* McHugh includes a 2006 interview between artist Cory Arcangel and curator Karen Verschooren. Arcangel has a lively web presence for his artistic practice as well as exhibiting extensively in galleries and traditional exhibition spaces. In the interview Arcangel asserts that Internet Art cannot simply be taken from the net and put in the gallery without thought. “You can't just put a computer with a browser that's pointing to a website. You have to somehow acknowledge that it is in a gallery” (as cited in McHugh, 2011, p13).



End of the World (2012) (2011) Antoinette J. Citizen

After *End of the World* (2012) (2011) spent some time on the internet, I was invited to show the work at the Institute of Modern Art in Brisbane. The work as is (or as was), did not feel like it would translate well into a gallery setting. Viewed on the Internet, the audience would be sitting in front of a computer and the mouse cursor could be seen as the audience's own cursor being clicked periodically. As a video on a screen this would diminish the translation. I decided the work needed a physical element to function within the physical environment. This evolved to include a desk, computer and keyboard within the installation and a robotic housing over the mouse that could click the mouse button, mimicking the gesture of the hand. This way the audience could see the physical clicking of the mouse as it responded to the scrolling through the months of the calendar.

Performing the Artist

I have made purely Internet-based artworks sporadically, however they are not the dominant form in my practice. While transforming Internet art into gallery art is not a primary concern of mine, it does speak to the importance of the Internet as site in relation to my method. The Internet is utilised as an extension of my studio as I continually update my website (antoinettejcitizen.com) with my current works. This site is supported by a blog where I post information on making, referencing the various sources I used to create my electronic works. This web presence is an essential part of my studio practice as I use it as a method to evolve my research. In the editor's introduction, Domenico Quaranta (as Cited in McHugh, 2011) speaks to the performativity of post-Internet artists:

The central theme that Gene works through during the blog is the performativity of Internet Art. In an ocean of media, he claims, Internet artists and their audiences are responding not to individual works, but to a 'net presence'. He [McHugh] writes, "the artist's work is viewed as one on-going performance; the audience follows the artist as he or she performs the act of creating individual works. This performance is where audiences are nudged to qualitatively sort out and find meaning in artistic experience on the Internet" (p2).



3:2 (2007) Jamie O'Shea

This performative method is seen in many artists' practices. Jamie O'Shea created *3:2* (2007) at Eyebeam Centre for Creative Technology in New York. In *3:2* (2007) O'Shea created an environment where he would live for one month on an alternate time frame from the rest of the world. Natural light was blockaded from entering the space, in exchange for artificial light rising over different time frames. O'Shea's timeline existed as three hours to two hours making his existence drag behind that of ours at a three by two hour ratio. Our three weeks became his two weeks, allowing him to emerge from the installation from the past into the future, thus creating a time machine. The installation utilised a fellow Eyebeam member's algorithm that would allow access to the Internet on a delayed basis. O'Shea could only view Internet streams at the time in which his installation was, making him fall further and further behind our timeline each hour. The work resulted not in the installation he built, but in the artefacts left over from the experiment. During the time O'Shea spent in *3:2* he created a series of blackboard diagrams discussing theories of time travel. These photographic documents tell the story of the performative work, to which the audience is not privy (image above).

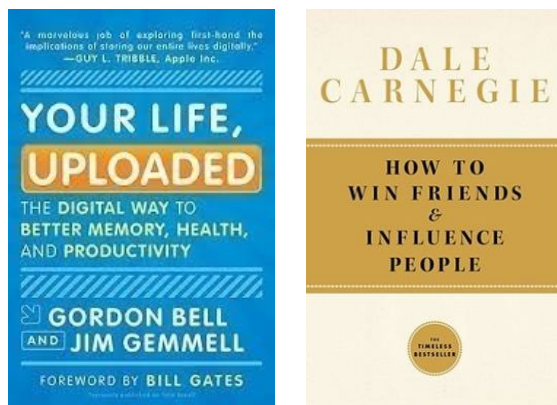
This performative style is across the majority of my works, as I consciously perform the role of the artist. For my work *System and Method for Predicting the Future*, which I will detail in chapter four, I placed myself as the foundation of the work by both performing the role of artist/inventor creating, designing and building the device as well as performing the role of the subject upon whom the device is tested. The 'performing' of the artist is pivotal to how I understand my process, both on and offline. I used the pseudonym Antoinette J. Citizen for my creative practice. It serves as a means to inhabit my practice subjectively and simultaneously observe it objectively. This enhanced reflexivity allows me a degree of freedom to extend ideas beyond what I might 'normally' do as Michelle Woulahan, 'to act as if' I were another. There is also the freedom to be comfortable within the performed nature of an artistic practice, which requires my personal actions to be part of the work itself.

This performative method relates to terms phrased by Judith Butler in describing gender as a performative action. In "Gender Trouble", Butler (2002) argues that gender is performed rather than gender binaries actually being implicit in human nature. For my project the notion of performativity is moved from gender to the performance of our own identities. Within this project I engage with bundle theory in the understanding of identity and the self. Bundle theory, proposed by eighteenth century philosopher David Hume, argues that consciousness is not a singular unit but rather a collection of mental states and perceptions. For Hume, the notion of an authentic self over time was "thought to be a fiction and an act of the imagination; we identify persons over time out of custom, without a more profound or defensible philosophical reason" (Hales, 2012, p181). Unlike ego theory where the self is persistent over time, bundle theory proposes that there is no self, no single consciousness that experiences everything over the course of a lifetime. Instead

we are made up of bundles of perceptions that are different in each moment. Understanding the self as a series of states opens the opportunity to reflect on performativity as method. There is no single fixed self, the self is a series of states, so the self I know as Michelle is arguably as mutable as the self I concocted as Antoinette.

Chapter Three: Quantification + Self

The 'Quantified Self' presents an idea of enabling a higher awareness of self through technological self-surveillance. It is a practice that seeks answers through numbers and utilises data collection and analysis to give the users an objective view of their biology, actions and behaviours. The phrase was first used by Gary Wolf and Kevin Kelly, editors of Wired magazine who began the Quantified Self blog in 2007. The Quantified Self website is a database of life logging technologies, news and information and now serves as a forum and meet-up arena for quantified selfers (Quantified Self, 2015). The term Quantified Self (QS) has now become synonymous with the increasing movement of people who use life-logging devices in their everyday life.



Initially I was seduced by the QS movement. 'self knowledge through numbers' the by-line for the QS website, seemed infallible. The idea of the science of self, the numbers, the data, lured me into thinking that documenting my every move could somehow increase my self-knowledge leading to self-improvement. Why? Well, science of course. Science as I perceive it is the best method we have for understanding the world in which we live. However over this period of research I began to see parallels between QS and Self-Help. Gordon Bell and Jim Gemmell, pioneers of life-logging technologies, entitled their 2010 book *Your Life Uploaded: The Digital Way to Better Memory, Health, and Productivity*. Reading it, it became apparent to me that QS could be viewed as a natural progression from the well trodden ground of motivational books like *How to Win Friends and Influence People* (1981) by Dale Carnegie, or *The 7 Habits of Highly Effective People* (1989) by Stephen R. Covey, and *You Can Heal Your Life* (1987) by Louise Hay.

When comparing the QS and self-help movements many similarities appear. Motivational techniques described in self-help books are utilised by QS applications as a way to encourage the user to actually change and improve themselves. They both make claims to offer a greater understanding of the self and parallel themselves with science as a means to claim validity (QS with health science and self-help with Psychology practices). But

overall what came to be the most interesting part was that both see happiness, healthiness and productivity as the ultimate goals. Previously these had appeared to me as perfectly normal aspirations, but through the research project I began to think about how happiness and health being the ultimate goal to life potentially loses out on the complexity of humans. If we aim for 7.5 hours sleep, 2000 calories, 30 minutes of exercise, etc., What do we lose? Is the average the best way to live? Is health the only goal? As my research is based upon the speculation of the datafication of self-knowledge, this chapter is a technology review of the field of life-logging technologies used in the pursuit of a quantified self.

Life-logging

Life-logging technologies come in the form of electronic devices, applications, software and websites, available to consumers to collect, manage and analyse data on their own behaviours. The users of these technologies, or 'life-loggers' as they can be known, record and archive extensive amounts of information about their own lives. The information collected ranges from health related data (heart rate, weight, calorie intake, sleep patterns , etc.) to location tracking, time based records (time spent at work, home, traveling, showering etc.) or any quantifiable activity the person wishes to record. These technologies present themselves as having the potential for self-improvement through greater understanding of the self. Life-logging devices do not in themselves modify behaviour. Rather, they present the user with information in an attempt to promote self-initiated behaviour modification techniques. Tracking, collecting and analysing data is not a new practice. It has been prevalent in many fields for centuries. Deborah Lupton (2013) states that "voluntary self-tracking is a logical extension of the employment of visualising technologies in medicine"(p298). These visualising technologies like X-rays, ultrasounds, MRIs, electrocardiographs, EMGs have been employed by medical professionals for decades in an attempt to map and understand the body, "to gaze into and produce images of its interior" (Lupton, 2013, p298).

In an article "As We May Think" appearing in *The Atlantic* in 1945, author Vannevar Bush speculates on the future of technology in relation to the recording of knowledge. Possibly one of the earliest publications referencing life-logging, Bush imagines a future where scientists wear something which would be described in today's terms as a Google-glass-like device, enabling scientists to freely move about the laboratory and take images of note worthy items for record on demand.

On a pair of ordinary glasses is a square of fine lines near the top of one lens, where it is out of the way of ordinary vision. When an object appears in that square, it is lined up for its picture. As the scientist of the future moves about the laboratory or the field, every time he looks at something worthy of the record, he trips the shutter and in it goes, without even an audible click. (Bush, 1945, p4)

Bush (1945) notes the increasing amount of information in the world and speculates about

the need for technological intervention to keep abreast of this knowledge. He states, “professionally our methods of transmitting and reviewing the results of research are generations old and by now are inadequate for their purpose”. And continues, “a record if it is to be useful to science, must be continuously extended, it must be stored, and above all it must be consulted”. Bush postulates about a device for memory extension he calls the “memex”. The memex is a device that can record limitless amounts of data, information, books, logs and communications. The device can be consulted with exceeding speed and flexibility, in essence allowing the user to go beyond the bounds of her own memory.

Life loggers

In early 2000, Gordon Bell and Microsoft researchers Jim Gemmell and Roger Lueder reflected on Bush’s idea of the memex as a blueprint for their lifetime storage software: MyLifeBits. The project leverages the data collections of Bell, an extreme life-logger who has been intent on capturing and digitally recording everything in his life including “articles, books, cards, CDs, letters, memos, papers, photos, pictures, presentations, home movies, videotaped lectures, and voice recordings” (Bell, 2010, p28). Bell’s records have been used to create the MyLifeBits software. This software uses a server database to make fast searching of the immense quantity of Bell’s data possible through hyperlinks, annotations and tags. The database system works with the use of metadata. Reference information is embedded into each entry allowing disparate items to be related by markers. “With MyLifeBits we could find all items that share a certain property, such as having the same creation date, or having been edited during a particular meeting, or having been viewed within a certain span of hours after a particular phone call”(Bell, 2010, p43). This style of file management system is increasing in prevalence in today’s applications. Evernote, Onenote and Google analytics utilise a similar method in order to be able to rapidly mine and collate information giving a distinct variable (Bell, 2010, p40-42).



Steve Mann (1980-1999)

Steve Mann dubbed ‘the father of wearable computing’ and self-proclaimed Cyborg has been wearing a vision enhancing system for thirty-five years (Mann, 2013) (Bilton, 2012).

Mann (2002) first used the term *sousveillance* to describe an inverse form of surveillance where the camera's footage is taken from the human perspective. Mann has engaged in *sousveillance* since the 1970s, inventing personal wearable computing devices that will record video of every aspect of his life. Similarly the Sensecam, a wearable computing device, was released in 2003 by Microsoft researcher Lyndsay Williams. The Sensecam, which is worn around the neck, takes pictures automatically when it detects a new environment or an appearance of a person, collating a photographic series of everywhere the user has been and every person they have met (Bell, 2010, p48). These wearable photo-logging devices have increased in prevalence over the last few years with examples like Narrative (a matchbox size camera worn on the shirt collar) that takes a photograph every thirty-seconds and Google Glass which allows user to snap a photograph with a wink of the eye.

Early adopters of wearable logging devices outside of the dedicated 'life-loggers' largely fell into persons monitoring health issues and athletes. For decades diabetics have used portable glucose monitors to manage their disease, as have patients with high blood pressure utilised home monitoring devices (Swan, 2009, p509). Competitive and semi competitive athletes have been marketed a plethora of wearable logging devices like Polar's heart rate monitors and Garmin's handheld GPS units that monitor the users physical activity in order to assist in improving fitness training. Within the last few years life logging devices have reached the mainstream consumer with logging devices available in electronic stores like JB HiFi and Harvey Norman. As of 2015 there are close to six hundred applications and devices for life-logging listed on the [Quantified Self](#) website guide.

Logging Devices

The most common life-logging devices used currently are biometric data loggers or fitness trackers which are self-contained devices worn on the body to collect information on physical activity. These devices upload data to the user's smart phone or computer to give graphical visualisation of the collected data that can be compared to the previous day's, week's or month's data. Fitness trackers like the Up by Jawbone, Fitbit and Bodyfit Media are widely available consumer products that essentially act as 'smart' pedometers. While pedometers previously used simple tilt switches to determine movement these smart pedometers rely on 3-axis accelerometers and sophisticated algorithms to record the user's movement and determine step count, distance travelled, sleeping patterns and calorie expenditure. Bodyfit media, a smart pedometer, includes additional sensors including heat flux, galvanic skin response and skin temperature. These sensors determine how much the user is sweating, how hot they are and how much heat is transferred into the environment. These measurements determine what kind of exercise is being undertaken and how difficult it is to the user in order to generate a personalised account of fitness activities. Studies have shown that the Bodyfit media has equivalent measures of 'free-living' energy

expenditure as compared to established criterion standards (Johannsen, Stewart, Calabro, Franke & Welk, 2015).



RunKeeper, email excerpt

Life-logging apps and devices often include reward systems to increase desired behaviour. These vary from personal record tracking and comparison, like “A New Personal Best for Cycling” pictured in the image above taken from an email update, to applications that permit comparison and competition with friends and other online users. Fitbit, Run Keeper and Nike Fuel Band all offer Facebook integration, so users can post achievements to their Facebook page and compare results with online friends. Fitbit also utilises a badge system where users are awarded badges on their achievements. These badges can be displayed on social networking sites and act as a method to encourage users to continue logging and improve on previous benchmarks. This method of reward system, commonly referred to as ‘gamification’ is prevalent across digital media devices and applications, not solely through the quantified self movement. Beeminder an online and mobile application takes this reward based system of life-logging to a new level. Participants of Beeminder set goals such as weight loss and wager money against their goal. Logging of progress towards one’s goal is required each day and if the participant goes off track their wager will be deducted.

Technology advances, lowering cost and physical size of accelerometers, Global positioning systems (GPS) modules, electroencephalography (EEG), Electrocardiography (EKG) and other sensors have made these methods of measuring available to consumers. Accelerometers embedded in the various fitness devices have been utilised to measure step count, step elevation and sleep quality. Combining the sensor and sophisticated data analysis means the user can wear the device without having to input any additional data and still be provided with accurate results. Apps such as *Mappiness* utilises a time-based sampling system to collect data on the user’s mood in a method that attempts to circumvent user input bias. The app will notify the user at random intervals within the day, prompting a series of question relating to mood, environment and activity. This technique of random sampling reduces time based issues experienced with memory and delayed response.

Mobile phone apps can utilise the devices' embedded sensors like GPS and internet connection to generate data without external devices. Moves, a popular Android and iPhone app uses the device's built-in GPS and accelerometer to provide time and distance calculations of different travelling methods. It calculates whether the user is cycling, walking or running and returns daily updates on step count, kilometres cycled, time and caloric information.

The increase in speeds and availability of internet connection on mobile devices has meant that software data analysis no longer needs to be on personal devices. Data can now be uploaded and analysed by superior computers then results sent back to you. Moves uses this technique to analyse collected data and provide higher accuracy of results. Websites such as BigML, FlowingData and Fluxstream allow users to work with complex datasets and visualisations. Previously the high cost and specialised expertise "generally limited access to institutional professionals, but cost decreases and tool improvements have made data collection and manipulation more available to the individual" (Swan, 2009, p508). Devices like the *Narrative* which amass over 2000 images per day, use a dedicated online file management system to store and make browsing these photos possible.

Technologies for gathering data are readily available at low cost to the user. Some of these technologies include note taking applications, social networks, photo and video management websites, mobile apps, web based applications, biometric devices, data analysis and data visualisation software. However these technologies are not unified or integrated with one another (Bell, 2010, p14). This makes data analysis on varying data sets inefficient and difficult for the user. Applications suffer from inadequate methods of data synchronisation across platforms, and users face issues such as requiring multiple devices each with their own software, unique user account and passwords for every activity they wish to calculate. As improvements to application and device integration are made, users will be able to mine their digital archive to reveal patterns in their activities across multiple datasets (Bell, 2010, p23). This will likely see improved performances in data analysis with a wider access to data variables.

The Quantified Self movement presents an idea of enabling an awareness of the self, greater than we could have without technological intervention. While life-loggers are at the extreme end of the scale, automated logging is starting to be embedded in the technologies that everyday people use today. As we progress into a world of ubiquitous computing, it seems likely that datafication will increase significantly. The works I have created through my research are not didactic; they present neither a 'for,' nor an 'against' case for these technologies; instead I have responded to the range of potentials and possibilities, both positive and negative, in order to offer a platform for discussion and thought.

Chapter Four: Art + Data

As information and data become more and more prevalent within our society, it is a natural progression to see data utilised as a creative medium. While my project specifically looks at the act of collecting and quantifying information on the self, within this contextual analysis I have surveyed a range of artists involved in data practices. There have been several exhibitions, events and festivals exploring the theme of art and data within the last few years. *Hack The Space* was a twenty-four hour event held at the Tate Modern during 2014. Over 140 programmers, artists and other creatives filled the Tate's Turbine Hall to collaborate on the brief "take any form of data and transform it into a creative digital artwork" (thespace.org, 2015). The datasets used within this event ranged from everyday data, to data that was political in nature, such as the names of 5196 people who died in the 2008 Sichuan earthquakes, or the statistics on antidepressant use and their effect on crustaceans (Ellis-Petersen, 2014). The same year Centre de Cultura Contemporània de Barcelona held the exhibition *Big Bang Data* to explore the saturation of information society is experiencing. Quoted on the Centre de Cultura Contemporània de Barcelona website:

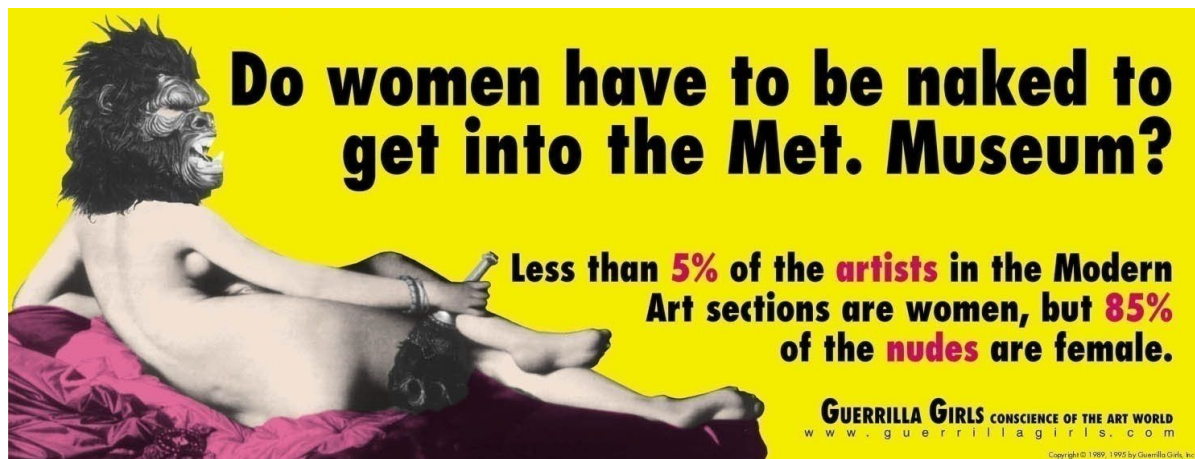
The last five years have seen the emergence of a generalized awareness among academic and scientific sectors, government agencies, businesses and culture that generating, processing and above all interpreting data is radically transforming our society. We all generate data, with our mobile phones, sensors, social networks, digital photographs and videos, purchase transactions and GPS signals. What is new is that it is increasingly easy to store and process these vast quantities of data that detect patterns (of incidents, behaviour, consumption, voting, investment, etc.). This fact is very quickly and completely changing the way decisions are made at all levels. (cccb.org, 2015).

Earlier this year Transmediale festival and conference, "Capture All" examined the quantification of everyday activities, the increase in citizen surveillance, mass data acquisition and commercialisation of personal data. Artists involved in these practices are diverse as there are datasets that exist, from artists who use data extrapolated in real time, data-driven computational works, artists using generative data for visuals, bio artists cataloguing DNA and artists developing political works with statistical information. Within this review I will speak broadly to the use of data as a material within a contemporary art practice, the use of data visualisation and data re-interpretation, and point to individual artists engaged in quantified self, and self-surveillance practices.

Data as Material

In 2007 Victoria Vesna edited the book *Database Aesthetics: Art in the Age of Information Overflow*. The book is "a collection of essays that begins to show how an aesthetic emerges when artists take on the challenge of creating work using the vast amount of information that bombards us daily" (p10). This book describes a developing prominence within our

information driven time, of databases and data used as artistic materials.



Do women have to be naked to get into the Met. Museum? (1995) Gorilla Girls

The iconic work by the Gorilla Girls pictured above, utilises statistical data to create a work that demonstrates the inequality of women in art. The Gorilla Girl's poster reads "Do women have to be naked to get into the Met. Museum? Less than 5% of the artists in the Modern Art sections are women, but 85% of the nudes are female." This work uses the direct language of data to make the politically potent work. Data is used as the medium which carries the message. A more recent work, *A Piece Of the Pie Chart* by Annina Rüst (2014), is a robotic work that decorates cakes with pie charts depicting statistics on gender inequity in the workplace. Pie charts, graphs and data visualisations techniques have been adopted into the art iconography. While significantly less politically potent, Damien Hirst created a series of paintings of pie-charts with corresponding colour key, mimicking those we might expect to see in business and board rooms. The works are titled by the data sample they represent. For example *Pets Bought at World of Pets* (2012) charts purchases for dogs, cats, birds, fish and other pets. Datasets are also used by artists through non-traditional visualisation methods. Tracy Emin's *Everyone I Have Ever Slept With 1963-1995* (1995) utilises the idea of the dataset within a contemporary artwork. The work comprises a tent with appliquéd names of everyone the artist has ever slept with. Emin skews the dataset by offering an alternate reading of the notion of 'slept with,' from the typical sexual implication to include everyone the artist has literally ever slept in close proximity to.

Data in art practices can also be used to a point of abstraction where the data is not recoverable to the audience. An example of data abstraction are the works of Ryoji Ikeda. Ikeda's work *Test Pattern* (2008) uses computational elements to create a system that converts the data existing in any files like text, sound, images and video into barcode patterns using binary coding of 1's and 0's. The resulting work is exhibited through installation or live performances that bombard the viewer with a visual and auditory experience. While the data is used to create the work, it is not decipherable and not necessarily important for the viewer to know the history of the dataset.



Telepresence Water (2011) David Bowen

Another artist who uses pre-existing datasets to animate his work is David Bowen. Bowen's practice relies heavily on the process of data extraction, collection and reanimation. In *Telepresence Water* (2011) Bowen utilises the wave data collected from an adrift buoy station. The wave intensity and frequency is transmitted from the National Oceanic and Atmospheric Administration and scaled and transferred to a mechanical grid structure in the exhibition space. The mechanical grid animates the data simulating the water's movement. The data collection method is a vital aspect of the work. Wave data is being collected from "data buoy station 51003. This station was originally moored 205 nautical miles southwest of Honolulu on the Pacific. It went adrift and the last report from its moored position was around 04/25/2011. It is still transmitting valid observation data but its exact location is unknown... This work physically replicates a remote experience and makes observation of the activity of an isolated object, otherwise lost at sea, possible through direct communication" (Bowen, 2011). While the work could be read without knowledge of the acquired dataset, the work is livened by the artist providing the audience the information that the mechanical sculpture is imitating the movements of the water from a buoy adrift at sea.

When considering data as a material in art, it is interesting to reflect on interactive works that rely heavily on data collection and analysis. Contemporary artists like Chris O'Shea and Daniel Rozin create computationally driven interactive works with OpenFrameWorks, Processing, Arduino and similar programming platforms. O'Shea's *Hand from Above* (2009) and Rozin's *Weave Mirror* (2007) both extract data from real-time video feeds of the audience. In *Hand from Above* (2009), a billboard streams a video feed from the outdoor public square it is located in. O'Shea manipulates the live video feed in real time to include a giant hand interacting with the pedestrians. Rozin also uses live

video feeds of his audience in *Weave Mirror* (2007), however the visual feedback is reanimated using wooden blocks gradating in colour to create a mirror effect. While these pieces are reliant on the data collection and analysis, the data collection or analysis is not made apparent to the viewer. It could be suggested that works without the intention of presenting the data or works that consider the data a key element in the work, are not using data as material but only as a process.

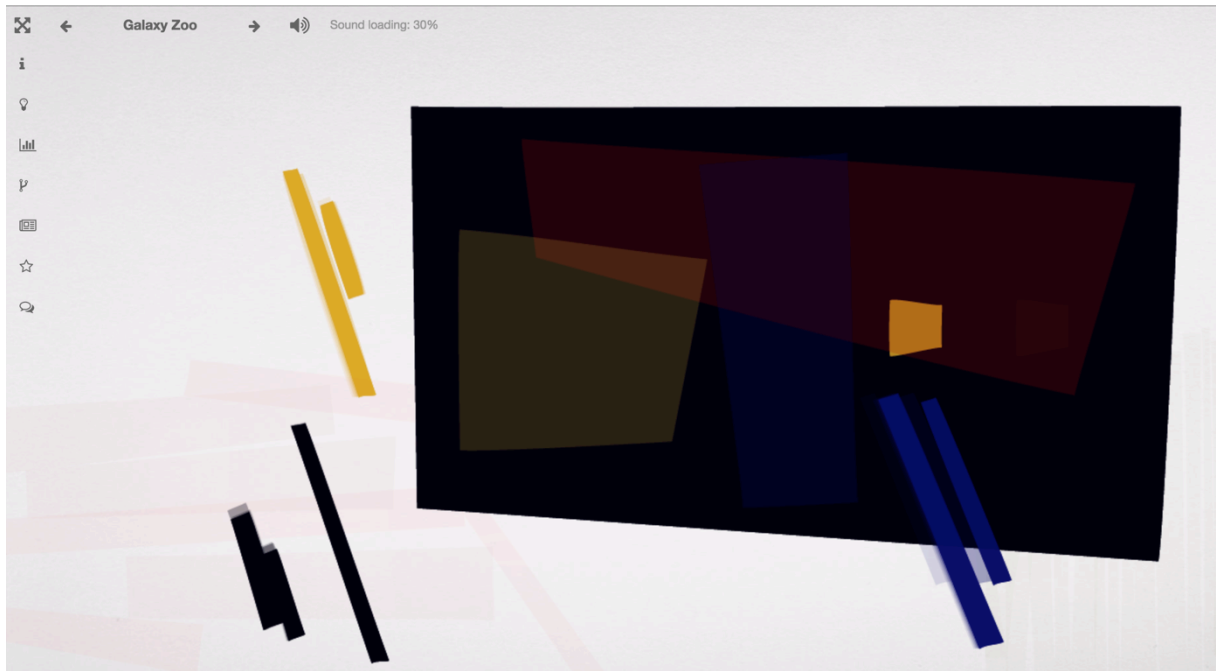


Google Faces (2013) Onformative

Utilising data in process and presentation can be seen in many digital media works. The method of searching datasets with algorithms is demonstrated by Onformative design studio in collaboration with Christian Loclair's work *Google Faces* (2013). *Google Faces* (2013) scours Google Earth with facial recognition software in search for faces in the landscape. The facial recognition software scans images using an algorithm which depicts relative data about positions of facial features; eye distance to nose to jaw line, etc. The work was inspired by the psychological phenomenon of face pareidolia; where people see faces in everyday objects and the environment (Liu, 2014). Cristobal Mendoza capitalises on reimagining stored data through databased collections in many of his works. *Taking a query = "line" for a walk* (2008) renders an animation based on tagged images on the photo sharing site flickr.com. For the work Mendoza created a program and database system to search for images tagged with the word "line". Mendoza's program would then scale and rotate the images in a way that generated a continuous line throughout the video.

As these examples indicate, data has been shown to be an important theme in contemporary art practices across many different disciplines. It can act as an immediate communication tool, or present opportunities for animation and activation of works themselves. With the access to increasing amounts of datasets, computational modelling and generative visualisations, data seems likely to be persistent within creative practices in the future.

Data Visualisation



We Need Us (2014) Julie Freeman

In evolutionary terms, visual-pattern recognition was associated with immediate sensory stimuli in the environment, and the ability to discern patterns appropriately often had life-and-death consequences for early human. Far from being left behind as we vault into the Information Age, this evolutionary heritage persists, investing visualizations with emotional content that has the effect not only of reifying visual representations but also of making them resonant with qualities we may not consciously recognize but to which we respond nevertheless. The very responsiveness to visualizations that make them effective as analytical tools also makes us vulnerable to implications evoked by them that may not be justified by data alone (Cook & Diamond, 2011).

Data visualisation techniques have been used for centuries as aids to interpret and explain information. Statistical graphics in the form of pie charts, bar graphs, scatter plots have commonly been used in business and science. Since the advent of computers, and the availability of computer generated imagery software, data visualisation has proliferated across a diverse range of disciplines and has turned data visualisation into a practice in itself. Cultural theorist Peter Lunenfeld (cited in Cook & Diamond, 2011) raised concerns about the power of the visual, noting that through the mediation of popular culture, “the particular configuration of the contemporary visual discourse is one in which the visual is understood as a revealing: transparency, clarity, and truth”. Lunenfeld warns about “the ‘sexiness’ of scientific imagery and its uncritical use in popular culture, in policy circles, and even in scientific domains” (p56).

The website “Information Aesthetics: where form follows data” (2015) explores the “symbiotic relationship between creative design and the field of information visualisation”. The website’s archives date back to 2004 with thousands of posts collected from projects that “represent data or information in original or intriguing ways” (Moere, 2015). To me

the best way to describe these works would be as ‘data porn’. The works are primarily focused on looking beautiful and not particularly concerned with the communication of data or being critical in any way. The visuals draw you in through their aesthetic appeal and while you may look upon in amazement, you come away with nothing.

Data visualisation can also take a more abstract avenue as in the works of the previously mentioned artist Ryoji Ikeda or Julie Freeman’s *We Need Us* (2014) (pictured above). *We Need Us* is an online artwork that aggregates data from users of “Zooniverse”¹. This data is processed to create real time animations and soundscapes within the web browser. Unlike the works on the “Information Aesthetics” site, which attempts to convey the dataset, Freeman’s work “investigates the unique properties of the data itself” asking the question “if the data had lives of their own, how would they be revealed?” (Freeman, 2014).



Cosmos (2014) Semiconductor

Data visualisation in art works also presents itself in non-two-dimensional forms. *Cosmos* (2014) is a two metre spherical wooden sculpture that explores how science represents nature and how it differs from the way humans experience it. Created by *Semiconductor* the UK artist duo Ruth Jarman and Joe Gerhardt, the sculpture is now located in Alice Holt Forest UK, from where the original data was taken. Using data statistics of the carbon

¹Zooniverse enables anyone to classify large scientific datasets about subjects such as astronomy and biology. With over a million users working together to analyse data, it is the world’s largest citizen science project (Freeman, 2014).

dioxide uptake and loss from the forest *Semiconductor* utilises digital techniques “to reveal the visual patterns and shapes inherent in the data”. The data is utilised to create the form of the patterns on the wooden sphere. Like *Semiconductor*, artist Luke Jerram creates the work *Tide* (2001) using the data generated from scientific apparatus. In *Tide* data is streamed from a gravity meter and is used to output changes in the water levels of three glass bowl like sculptures. The glass sculptures have a robotic friction device that rubs the rim resonating sounds, similar to a finger on a wine glass. Jerram uses a water pump to change the water level; a high gravitational value pumping more water into the sphere and a low gravitation value draining the water from the spheres. The changed water levels result in different sounds resonating from the sculptures. Within *Tide* and *Cosmos* the data is not intended to be recoverable, it is used as a material to visualise the information in an aesthetic form. It is an artistic interpretation of the data. With my practice I am less interested in the interpretation of data, as I am with the meaning we attach to the data itself. Rather than creating new methods of visualisation, I utilise existing methods such as charts or text, to speculate on what data means within our lives.



Apocalypto Ticket Sales by Week (2008) Joshua Callaghan

Joshua Callaghan uses traditional methods of data visualisation, graph and charts but constructs them in 3D forms. Callaghan’s solo exhibition *Very Concerned, Somewhat Concerned, Not at All Concerned* at Bank Gallery, LA, in 2008 features nine sculptures representing various datasets. The works are named by their correlating dataset: *Apocalypto Ticket Sales by Week*, *Consumer Confidence 2007-08*, *Zimbabwe Inflation 1998-Present*, *Injury by Type*, *U.S. Population by Race*, *Human Performance Under Stress*, *Military Spending by Nation*, *Global Tobacco Production 1947-Present* and *Broadband Penetration by Nation*. Callaghan uses a range of building materials including steel, wood, concrete and copper to create three-

dimensional versions of traditional charts. The exhibition includes pie charts, bar graphs and line charts, however there is an absence of typical annotations seen on charts like colour keys or text. Callaghan's removal of keys and identifiers of the statistical information changes the reading of the work. It becomes symbolic of data. I see this work presenting a humorous proposition, acknowledging the saturation of information and statistic in contemporary culture, that we now build sculptures and monuments to its existence.

Critique of Data

Public Face (2008) by Julius von Bismarck, Benjamin Maus & Richard Wilhelmer, is a large neon light of a happy face that has a mechanised smile that can be turned upside down to make a sad face. The neon face's smile is based on real time data collected about the emotional state of the city it is located in. Video surveillance of populated areas are analysed by facial recognition software to determine the average emotional state of the population; happy or sad. This is a drastically simplified method of representing emotions. In its simplification it becomes absurd. The happy or sad face cannot reflect anything about the complex state of human emotions. In doing so the work could be read as a speculation on the value of data collection and questioning our innate trust in data sources. I am interested in the use of humour particularly a wry sense of humour as used within *Public Face*. This use of humour can also be seen in the electronic media artist and Associate Professor at OCAD University in Toronto Canada, Nancy Paterson's work *Stock Market Skirt* (1998). Vesna (2007) in her book "Database Aesthetics" states that this piece is a "play on Desmond Morris's theory that the women's fashion industry responds to fluctuations in the equities market by hiking or lowering hemlines". *Stock Market Skirt* is a blue and black cocktail dress embedded with actuators and a system of cables that raise and lower the dresses hemline depending on the stock market. A computer program extracts data from the stock market and as stock prices rise, the skirt's length is shortened, and when stock prices fall, the skirt lengthens. Paterson's *Stock Market Skirt* presents an intentionally wry take on the 'Hemline Index' utilising stock market data to animate the work.



Left: *Stranger Visions* (2012-2013) Heather Dewey-Hagborg, Right: *Invisible* (2014) Heather Dewey-Hagborg

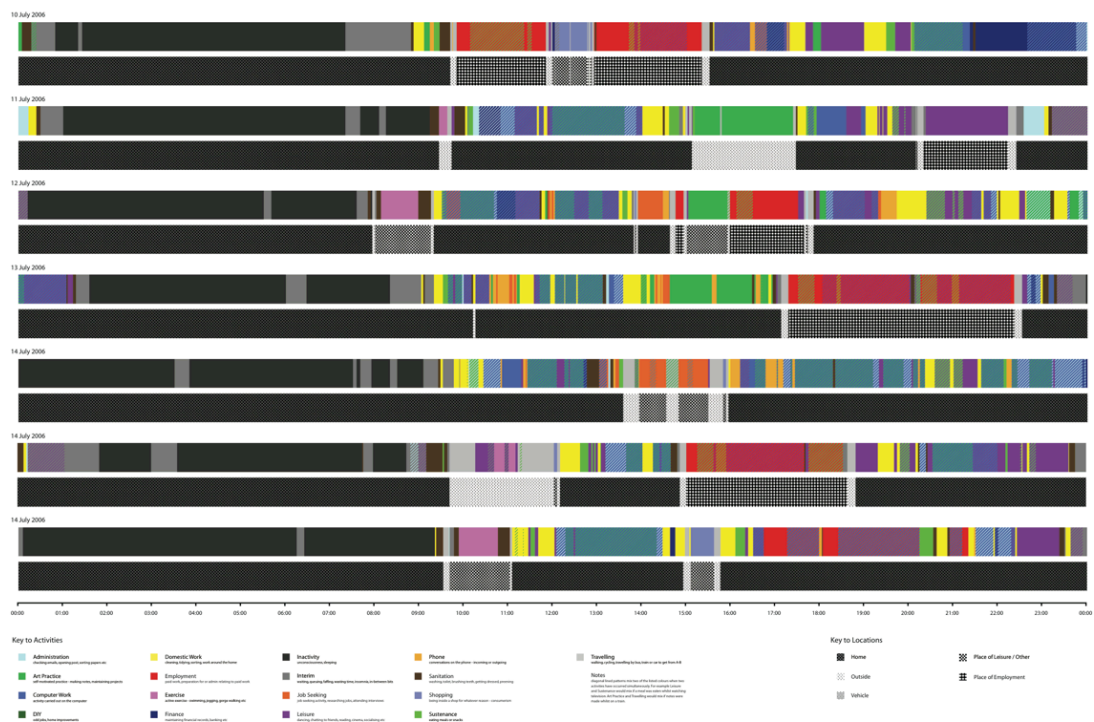
In a dissimilar approach to *Public face* and *Stock Market Skirt*, Heather Dewey-Hagborg presents a serious analytical project *Stranger Visions* (2012-2013) that questions the scope data can play within our society. Hagborg collects cigarette butts, chewing gum and hair left in public areas to extract the DNA. Hagborg then uses existing scientific research on genetics and facial structures to generate the possible face of the subject. These generated faces are full colour 3D printed and displayed in a museum style setting with the collected sample and project notes. The question that is continually raised when people see this work is whether ‘it is real’; real in the terms of whether the generated face actually resembles the individual. However when we consider the fact that these techniques are being used by government bodies and agencies, the ‘realness’ or likeness of the models is redundant (Dewey-Hagborg, 2012). Dewey-Hagborg points to a very real potential in biological surveillance and asks us to reflect on the ease of access to our very own unique dataset: DNA. Dewey-Hagborg’s work *Stranger Vision* (2012-13) was followed by the work *Invisible* (2014). The work comprises a two-part DNA eradicator; an ‘Erase’ and ‘Replace’ spray. ‘Erase’ claims to delete 95.5% of the DNA left behind on personal items and ‘Replace’ obfuscates the remaining .5%. Dewey-hagborg states on the *Invisible* website page “you wouldn’t leave your medical records on the subway for just anyone to read. It should be a choice. You should be in control of how you share your information and with whom: be it your email, your phone calls, your SMS messages, and certainly your genes. Invisible is protection against new forms of biological surveillance” (Dewey-Hagborg, 2014).

Invisible was shown at the 2015 Transmediale Festival “Capture All” which looked “at how we make sense of a culture dependent on measurement and automation procedures, and how to act with autonomy within such a culture” (Transmediale.de, 2015). The persistent theme that emerged in the festival was that of privacy in a data-driven age. Are we entitled to an expectation of privacy? Who owns the data we generate? The phrase that was

casually thrown around as if it were fact was that “data is the new oil”. Businesses are being launched around the creation, collection and analysis of data. The applications we have on our phone are offered to us for free in return for an unspoken acceptance that our data will be sold to someone who can capitalise on it.

In 2014 in response to the capitalisation of personal data, artist Jennifer Lyn-Morone incorporated herself. The model of corporation allows her to turn her “health, genetics, personality, capabilities, experience, potential, virtues and vices into profit” (Lyn-Morone, 2015). Lyn-Morone is beta testing an app called DOME (the database of me), that can collect and store data similar to other life-logging devices, but with the peace of mind that the data generated is yours and yours alone. This project points directly at the results of mass-data-accumulation under capitalism and challenges us to stand up for our own privacy rights. Within this project my work has not approached the issues of data privacy. I actively use data applications without concern to where my data might end up. Although I recognise that this is an essential conversation for a continuing data culture, within my project I have chosen to reflect on the personal reasons for datafication of self-knowledge.

Art + Quantified Self



Timelines (2006) Ellie Harrison

Like Lyn-Morone, many artists have worked with the concepts around the quantified self whether directly or indirectly. The *Facebook Demetricator* (2012) by artist Ben Grosser critiques data by devaluing numbers deemed important to usual social networking sites. In this work Grosser created a web browser extension that will hide all metric values

assigned by Facebook, thus ‘unquantifying the self’. Facebook is riddled with numbers, quantifying each action on the site; how many likes or notifications, number of comments or shares, amount of friends or people available to chat. Grosser (2012) asserts that Facebook’s “relentless focus on quantity leads us to continually measure the value of our social connections within metric terms, and this metricated viewpoint may have consequences on how we act within the system.” The web browser extension is available free and Grosser invites the public to install and experience a demetricated version of Facebook, and in doing so questions the value of quantification in our daily interactions and whether this proliferates the consumerist need for quantity over quality. In *Inventory* (2007) artist Carey Young uses her weight to extrapolate the mass of each chemical element in her body. This mass is then used in combination with the current market value of each element to determine the value of the work and the value of the artist’s body. The total market value of the elements is displayed graphically on the gallery wall and also represents the price of the work. Each time the work is installed, the values change responding to the current market value of the work of art and the artist herself.

Every Word I Saved (2006), an artwork by Cristobal Mendoza, uses a program to mine words from the artist’s digital life. Logs for emails, text documents and messenger are put into databases, ordered alphabetically and displayed via a graphical interface detailing every word Mendoza saved between the year 2000 and 2006. This obsessive collecting mirroring the practice of a life-logger is present in the early works of Ellie Harrison, the British visual artist. Harrison published the book *Confessions of a Recovering Data Collector* in 2009 that details several of her works relating to her data collecting activities in the early stages of her practice. The works depicted range from photographic documentation of everything she ate for a year in *Eat 22* (2001-02) to documentations of her thoughts in her *Tea Blog* (2006-08), to installations visualising collected data on her flatulence and sneezes. The image above is from Harrison’s work *Timelines* (2006) and visualises everything the artist did 24 hours a day for four weeks. Harrison’s body of work is an impressive showcase of a life-logger and artistic practitioner. However it is Harrison’s more recent works that are closer in presentation to my own project, although the content within these new works has moved away from the self.



The History of Financial Crises (2009) Ellie Harrison

The History of Financial Crises (2009) (image above) is an installation using everyday objects to demonstrate a dataset in relation to historical financial crises. For this work Harrison lines up eleven pop-corn machines on a table in the gallery, each machine representing one of the financial crises experienced in the past hundred years. As time passes the popcorn machines are triggered one by one in chronological order. “For a matter of minutes an air of chaos envelopes the space as popcorn explodes frantically onto the floor. Then all goes quiet again... until the next crisis occurs” (Harrison, *The History of the Financial Crises*, 2009). Within the same body of work Harrison produced *Toytown* (2009), a children’s car ride that only works when headlines relating to the recession appear on the RRS feeds of the BBC news. These works imbue a wry sense of humour and a ridiculousness that I admire. Rather than the austere commitment to data within Harrison’s quantified self works, her later works the data is secondary to the conversation within the work, which provides a level of criticality I seek within my own project.

Works that are both critical and self-quantifying can be seen in Michael Kontopolous’ *Measures of Discontent* (2009) series. Within this series of works the artist attempts to measure and represent anxiety through electronic media art. The works within the series present home monitoring systems that measure and document a certain activity commonly related to anxiety. Kontopolous (2015) states of the inspiration for his work, “I was

inspired by certain countries' efforts to impose a quantifiable value to the 'happiness' of its people—Notably, the tradition of Gross National Happiness in Bhutan. Or even contemporary articles in magazines such as Business Week that aim to measure the worlds 'happiest countries'. It follows that if you can 'measure' happiness than you can also 'measure' unhappiness.”



Sigh Collector (2009) Michael Kontopolous

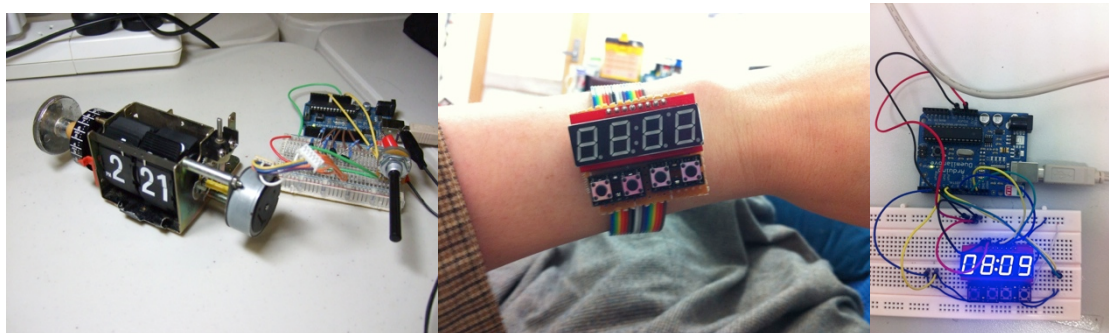
Two works within the series are *Pacing Track* (2009) and *Sigh Collector* (2009). *Pacing Track* (2009) is a walking platform that uses red yarn to “visualise the distance traversed while engaged in measured, contemplative walking” (Kontopoulos, 2015). As the person paces, the red yarn unravels in equivalent lengths, physically representing the act of pacing. *Sigh Collector* (2009) monitors chest movement to determine when a 'sigh' is detected. If a sigh is detected the portable unit will fill the equivalent amount of air into an inflatable red bladder. Kontopolous uses a performative approach in his work to collect the data in relation to his personal experiences of anxiety. In the video documentation of the works, we see the artist performing everyday activities within his home while using these devices. As data permeates our lives, it is expected to see this reflected in contemporary art practice. While there are a plethora of artists working with the visualisation of data, my project seeks not to visualise data as an end point, but to provide a platform for discussion. Kontopolous' work is exemplary of a contemporary practice that utilises data to consider and speculate on the effect technologies have on humanity.

Chapter Five: System + Method

My initial research project sought to examine the future of mixed reality technologies. Titled *Mixing Realities through Responsive Digital Media* the proposal stated:

Through this project I will be conducting practice-led research on the future of mixed reality technologies, focusing on the theoretical advancements that have the potential to increase the interconnected relationship between computer and human, and computer and the environment. To engage with this notion of interconnectivity, I will be creating artworks in the form of video and light installations and electronic objects that are responsive to elements of their environment. This will be achieved through working with programming platforms that allow interactivity through sensor input (webcams, motion detectors etc) to dictate and change the output (video, electronics, lights). (Woulahan, 2011)

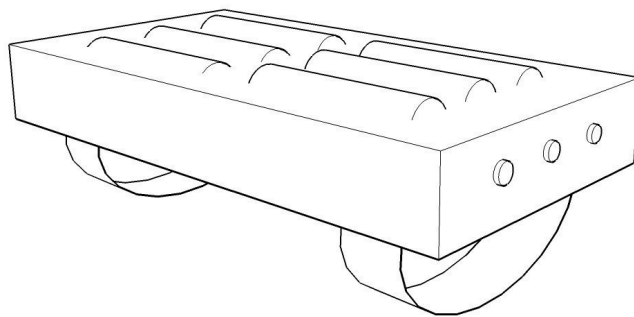
The first eighteen months of the project I dedicated my time to engaging with electrical circuits and programming, specifically Arduino and Processing as a way to develop my knowledge of electronic and digital media to facilitate my research. Somewhere during this period my research changed to focus directly on the electronic media I was using to make the previously proposed works 'responsive'. Instead of using the electronics to animate and augment video and light installations, my interest turned to ubiquitous computing and the role data plays in our lives. This research revealed how digital information within our contemporary society already presented a form of a 'mixed-reality'; and enabled me to see how data would potentially have an effect on the relationship between humans and computers sooner than virtual or augmented systems would.



Left: *Time Dilation Device* (2010) Antoinette J. Citizen Middle and Right: *25 Hour Watch* (2010) Antoinette J. Citizen

It was during this early period that I became an active member of the maker community. I frequented the Hack Melbourne space weekly and participated in workshops with Media Lab Melbourne and spent countless hours online hunting information on electronics and programming. This experience shaped the method of my research by developing a playful approach to making. I would acquire a new piece of software or an electronic component and to learn how it worked, I would create projects with the related media. Pictured above left is a working prototype of *Time Dilation Device* that I created after dissecting discarded

printers and clocks I had found in hard rubbish. Upon getting this clock to work with Arduino, the plan was to team it with facial recognition software, so the clock would only run when not being looked at. Above middle and right is another working prototype that I made when learning about 7-segment displays. The *25 Hour Watch* was intended to be part of a performative work where I changed my time to a twenty-five hour day, each day slowly sinking out of time with the rest of the world. During this stage of research I was prolific in my making. I would be playing with ideas, tinkering with works like the above continually as well as hashing plans for other devices and works through diagrams, sketches and 3D renderings.



Portable apparatus for Maintaining Human Needs (2012) Antoinette J. Citizen

Looking into potential methods of display of devices I became enamoured with patents; Google patents specifically. With over 7 million US patents, I was able to search for a seemingly endless variety of inventions. I began reading patents like “Method of Space Compression Time Dilation Machine,” “Method and Apparatus for making Double-walled Glass Vessels” or “System and Method for Super-Intensive Shrimp Production”. I was seduced not by the inventions themselves but the language and diagrammatic style utilised in these documents. Studying Google patents, I was able to mimic the style of language utilised to produce a series of ‘patent-like’ documents. I use patent-like as a term as they are not patents, and I do not wish them to be. I advocate for open source and creative commons usage. These documents became a research method to explore ideas without being restricted to the boundaries of reality. I had numerous ideas for works which would not be feasible to build and create in their entirety, so making these documents became a way I could further explore these conceptualisations. The title of my works within this project have come from the required preamble evident in patent documents. It is helpful to note that most of my works, like myself, have two names. They have an official work title in the form of a patent title and a colloquial name by which I refer to it. The second name is usually descriptive of the material or a shorthand variant of the title. Due to the length of some of the official titles, I will introduce works with their title, but refer to them using their simplified names.

DEVICE FOR TRACKING (Black Box)

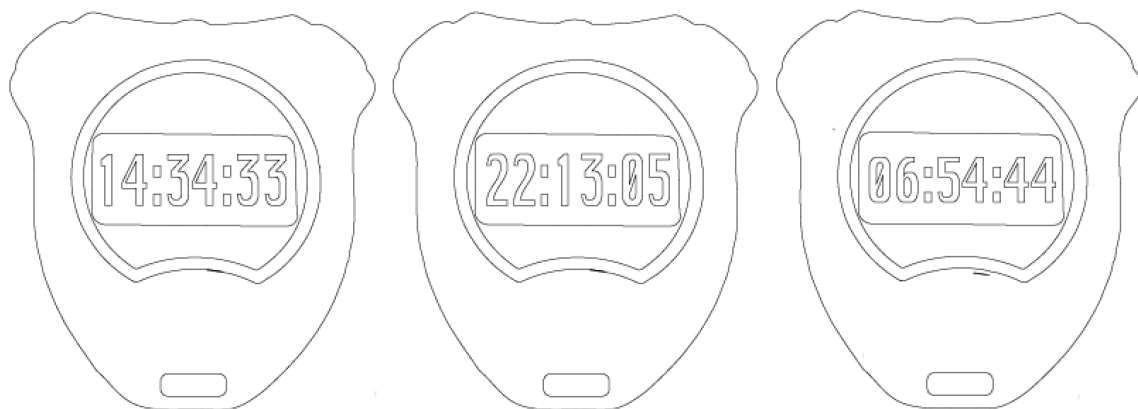


Device for Tracking (Black Box) (2011) Antoinette J. Citizen

Device for Tracking or *Black Box* (2011) was the first work I made that cemented my research area in reflection of data and the use of quantification to explore the concept of self. Comprised of an acrylic black box and small monochrome LCD screen, it displayed data collated from various sensors contained inside it. The LCD read across four lines: distance travelled, interactions counted, time in existence and a relative position percentage. The work initially intended to explore how information may constitute a mixed reality in relation to my early inquiries. However, the reading evolved after its creation: the small black box was no longer just an object but a quantified history of itself; it existed both in a physical and a digital realm. Its function however was irrelevant, it did not utilise this data in any meaningful way other than to regurgitate it back to the audience. It became apparent that the work manifested an anthropomorphic quality. I started to take it from place to place, on the tram to and from the studio, driving with me around in the car, like a child would with a Tamagochi. The numbers presented a history of its life, where it had been, how much it had done, its age and in doing so the work became an analogue of the human mind, though potentially a quite nihilistic one. Thinking and considering this box as an entity of its own made me want this box to 'live', to have adventures, to travel, to interact. As its kilometres and interactions count ticking up were the only indication of its presence in the world, I did not like to turn it off. It is still on, sitting on my desk collecting kilometres only by the ineffective indoor GPS signal that randomly transports it virtually a few metres every so often.

At the time of making this work I was reading various writings on the philosophy of mind. Contemporary philosophers like John Serle, Daniel Dennett, and pop-psychologist Bruce Hood directed my pondering to the question of self, the mind and consciousness. I was using the box as a method to consider the mind; for what are we but a collection of our experiences? These readings kept bringing me to David Hume and his theories of consciousness and the self. Bundle theory as conceived by Hume became an important way for me to consider the mind. The theory offered a perfect analogue to critique the Quantified Self. Hume (1911) stated “I may venture to affirm of the rest of mankind, that they are nothing but a bundle or collection of different perceptions, which succeed each other with an inconceivable rapidity, and are in a perpetual flux and movement” (para 3). While there are several theories of the self, bundle theory assists in contemplating the mind when we consider quantification. If the self is just a ‘bundle’ or a series of perceptions, then quantifying these is not out of the question. Bundle theory offers a platform for considering the categorisation of the self.

METHOD FOR TIMING THOUGHTS (Thinking about Making Art)



During an artist talk by Georgina Cue in early 2011, I was drawn to reflect on *time* being equated to *value* in artistic practice. There is a certain romantic allure to an artist slaving away at their craft; sculpting, moulding or in the case of this artist, cross-stitching. She spoke about the laborious hours spent on her living room floor, and the audience (myself included) were impressed at the dedication and diligence of this artist’s practice. While my work is heavily processual, my favourite working method is conceptual. That is I like to think. And I love to think about making art. Ideas do not just come, they fester. They bounce around in my mind, while I consider and rework them. Sometimes they nag, demanding resolution or they fade away only to be absorbed into other ideas. I annotate my ideas with crappy sketches on pieces of paper and hang them to the walls of my studio. I use these notes as a means of reflection, looking at them daily allows them to stay in the back of my mind. I have developed a myriad of techniques that assist in the thinking

process, one of which I will detail further in the section *System and Method to Assist an Insomniatic State for Creative Thought*. I use boredom as a method to assist in creative thinking and critically engaging with practice. “Boredom: A lively History” written by Peter Toohey talks to the benefits of boredom on creativity: ‘Because it can breed dissatisfaction with views and concepts that are intellectually shop worn, boredom can encourage creativity. Boredom may drive thinkers and artists to question the accepted and to search for change’ (Toohey, 2011, p185). Boredom created from walking or sitting staring out the window or very light sleeping, devoiding oneself of usual stimuli allows the mind to wander, to make connections, to postulate in endless scenarios. It is also my one process that does not involve the internet in any way.

After the artist talk I was compelled to compare the labour of sewing with the labour of thinking. It seems absurd to compare; thinking, pondering, reflecting, anything involving only the mind and not the rest of the body appears to the outsider as a lazy task. Interested in the comparison I decided to start timing my thinking about making art. My plan was to carry a stop watch around so I might time my thoughts about certain works. This however was not the easiest task. Allowing your mind to wander absently from the world into a creative train of thought while remembering to press the stop and start button of the stop watch, ruins the process of thinking quite a bit. The final work *Thinking About Making Art (2011-2014)* is presented as a series of stopwatches, each tagged with a title of one of my other works. Some watches are presented in pairs or threes tagged with the same name, indicating the addition of twenty-four hours for each. The work is almost true, being partially quantified and partially guesstimated. In the end the idea of an artist timing her own thoughts over years of making appears as a more laborious task than the thinking itself, more impressive a task than just the thinking alone at least.

METHOD AND SYSTEM FOR LOGGING THOUGHTS AND/OR ACTIONS (Cordial Logger)

As I was getting used to timing things with stop watches I experimented with logging internal conversations (i.e., conversations with oneself) and external conversations (i.e., conversations with anyone else orally). I would carry two stop watches around with me, starting one when in conversation with others and the other when I entered dialogue in my own head. This practice became complicated when my interactions with others were effected by the logging. Being told it was “creepy” or that they preferred I didn’t do it, challenged the success of recording actual values. I attempted to log post conversations but this proved insufficient. In the end the answer was quite simple, a mobile phone. People in our contemporary culture are used to each other tapping on their phones. It has reached a point where it does not even have to interrupt conversations. There is an etiquette, but it is one we have adapted to: mobiles are part of our experience, and tapping my phone at random intervals did not seem to bother anyone.



Device, System and Method for Logging Internal vs External Conversations (2012) Antoinette J. Citizen

Method and System for Logging Thoughts and/or Actions, or the *Cordial Logger* by which I refer to it, was made in true bricoleur fashion. As I had been logging various aspects of my life for some time, I wanted to create a device that could display one of my data sets in real time, namely internal and external conversations. Created in a day, mounted on my bedroom wall, I gathered the parts from around the house. A water bottle and cordial bottle was utilised as the logging material. I constructed a simple shelf holding the two bottles upside down to form a dispenser. The caps of the bottles were drilled and plastic tubing fed through. A quick Google search revealed an easy valve design made using servo motors, a bit of aluminium tubing and a whole bunch of zip ties. The water and the cordial each had their own valve that dispensed the liquid into a communal glass jug below. I connected the servos to an Arduino micro-controller, which used a Processing sketch to pull data from a private twitter feed that I could post to from my mobile. The device could log any two variables based on duration of time. As the cordial supply was limited, time duration was divided by a ratio of 1:60, one minute of liquid representing one hour of the variable.

The work was moved from my bedroom wall to be exhibited at Kings ARI gallery in Melbourne in 2012. For this exhibition, I emptied the 'loggings' of cordial mixture from

the jug into recycled bottles, each bottle representing one day of loggings. The colour of the cordial logs changed day to day, graduating depending on my interaction with others. As the performative element of the work could be potentially missed in viewing, I left the twitter feed open on the computer display, alongside the updating Processing code; in an attempt to facilitate the reading of what was going on in the work. This was my first foray into bringing studio elements into the gallery to allude to the performative component happening within the piece.

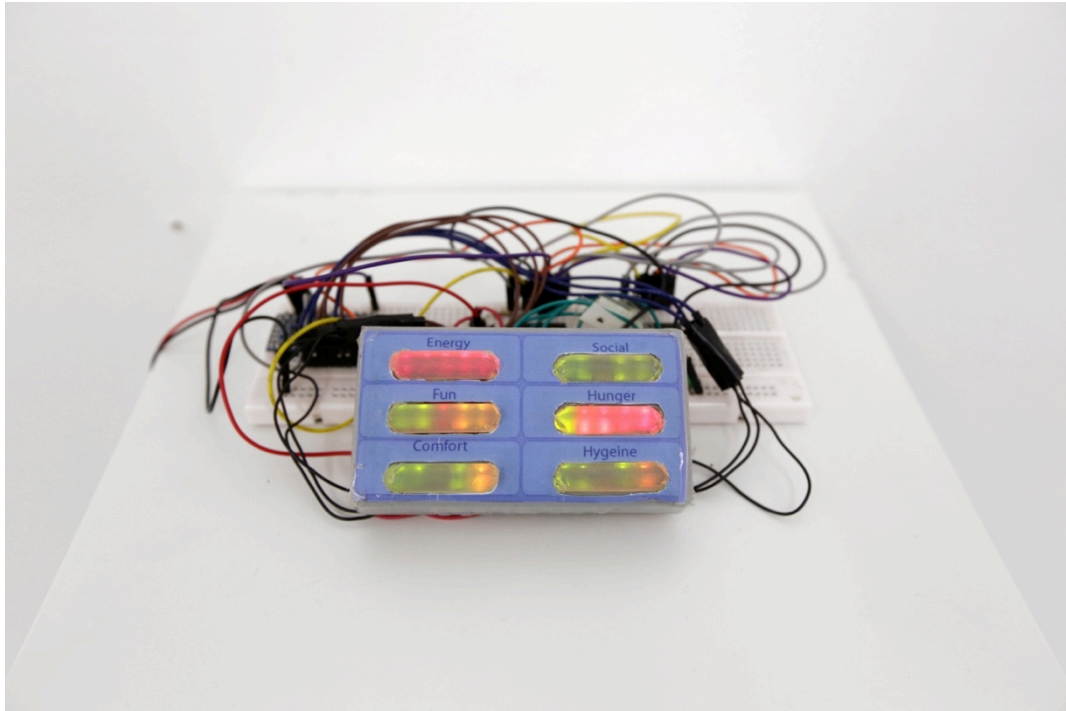
PORTABLE APPARATUS FOR MAINTAINING HUMAN NEEDS (Human Needs Meter)

Beginning my postgraduate research I considered myself a Transhumanist. The term transhuman as I use it, describes a transitional stage between humans and posthumans², where evolution has been brought about by technological intervention. Transhumanism however details a rational way of thinking about the future of the human species in relation to this evolutionary process. Throughout my studies in undergraduate and postgrad I have read Transhumanist theorists from academics Nick Bostrom, David Pearce, Donna Harraway and Max More. These theorists have informed my research in the ethics of technological interventions within our lives. Bostrom, a leading transhumanist philosopher and director of the Future of Humanity Institute defines transhumanism as two principle inquiries:

- (1) The intellectual and cultural movement that affirms the possibility and desirability of fundamentally improving the human condition through applied reason, especially by developing and making widely available technologies to eliminate ageing and to greatly enhance human intellectual, physical, and psychological capacities.
- (2) The study of the ramifications, promises, and potential dangers of technologies that will enable us to overcome fundamental human limitations, and the related study of the ethical matters involved in developing and using such technologies. (Bostrom, 2003)

As an optimist about the future of technology, I tend to champion the use of technology to advance the human species, inspired by the idea of post-human beings. However as an artist I try to be sceptical and to challenge my own intuition, using my practice as a debate both for and against my research enquiry. *Portable apparatus for Maintaining Human Needs (2011-2013)* or the *Human Needs Meter* was developed as a dialogue between transhumanism, quantification of the self and reflection on bundle theory. The work, created many times over during the research project, exists as varying prototypes and a patent-like document detailing its technology and use.

² Post Humans are defined as “possible future beings whose basic capacities so radically exceed those of present humans as to be no longer unambiguously human by our current standards.” (Bostrom, 2003)



Portable apparatus for Maintaining Human Needs (2013) Antoinette J. Citizen

The *Human Needs Meter* works-in-progress series postulates a wearable device that appropriates the aesthetics and function of the 'needs meter' in the computer game Sims 3 (The Sims Studio, 2009) and pairs it with life-logging technologies for a user to track their own needs. Within the Sims game, players utilise a multiple bar meter containing the needs energy, social, fun, hunger, comfort and hygiene. These needs are tracked and the status is displayed via the bars ranging from green (optimum) to red (neglected). Keeping these needs at optimum levels will avoid the Sim evincing erratic behaviour. My version, the *Human Needs Meter*, proposes an electronic version of the digital counterpart designed for 'non-simulated' users to track their needs in real life. Using a simple button interface, data is intended to be collected and compared against preset units, which determine the status of the needs bar. Following is an excerpt from my patent-like document detailing how the needs and units are optimised:

The need energy is based upon sleep and caffeine. One hour of sleep or one coffee is equal to one unit or one button press. Eight units of energy will equal the optimum energy need level. These units will incrementally decrease over waking hours, as per one unit for every two hours. Hunger is based on food intake. One meal (500 calories) is equal to three units and a snack or beverage (150 calories) equal to one unit. Optimum hunger needs state will be reached after two units, with units being depleted every five hours. The Fun need is based on activities the user deems to be 'fun'. This may vary from user to user, though could include activities like playing sport, dancing, playing video games, etc. The Fun need is based on a weekly cycle of eight units to equal optimum level depleting at one unit per day. One hour of 'fun' is equal to one unit, or one button press. The Social need is also based on a weekly cycle of fourteen units, one hour per unit, depleting two units per day. Social need requires the user to interact with other human beings through communication. This may be face to face or mediated through digital technologies. The user may determined that their social activities are also 'fun' therefore one hour of socialising will equal one unit of Social and one

unit of Fun. The Comfort need is based on activities and environments the user determines to be comforting. It is based on a daily cycle of two units equalling two hours, depleting over waking hours. Comfort need may also co-exist with other needs. The Hygiene need is based on a daily cycle of sixteen units per day. A shower or bath is equal to six units, hand washing, brushing teeth and all other grooming methods count for one unit each. Units are depleted at one unit per hour during waking hours.

These units are collected through button input from the user. The buttons are connected to a micro-controller that calculates the current need status based on the predetermined units. The need status is updated onto a visible display (FIG. 1 [2]). The display is made up of six bars that resemble 'health bars' with five rectangle RG light emitting diodes placed under a shaped glue stick which diffuses the light. These 30 RG LED are multiplex through two daisy-chained eight-bit shift registers connected via SPI to the micro-controller.

Human Needs Meter was exhibited in three group shows in 2013. Once in New Zealand at Stark White for the show "Bazinga!" curated by Robert Lenard and at Ryan Renshaw for the exhibition "Faux Pas", and as part of a collaborative residency with Melbourne Media Lab. At each exhibition it was shown as the current version existing at the time the exhibition was on, displayed alongside the patent-like document. The prototype in each incarnation looked seemingly unfinished with all of its wires and electronics exposed. Rather than thinking of this piece as a final working device, I think of the work as an evolving prototype, inclusive of all progression. The resolution of the device is unimportant as I feel the performative aspects of making a 'human needs meter' spoke just as well. By being an evolving prototype the reading of the work is drawn to the action of making. The piece is aspirational, in a state of constant becoming. This evolving nature of the work is present throughout my practice, with works tending to be forever in an unfinished state.

The work *Human Needs Meter* proposes an absurd position; that humans, like their virtual counterparts can be quantified into categories to maintain their wellbeing. Six categories we can safely assume are not enough. But what about 12? 42? 1000? 1 000 000? Are the categories required infinitely long or with the right computer power is quantifying the self a possibility? Though technology is not quite there yet, I feel it is important to reflect about ourselves within these terms — are we reducible to simple units of tasks? How effective will computer monitoring be at increasing our wellbeing? I originally intended to perform with this work, though as yet none of my prototypes have made it to a beta stage. I envisaged wearing the meter, responding directly to the pre-set units over a designated period of time (possibly three to six months). During this time I would quantify my mood and wellbeing and compare and contrast it to data taken sans meter. Would keeping six categories at optimum levels have any change on my wellbeing? Extreme life loggers and those of the Quantified Self (QS) movement appear to believe quantification can improve health and wellbeing. Gordon Bell, the pioneer of MyLifeBits, detailed in chapter three, wrote the book with Jim Gemmell "Your Life Uploaded: The Digital Way to Better Memory, Health, and Productivity". It details Bell's experience with life logging and is a

testimony to the QS movement on how to use quantification and digital memory to “improve your health and extend your life” (Bell, 2010, p24).

It was during this point of my research I began to draw parallels between QS and self-help movements. Bell’s book read like a techno injected self-help book. They both utilise science as a means to claim their validity. QS with its truth in numbers and health science research, and self-help gleaning respect from the soft-science of psychology. While in my view self-help books are often about how “to be yourself”, QS updates the practice with how to be “the very best version of yourself”. I began to compare and contrast these practices and realised that they were simply cultural progressions offering the same thing. This revelation made me consider the quintessential purpose of these practices: health and happiness. While it previously never occurred to me to question these as goals, I began to think about how happiness and health being the ultimate goal to life potentially misses out on the complexity of humans. Questioning the value of health as the ultimate goal, I came to the writings of healthism. Deborah Lupton (2013) likens the goals of healthism to the quantified self: “healthism positions the achievement and maintenance of good health above many aspects of life and features of one’s identity, so that an individual’s everyday activities and thoughts are continually directed towards this goal. A dominant belief underlying healthism is that fate can be controlled, at least to some extent, by personal action and taking responsibility for one’s health” (p397).

SYSTEM AND METHOD TO ASSIST AN INSOMNIATIC STATE FOR CREATIVE THOUGHT (Insomnia)

Following the *Human Needs Meter*, I began to challenge the idea of having an optimum state. Even if technology advanced to a level where each state could be entirely individualised to the person, I was interested in what could be lost if the so called ‘ultimate health’ was maintained. Around this time I had been cured of insomnia. I have ambivalent feelings towards insomnia, because while I hated the sleepless nights filled with torturous anxiety; I also associated those nights with creative thinking and planning. Hypnagogia is an in-between state, where the person is not yet asleep, but also not awake. And insomnia is a terribly effective way of precipitating long spans of hypnagogia. It is documented that many creative people have utilised this state for thinking, as it is associated with creativity and problem solving.

Hypnagogic imagery may render more obvious those images involved in scientific creative activity. Indeed, hypnagogic images seem to have been a critical factor in chemist Friedrich August Kekule’s conceptualization of the structural formula of the benzene molecule. Ludwig van Beethoven reported obtaining inspiration for a composition in 1821 while napping in his carriage en route to Vienna... Thomas Edison often stretched out on his workshop couch; during these ‘half-waking’ episodes, he claimed that he was ‘flooded’ by creative images. Mary Shelley reported that her classic

tale, Frankenstein, came to her as a series of hypnagogic images (Krippner, 2011).

The Zeo is a life-logging device that employs sleep-coaching techniques to achieve ultimate sleep conditions. It uses electroencephalography technology to determine sleep stages and combines this with prior sleep research to offer the user advice on achieving a higher quality of sleep. Reflecting on my personal experience with sleep, I was concerned that while insomnia was not completely desired, aiming for ultimate sleep health would have detrimental effects on access to creative states and fluid thinking. Interested in using this technology in the 'wrong' way to point to the potential of an unhealthy state, I decided to create a work with the Zeo that would assist in creating an insomniatic state.



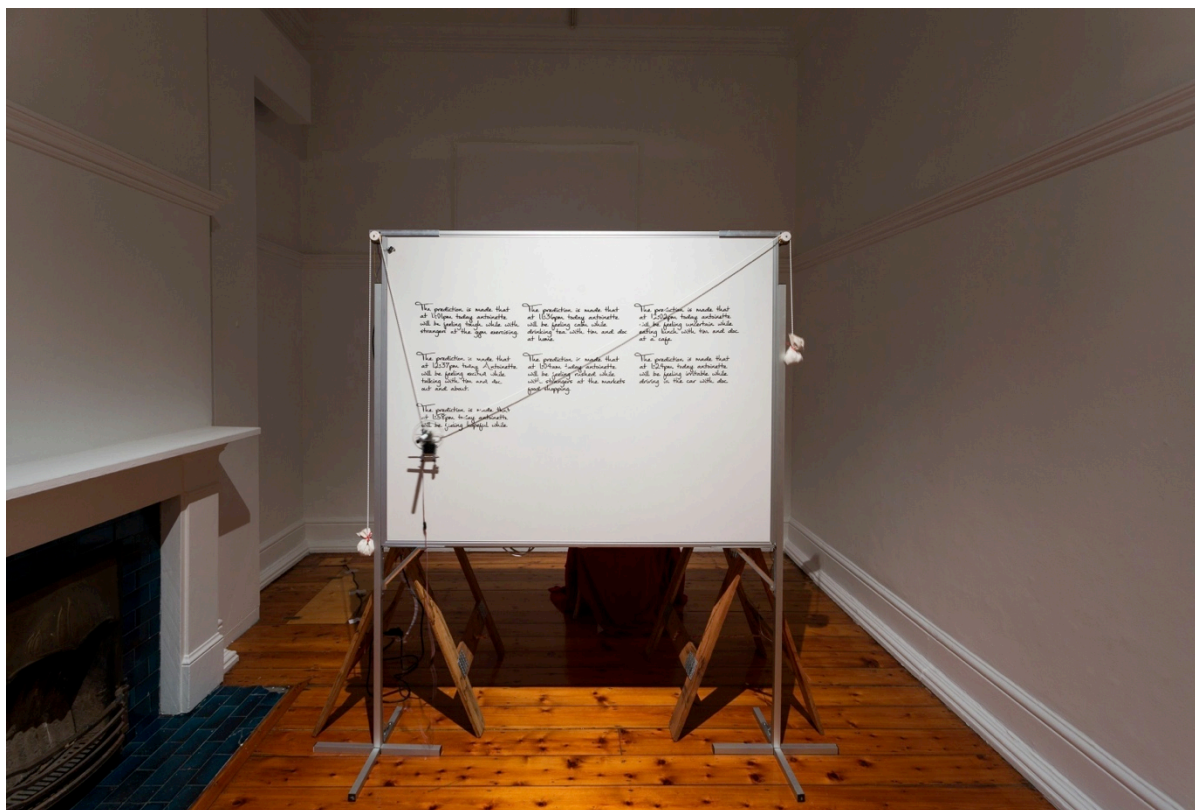
System and Method to Assist an Insomniatic State for Creative Thought. (005) (2013) Antoinette J. Citizen

System and Method to Assist an Insomniatic State for Creative Thought. (001 – 005), referred to in shorthand as *Insomnia*, was created in reflection on insomnia and optimum sleeping states. The work is an experimental system and method that seeks to create and maintain an hypnagogic state to assist with creative thought. The system utilises the Zeo to determine sleep stages and is teamed with other apparatus to keep the user in a perpetual state of almost being asleep; thus allowing the user to experience the fluid thinking state available to insomniacs without the overwhelming negative side effects the disorder embodies. For this work I used a hacked version of the Zeo to access data relating to different sleep cycles. This hack called Open Zeo, came from Github as an open-source code for android platforms which could extract the data from the Zeo manager. Wearing the Zeo the user's sleep states were analysed and the secondary apparatus triggered when it was detected

they were drifting into a light sleep. The secondary apparatus included an Arduino with various automated contraptions using either sound, movement or bright lighting, designed to gently rouse the user. These contraptions were made from objects and devices found within my studio or at the gallery in which it was displayed. For example, a fern branch attached to a servo motor placed to be able to lightly brush the leg, a bell paired with a solenoid could ring, or a lamp could be switched on. These contraptions were placed in proximity to a bed or resting area, so when triggered they would bring the person back to an awake state.

The studio in *Insomnia (004)* became the gallery when I set up the work for an open studio at School House Studios and invited the audience into my usually private space. Conversely, the gallery became the studio in *Insomnia (005)* as I set up the work at Level gallery in Brisbane to mimic my studio. The studio is an integral part of my practice, as it is with many artists. Clare Doherty (2000) writes “in most cases, the studio is more necessary (crucial) to the artist than the gallery or museum” (p16). For me the studio is even more important than a place for making art, it is an instrument of my performative method. I incorporate or allude to the studio within my works as a means to point to the process of making. The studio stands in place of me upon presentation of the work.

SYSTEM AND METHOD FOR PREDICTING THE FUTURE (Whiteboard/Predictions)



System and Method for Predicting the Future (2013) Antoinette J. Citizen

Considering the Quantified Self movement along the continuum of self-help, I began to look at previous incarnations of other support methods that sought to offer insight into the self. Parapsychology and forms of divination appeared to exist on a similar spectrum. Reading *Semiotics of Fortune Telling* (1989) I came upon a quote in reference to fortune tellers, yet it seem to fit with many of the forms of support I was researching: “The world in which we live often seems alien to us, even hostile... We have rejected, for the most part, the consolation of organised religion, yet we seek reassurance. When we can predict, or think we can predict the future, we feel that we are less likely to be victimised by blind chance” (Aphek & Tobin, 1989, p178). I must admit here that I hate any of forms of parapsychology, divination or astrological readings. I despise them, and will debate anyone who mentions psychic readings, horoscopes or paranormal events. But just as I use artistic practice to challenge my optimism of science and technology, I too advocate for challenging my disdain as a research method.

System and Method for Predicting the Future (which I refer to as *Predictions* or just *Whiteboard*) came about from this research, considering the comparisons between quantified self and divination practitioners. I was questioning whether the quantified self with its scientific appeal provided anything more than that offered to those who follow divination or astrology? I was interested in how life logging and fortune telling could be placed together to examine our desires for future guidance. Specifically, how we need to feel in control of our destiny and how we use paranormal and technological markers to do this in the same way. I started to look at practices of divination, self-help and quantified self as a linear progression of the other, each providing equivalent comforts in people’s lives.

Predictions was first exhibited at Linden Contemporary Art Centre in 2013. It is a kinetic installation that analysed my own personal data in an attempt to predict actions or activities that I will make in the future. These predictions are written out onto a whiteboard using a robotic x and y plotter, typically predicting 30 minutes to an hour before the action is to be undertaken. These predictions continue throughout the day creating a grid of predictions on the whiteboard. An example prediction is: “The prediction is made that at 3:15pm Antoinette will be feeling anxious while writing her exegesis at the studio.” For this work I created a form on my phone using the Android app *KeepTrack*. The form contained entries for activity, who I was with, feeling, location, day and time. This app was paired with an interval alarm to remind me to complete the form every fifteen minutes for a six month period. Predictions were then generated from bigml.com, an online web service that offers predictive analytics with the datasets provided by the user. BigML is one of many data analysis web services available to individuals, that allows for analysis of big data projections that cannot be calculated by conventional techniques. While my complete dataset of my daily activities did not come close to what is understood as ‘big data,’ I felt compelled to use this software to reflect upon the potential of data analysis and predictions.



System and Method for Predicting the Future (2013) Antoinette J. Citizen

The work consciously incorporated the idea of fortune telling. As I view it, the fortuneteller collects information from the individual through body language, gesture and conversation. This information is combined with a generic prediction method that appears to be individually tailored to foresee a person's future. This work instead collects information through life-logging methods and creates generic predictions based on computational analysis. Parapsychology is mimicked in the work both through the content of predicting and the physical system that is used to make predictions. *Predictions* uses an x and y plotter that can write on the whiteboard with a high degree of accuracy. This style was chosen for its reference to 'automatic writing' seen in Parapsychology. In referencing automatic writing through a technical device, I reflected on how life-logging and fortune telling both looked to examine our desires for future guidance. Quantified Self's reliance on numbers makes it appear scientific, and thus seems like a more objective description of reality. Yet as Deborah Lupton (2013) describes 'numbers are not neutral, despite the accepted concept of them as devoid of value judgements, assumptions and meanings. The ways in which phenomena are quantified and interpreted, and the purposes to which these measures are put, are always implicated in social relationships, power dynamics, and ways of seeing' (p399). The neutrality of numbers is considered in the work when reading the predictions on the whiteboard. They are overtly banal and mundane, offering inconsequential foresight. Their banality points to the uselessness of predictions, predicting things that are so likely to happen that they could have as easily been guessed by myself. The performative action of collecting six months worth of data becomes redundant, reflecting on the value of quantifying the self.

X and y plotters are not new inventions – various versions of plotters have been around for decades. Recently there has been a resurgence in the use of plotters, with artists and makers utilising the technology. Many artists have created works using plotting technology including *Smoking Bolts* (2013) by Simon Ingram, *Perpetual Drawing Apparatus* (2008) by Julius von Bismarck and Benjamin Maus, and Nicolas Roy's *Cardboard Plotter* (2013). To make this work I modified existing open-source code and mechanical details available freely on the Internet, with essential parts coming from the *Polargraph* maker Sandy Noble (2015), and Paul Fisher's *Makelangelo* (2015); both of whom took inspiration from *Hektor* - a graffiti robot by Jürg Lehni and Uli Franke (2015). Watching plotters of artists or diy-ers using everyday writing tools (i.e., pens and pencils) gives the robotic drawing machines a magical sense. Viewers are compelled by how the robot can draw at a level as well or better than their own with minimal equipment.

It was important to me to present both the seemingly magical appearance of the drawing robot, but also not hide any of its working parts. My practice in this project has been focused on including the studio process and performative elements within the work, as they are essential to the reading. So for this work I experimented with the inclusion of a 'studio' as part of the work. The first thing the audience sees is the whiteboard with a simple contraption holding the pen to the whiteboard. Upon inspection the two motors placed on either side of the whiteboard are moving at small intervals with the pen attached by a plastic chain drawing ever so slowly. Small calico cloth bundles act as weights on the opposite end of the plastic ball chain that connects the pen to the motors. These move up and down as the motors and pen move. In a 'Wizard of OZ' style reveal, the audience is able to go behind the whiteboard where there is a studio setup with working components of the robotic whiteboard on display. The setup is modelled on my own studio with a plethora of sketches and notes adorning the back of the whiteboard, blanket resting on the chair, coffee cups and various studio paraphernalia lying about.

METHOD FOR COUNTING QUALIA (Pie Chart)

For the work *Method for Counting Qualia* or *Pie Chart*, I made a 3-dimensional mechanical wooden pie chart. The chart, like its 2D counterpart, displays quantitative information by dividing a circle into sectors, each sector corresponding to a percentage of the dataset. *Pie Chart* can display three variables, utilising twenty tetrahedrons that are mounted onto motors and bearings. This work was made and exhibited directly after *Predictions*. Originally I had envisaged using the pie chart in a similar method to the Cordial Logger, however after the intensive logging required for *Predictions* I felt that I could not face having to log more of my life. Logging is intrusive, it has to stay present in your mind so you can be consistent with your logging. In *Predictions* I was able to use a time-based alarm system to circumvent this need for concentration, however logging qualia would require constant attention.

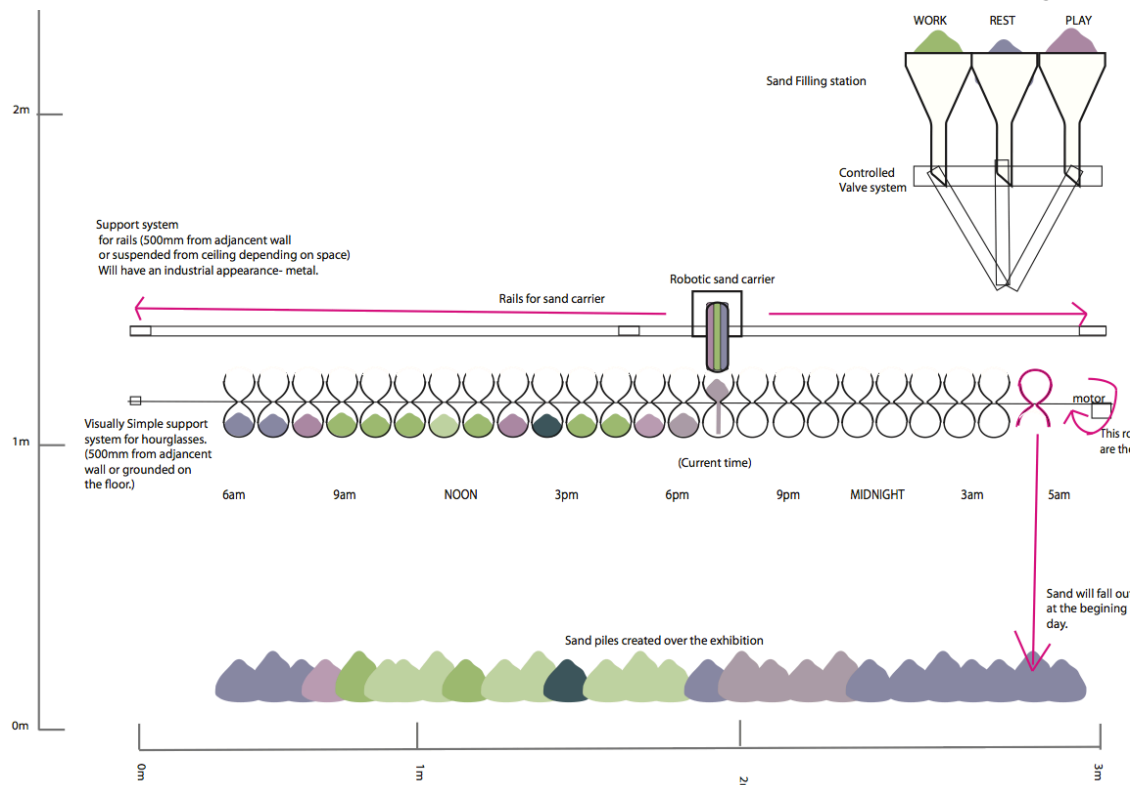


Method for Counting Qualia (2013) Antoinette J. Citizen

When *Pie Chart* was first exhibited in Brisbane at *BoxCopy* I decided that for this show I would access data sets from my social network sites relating to experiences of Qualia,⁵ Each day three qualia were chosen, for example ‘the taste of coffee’ vs ‘the redness of a rose’ vs ‘the pain of a headache’. These percentages were continually updated on the pie chart. I feel that the decision to not incorporate my own personal loggings and use another method was to the work’s detriment. Accessing these datasets from the Internet gave it an added complication and made the reading of the work onerous. It was too convoluted and this took away from both the idea of quantification and the reflection of qualia itself. The work however being a pie chart can be used in a different scenario, as it is not locked to its dataset. For the project exhibition *System + Method*, I will be returning to logging and attempt to log my own qualia. While I could change the variable, I feel attached to the dataset of qualia. The act of quantifying qualia, is essentially attempting to quantify the unquantifiable. This concept is an important aspect of my research as it points to questionability of “self knowledge through numbers”, and provides an alternative viewpoint to the research of the quantified self. Qualia are essential to our being. It is the human experience. By its nature it cannot be put into words, so why would we be able to understand it through numbers?

⁵ Qualia being the phenomenal qualities associated with experience. (Bayne & Montague, 2011, p124)

DEVICE, SYSTEM AND METHOD FOR DURATIONAL RECORDINGS OF CATEGORICAL INFORMATION (Hourglasses)



System And Method for Durational Recordings of Categorical Information (2014) Antoinette J. Citizen

For *Device, System And Method for Durational Recordings of Categorical Information*, aka *Hourglasses* I was interested in exploring the eight hour day movement; eight hours work, eight hours rest, eight hours recreation. A simple categorisation, but one that reflected a quantified lifestyle. At the time I was reading discussions about ‘free labour’ that have proliferated on the internet. As internet users we generate content for multinational companies through our social network posts, websites, blogs, reviews and create endless streams of data through the apps we use. And we do this all for free within what would be considered our eight hour ‘recreation’ sector (Terranova, 2000, p33). To contemplate the issues with 8-8-8 categorical method, I devised *Hourglasses* where I would attempt to categorise each moment of my life into a percentage-based value of each work, rest or play. For example right now I would say I am at 30% rest, 55% work, 15% play, because I am sitting quite comfortably (i.e., rest), writing my exegesis on my laptop (work) while listening to music (play). There are many life-logging applications available to compartmentalise activities, allowing the user to view percentage-based quantities of work, family, transport or even spiritual time. There is a ridiculousness in the attempt to quantify life in this way that I wanted to reflect on with this work.

Currently *Hourglasses* does not exist in prototype form. It is only in thought, diagrams and partial model. I envisage that the work would function in two parts; a wearable computing device that collects work, rest and play values throughout my day, and a kinetic sculpture

that exists within an exhibition space displaying the information collected. The logging device would be Internet enabled to be able to send the values remotely. This would allow me to use the device in my daily life without having to change my existing schedule to perform within the work. Each time I engage in a new activity or emotional state, I could adjust my logging device to suit the new work-rest-play values. The values being quantified are completely subjective. While I may consider one activity 50% fun — 40% rest — 10% work, someone else assigning values may have a completely different ratio. The information from the device would be represented through a kinetic sculpture, with three different coloured sands and 24 hourglasses in an elaborate categorical time keeping machine. The 24 hourglasses represent the 24 hours within the day, with the first hourglass representing the time at sunrise. As the information is updated from the wearable logging device, the sand is dispensed into the corresponding hour's hourglass.

The three colours of sand start to be mixed together creating new colours from the overall hours' different ratios of work, rest and play. At the end of the day, right before sunrise, the hourglasses are all turned upside down; the sand emptied on the floor, allowing a new day of logging to begin. The sand is accumulated in sand piles on the floor over the duration of the exhibition. This gives the audience an extended insight into the categorical experiences that have happened over the exhibition. With each different activity, the work-rest-play ratio changes. Just having three different sand colours mixing together create an exhaustive amount of colour variations. The sand piles will begin to reveal patterns and anomalies with new categories being created over the duration of the exhibited work. The original three categories becomes many, many more, depicting a much more complex view of how we emotionally experience our time.

While this work has not been made to its 'final state,' I have created various small models, patent-like documents and sketches to experiment with the work, but as yet an appropriate site and adequate funds have not become available. The work as an installation I envisage to be exhibited in a gallery or other space with large picture windows opening onto the street. The piece's main material is that of time, the installation evolves over the 24 hours in the day and slowly reveals similarities and differences in categories over the weeks of exhibition. The piece potentially creates a greater reading with multiple exposures over the duration, rather than the short interaction a gallery space tends to offer. While I do envisage the work exhibited as an installation, I value the processual work as being equally important. This is why for my project exhibition *System + Method*, I will be exhibiting the work in its current state, displaying images and sketches of the piece.

CHAPTER SIX: Conclusion

This project and supporting exegesis has been pivotal in developing and understanding my research methods that combine contemporary art practice and the maker community ethos. Although I present the works in an 'as is' unfinished arrangement, this has been a conscious decision resulting from experimentation. The aesthetic has developed directly through my methodology, creating a framework for the prototype, processual and performative methods to evolve and shape the works.

For the final exhibition *System + Method*, I will be presenting a selection of works from the body of research created during this research project. The works are not conclusive in providing an answer to the question of whether the self can be quantified, nor do they render a verdict as to whether there is any value to self-knowledge through numbers. There are reasons to quantify and there are reasons to leave things uncategorised. The works instead provide a platform for discussion, to acknowledging the presences of the technology and speculating on its use. Researching life-logging has opened my view to just how much of a role data tracking plays in our lives, both through our own choices to track and remember our lives via the Internet, and through the inconspicuous data collection that exists within our contemporary environment.

While I considered myself a transhumanist before the project, my convictions now are not so solid. It is not that I have given up on technology, more that I have become unsure about the environment in which technologies exist. I may come back to my transhumanist persuasions, if technology can be 'free' from built in obsolesces, from multinational corporate control, and from the restrictions that are created when advancements are made only in pursuit of profit. Or at least that is what I need to have hope for. Like the quantified self, self-help and divination practices, transhumanism is also a method used to feel in control of the future, if not more so than the others, as the dream of the posthuman body seeks ultimate control - to be able to escape death.

References

- Anderson, C. (2013). *The Maker Movement: Tangible Goods Emerge From Ones and Zeros* | WIRED. WIRED. Retrieved 3 June 2015, from <http://www.wired.com/2013/04/makermovement/>
- Aphek, E., & Tobin, Y. (1989). *The semiotics of fortune-telling*. Amsterdam: J. Benjamins.
- Bayne, T., & Montague, M. (2011). *Cognitive phenomenology*. Oxford: Oxford University Press.
- Barrett, E. (2007). Experiential learning in practice as research: context, method, knowledge. *Journal of Visual Art Practice*, 6(2), 115–124. doi:10.1386/jvap.6.2.115_1
- Bell, C., Gemmell, J., & Bell, C. (2010). *Your life, uploaded*. New York: Plume.
- BigML. (2015). BigML is Machine Learning for everyone. Retrieved 3 June 2015, from <https://bigml.com/>
- Bilton, N. (2012). One on One: Steve Mann, Wearable Computing Pioneer. Bits Blog. Retrieved 3 June 2015, from <http://bits.blogs.nytimes.com/2012/08/07/one-on-one-steve-mann-wearable-computing-pioneer/>
- Bismarck, J., Maus, B., and Wilhelmer, R. (2008) *Public Face*. [Art Work] Berlin.
- Bismarck, J. and Maus, B. (2008). *Perpetual Drawing Apparatus*. [Art Work] Berlin.
- Bostrom, N. (2003). The transhumanist FAQ. Retrieved 3 June 2015, from <http://www.transhumanism.org/resources/FAQv21.pdf>
- Bowen, D. (2011). *tele-present water*. [Art Work] Retrieved 3 June 2015, from <http://www.dwbowen.com/telepresentwater>
- Bricolage. (2012). In *Key terms in literary theory*. London, United Kingdom: Continuum. Retrieved from <http://ezproxy.lib.rmit.edu.au/login?url=http://search.credoreference.com.ezproxy.lib.rmit.edu.au/content/entry/contlt/bricolage/0>
- Broskoski, C. (2006). *Computer Skills*, Charles Broskoski, 2008. Retrieved 3 June 2015, from <http://cs.supercentral.org/>
- Bush, V. (1945). As we may think. *The atlantic montbly*. 176(1), 101-108.
- Butler, J. (2002). *Gender Trouble : Tenth Anniversary Edition*. Retrieved from <http://RMIT.ebilib.com.au/patron/FullRecord.aspx?p=180211>
- Callaghan, J. (2008). *Very Concerned, Somewhat Concerned, Not at All Concerned*, Los Angeles: Bank Gallery.

- Carnegie, D. (1981). *How to win friends and influence people*. New York: Simon and Schuster.
- Cccb.org. (2015). *Big Bang Data*. Barcelona, Spain: Centre de Cultura Contemporània de Barcelona. Retrieved 3 June 2015, from http://cccb.org/en/exposicio-big_bang_data-45167
- Consumer Physics,. (2015). MyScio. Retrieved 3 June 2015, from <http://www.consumerphysics.com/myscio/>
- Cook, S., & Diamond, S. (Ed) (2011). *Euphoria & dystopia : the Banff New Media Institute dialogues*. Banff, Alta.: Banff Centre Press : Riverside Architectural Press.
- Covey, S. (1989). *The seven habits of highly effective people*. New York: Simon and Schuster.
- Dewey-Hagborg, H. (2014). *Invisible*. Retrieved 3 June 2015, from <http://biogenfutur.es/>
- Dewey-Hagborg, H. (2012). *Stranger Vision*. [Art Work].
- Doherty, C. (2004). *Contemporary art*. London: Black Dog Pub.
- Ede, S. & Gulbenkian, F. (2000). *Strange and charmed : science and the contemporary visual arts*: Calouste Gulbenkian Foundation.
- Ellis-Petersen, H. (2014). Smart art: Hack the Space at Tate Modern. *the Guardian*. Retrieved 3 June 2015, from <http://www.theguardian.com/artanddesign/2014/jun/16/hack-the-space-tate-modern>
- Emin, T. (1995) *Everyone I Have Ever Slept With 1963-1995*. [Art Work]. London: Charles Saatchi Gallery
- Fisher, p. (2015). *MarginallyClever/Makelangelo*. *GitHub*. Retrieved 3 June 2015, from <https://github.com/MarginallyClever/Makelangelo>
- Fluxtream.org. (2015). Retrieved 3 June 2015, from <https://fluxtream.org/>
- Freeman, J. (2014) *We need us*. [Art Work] Retrieved 3 June 2015, from <http://www.weneedus.org/>
- Fry, B. (2009) *On the Origin of Species: The Preservation of Favoured Races*
- Gerhardt, J., and Jarman, R. (2014). *Cosmos*. [Art Work] Retrieved 3 June 2015, from <http://semiconductorfilms.com/art/cosmos/>
- Gorilla Girls. (1995) *Do women have to be naked to get into the Met. Museum?* [Art Work] . New York.
- Gray, C. (1996). *Inquiry through practice: developing appropriate research strategies. No guru, no method.*

Grosser, B. (2012). *Facebook Demetricator* [Art Work]. Retrieved 3 June 2015, from <http://bengrosser.com/projects/facebook-demetricator/>

Hales, S. D. (2012). *This Is Philosophy*. John Wiley & Sons.

Harrison, E., Jones, H., & O'Reilly, S. (2009). *Confessions of a recovering data collector*. Plymouth: Plymouth College of Art Press.

Harrison, E. (2006). *Teablog*. [Art Work] Retrieved 3 June 2015, from

Harrison, E. (2009). *Timelines*. [Art Work] Retrieved 3 June 2015, from

Harrison, E. (2009). *The History of the Financial Crises*. [Art Work] Stockholm: Mejan Labs. Retrieved 3 June 2015, from <http://www.ellieharrison.com/index.php?pagecolor=3&pageId=project-financialcrises>

Harrison, E. (2009). *Toytown*. [Art Work] Retrieved 3 June 2015, from

Harrison, E. (2009). *Eat 22*. [Art Work] Retrieved 3 June 2015, from

Haseman, B. (2006). A Manifesto for Performative Research. *Practice-led Research*. (118), 98-106.

Hay, L. (1987). *You can heal your life*. Santa Monica, CA: Hay House.

Halverson, E.R, & Sheridan, K. M. (2014). The Maker Movement in Education. *Harvard Educational Review*, 84(4), 495-504.

Hirst, D. (2012). *Pets Bought at World of Pets*. [Art Work]

Hood, B. (2012). *The self illusion*. Oxford: Oxford University Press.

Hume, D. (1911). *A treatise of human nature*: Book one Of the Understanding Sect. vi. Of Personal Identity. (Everyman's library. Philosophy & theology ; 548-549). London: Dent.

Ikeda, R. (2008) *Test pattern*. [Art Work]. Retrieved 3 June 2015, from <http://www.ryojiikeda.com/project/testpattern/>

Ingram, S. (2013). *Smoking Bolts*. [Art Work] Sydney: Art Space

Moere, A. (2015). *Information Aesthetics: Where form follows data*. Retrieved 3 June 2015, from <http://infosthetics.com/>

Jerram, L. (2001) *Tide*. [Art Work] Retrieved 3 June 2015, from <http://www.lukejerram.com/projects/tide?im=3>

Johannsen, D., Stewart, J., Calabro, M., Franke, W., & Welk, J. (2015). *Accuracy of armband monitors for measuring daily energy expenditure in healthy adults*. - PubMed - NCBI.

- Ncbi.nlm.nih.gov. Retrieved 3 June 2015, from <http://www.ncbi.nlm.nih.gov/pubmed/20386334>
- Kontopolos, M. (2015). *Michael Kontopolous*. Retrieved 3 June 2015, from <http://www.mkontopoulos.com>
- Kontopolos, M. (2009). *Measure of Discontent: Pacing Track*. [Art Work] Retrieved 3 June 2015, from <http://www.mkontopoulos.com/portfolio/measure-of-discontent-2/>
- Kontopolos, M. (2009). *Measure of Discontent: Sigh Collector*. [Art Work] Retrieved 3 June 2015, from <http://www.mkontopoulos.com/portfolio/measure-of-discontent-1/>
- Kontopolos, M. (2009). *What you missed* [Art Work] Retrieved 3 June 2015, from <https://vimeo.com/1609109>
- Krippner, S. (2011). Altered and Transitional States. In M. A. R. R. Pritzker (Ed.), *Encyclopedia of Creativity* (Second Edition) (pp. 33-39). San Diego: Academic Press. doi:10.1016/B978-0-12-375038-9.00008-X
- Lehni, J., & Franke, U. (2015). *Jürg Lehni — Hektor*. *Juerglehni.com*. Retrieved 9 June 2015, from <http://juerglehni.com/works/hektor>
- Levi-Strauss, C. (1966). *The Savage Mind* (6th impression. ed.). Chicago: University of Chicago Press.
- Lupton, D. (2013). Quantifying the body: monitoring and measuring health in the age of mHealth technologies. *Critical Public Health*, 23(4), 393-403. doi: 10.1080/09581596.2013.794931
- Lyn- Morone, J. (2015). *JLM Inc*. *Jenniferlynmorone.com*. Retrieved 3 June 2015, from <http://jenniferlynmorone.com/>
- Mann, S. (2013). *Steve Mann: My "Augmented" Life*. *Spectrum.ieee.org*. Retrieved 3 June 2015, from <http://spectrum.ieee.org/geek-life/profiles/steve-mann-my-augmented-life>
- Mann, S., Nolan, J. & Wellman B. (2002). *Sousveillance: Inventing and Using Wearable Computing Devices for Data Collection in Surveillance Environments*. Retrieved 3 June 2015, from [http://www.surveillance-and-society.org/articles1\(3\)/sousveillance.pdf](http://www.surveillance-and-society.org/articles1(3)/sousveillance.pdf)
- McHugh, G. (2011). *Post Internet*: Lulu.com
- Mendoza, C. (2008). *Taking a query = "line" for a walk*. [Art Work]. Retrieved 3 June 2015, from <http://matadata.com/projects.php?id=15>
- Mendoza, C. (2006). *Every Word I Save*. [Art Work]. Retrieved 3 June 2015, from <http://www.matadata.com/projects.php?id=1>
- Miller, J. (2000). Gregory Green. *Frieze Magazine*, (54), 1–3. Retrieved 3 June 2015, from http://www.frieze.com/issue/print_back/gregory_green/

- Noble, S. (2015). *Polargraph | drawing by robot*. *Polargraph.co.uk*. Retrieved 3 June 2015, from <http://www.polargraph.co.uk/>
- Onformative Design Studio. (2013). Google Faces. [Art Work]. Retrieved 3 June 2015, from <http://www.onformative.com/lab/googlefaces/>
- O'shea, C. (2009). Hand From Above. [Art Work]. Liverpool, England. Retrieved 3 June 2015, from <http://www.chrisoshea.org/hand-from-above>
- O'Shea, J. (2007). 3:2. [Art Work] New York, NY: Eyebeam
- Patterson, N. (1998) *Stock Market Skirt*. [Art Work].
- Peyton, S. (2008). Why Charles Broskoski Read 356 O'Reilly Books in 400 Days - O'Reilly FYI Blog. *Fyi.oreilly.com*. Retrieved 3 June 2015, from <http://fyi.oreilly.com/2008/05/-how-many-technology-books.html>
- Roy, N. (2013). *Cardboard Plotter*. [Art Work] Retrieved 3 June 2015, from http://www.niklasroy.com/project/149/cardboard_plotter
- Rozin, D. (2007). Weave Mirror. [Art Work] Retrieved 3 June 2015, from <http://www.smoothware.com/danny/weavemirror.html>
- Rust, A. (2014). A piece of the pie chart: feminist robotics. SIGGRAPH '14: SIGGRAPH 2014 Art Gallery. doi:10.1145/2601080.2677713
- Silver, J. (Producer), & Hughes, J. (Director). (1985). *Weird Science*. [Motion Picture]. USA: Universal Pictures
- Snodgrass, S. (1996). Gregory Green at Feigen. *Art in America*. 84 (1): 109
- Swan, M. (2009). Emerging Patient-Driven Health Care Models: An Examination of Health Social Networks, Consumer Personalized Medicine and Quantified Self-Tracking. *International Journal of Environmental Research and Public Health*, 6(2), 492–525. doi:10.3390/ijerph6020492
- Swan, M. (2012). Sensor Mania! The Internet of Things, Wearable Computing, Objective Metrics, and the Quantified Self 2.0. *Journal of Sensor and Actuator Networks*, 1(3), 217-253. doi: 10.3390/jsan1030217
- Terranova, T. (2000). Free Labor: PRODUCING CULTURE FOR THE DIGITAL ECONOMY. *Social Text*, 18(2 63), 33-58. doi:10.1215/01642472-18-2_63-33
- Thespace.org,. (2015). Hack The Space at Tate Modern Turbine Hall this weekend - The Space. Retrieved 3 June 2015, from <http://www.thespace.org/news/view/hackthespace>
- Toohy, P., (2011). *Boredom : a lively history*. New Haven: Yale University Press.
- Transmediale.de,. (2015). Capture All. Retrieved 3 June 2015, from <http://www.transmediale.de/>

Quantified Self,. (2015). *Quantified Self - Self Knowledge Through Numbers*. Retrieved 3 June 2015, from <http://quantifiedself.com/>

Yau, N. (2015). *FlowingData*. Retrieved 3 June 2015, from <http://flowingdata.com/>

Young, C. (2007) *Inventory*. [Art Work] Retrieved 3 June 2015, from <http://www.careyyoung.com/inventory/>

Vesna, V. (Ed.) (2007). *Database aesthetics: Art in the Age of Information Overflow*. Minneapolis: University of Minnesota Press.

Woulahan, M. (2011). *Mixing Realities through Responsive Digital Media*. [Unpublished Document].